BIOMASS CROP ASSISTANCE PROGRAM

PROGRAMMATIC ENVIRONMENTAL IMPACT STATEMENT

 

United States Department of Agriculture
Farm Service Agency

June 2010

FINAL

Programmatic Environmental Impact Statement

Biomass Crop Assistance Program
Farm Service Agency
U.S. Department of Agriculture
Abstract

The Biomass Crop Assistance Program (BCAP) is a new program established under Title IX Section 9001 Energy - Section 9011 of the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill). The program is composed of two components, the Matching Payments Program for collection harvest, storage, and transportation (CHST) of eligible materials, and the Establishment and Annual Payments Program associated with BCAP project areas. BCAP is administered by the Farm Programs Division of the Farm Services Agency (FSA) on behalf of the Commodity Credit Corporation (CCC). To implement the proposed action, FSA has developed a Proposed Rule which was published on February 8, 2010 and which initiated a 60-day public comment period. This Programmatic Environmental Impact Statement (PEIS) analyzes the impacts of the two action alternatives of the Establishment and Annual Payments Program component on the nation's environmental resources and economy. The alternatives examine (1) a targeted implementation of the Program, examining limited development of new commercial Biomass Conversion Facilities (BCFs) and newly established crops and (2) an extensive expansion of current biomass programs and new programs to greatly expand participation. The no action alternative (continuation of current program) is also analyzed in this PEIS to provide an environmental baseline. Cooperating agencies in the development of this Final PEIS are United States Department of Agriculture (USDA) Rural Development (RD), Animal and Plant Health Inspection Service (APHIS), USDA United States Forest Service (USFS), and USDA Natural Resources Conservation Service (NRCS).

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EXECUTIVE SUMMARY

1.0 BACKGROUND

The United States Department of Agriculture (USDA) Commodity Credit Corporation (CCC) proposes to implement the Biomass Crop Assistance Program (BCAP) enacted by Title IX - Section 9001 Energy - Section 9011 Biomass Crop Assistance Program of the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill). This legislation, which was passed into law on June 18, 2008, creates the BCAP and authorizes the program through September 30, 2013. BCAP is intended to assist agricultural and forest land owners and operators with the establishment and production of eligible crops including woody biomass in selected project areas for conversion to bioenergy. Additionally, BCAP allows for the collection, harvest, storage, and transportation (CHST) of eligible material to designated biomass conversion facilities (BCF) for use as heat, power, biobased products, or advanced biofuels. The BCAP is administered by the Farm Programs Division of the Farm Service Agency (FSA) on behalf of the CCC with the support of other Federal and local agencies. The BCAP is composed of two components: (1) the Matching Payments Program for CHST of eligible materials, and (2) Establishment and Annual Payments Program associated with BCAP project areas. The CCC and FSA provided a Notice of Funds Availability (NOFA) for the Matching Payments Program of BCAP for eligible biomass material on June 11, 2009 (74 Federal Register [FR] 27767-27772) and on July 12, 2009 provided an additional notice concerning the implementing regulations for the Matching Payments Program. These notices can be located in Appendix A. The NOFA announced the availability of funds beginning in 2009 for certain provisions of BCAP allowing for matching payments to certain persons or entities for CHST of eligible material delivered to qualified BCFs in advance of full implementation of BCAP. FSA invited comments on the NOFA from all interested individuals and organizations over a 60-day comment period. On February 8, 2010 the proposed rule for full implementation of BCAP was published (75 FR 6264-6288) (Appendix B) which terminated and rescinded the NOFA published on June 11, 2009.

2.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

The purpose of the Proposed Action is to establish and administer the Establishment and Annual Payments Program component of BCAP, as provided for by Title IX of the 2008 Farm Bill, specifically the establishment and production of eligible dedicated energy crops, as provided for by Title IX of the 2008 Farm Bill. The need for the Proposed Action is to fulfill the CCC Charter Act (15 United States Code [U.S.C.] 714, et seq.) and FSA's responsibility as assigned by the Secretary of Agriculture (hereinafter referred to as Secretary) to administer the provisions of the 2008 Farm Bill.

3.0 PROPOSED ACTION

The Proposed Action is to establish and administer the Establishment and Annual Payments Program component of BCAP as mandated in Title IX of the 2008 Farm Bill.

3.1 NO ACTION ALTERNATIVE

The No Action Alternative is carried forward in this PEIS in accordance with 40 CFR 1502.14(d) to represent the environmental baseline against which to compare the other alternatives. The No Action Alternative assumes that no Federal program like BCAP is implemented and assesses the potential impacts this could have on the natural and human environment. This alternative does not meet the purpose and need as described above, but is carried forward to provide a baseline against which the impacts of the Proposed Action can be assessed.

3.2 AFFECTED ENVIRONMENT

The geographic scope of the environment potentially affected by BCAP encompasses agricultural and forest lands of the U.S. This PEIS focuses descriptions of the affected environment on the proposed eligible lands under BCAP implementation. Resource areas potentially affected by this proposed action and analyzed in detail in this PEIS include:

- Socioeconomic and Land Use Resources
- Biological Resources, which includes vegetation and wildlife
- Water Quality
- Soil Resources
- Air Quality
- Recreation

4.0 ENVIRONMENTAL CONSEQUENCES AND MITIGATION

The environmental consequences from the proposed action alternatives and no action alternative are addressed in this PEIS and summarized in Table ES-1, below. The table also provides a summary of mitigation measures/best management practices and cumulative effects of the proposed actions.

Two alternatives are proposed for the administration and implementation of BCAP. The components of each alternative are presented in Table ES-1. In summary, the alternatives are:

- Alternative 1 – Targeted BCAP Implementation (Preferred Alternative; Environmentally Preferred Alternative)

Under Alternative 1, BCAP would be implemented on a more restrictive or targeted basis. BCAP project areas would be authorized for those projects that support only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres. No new non-agricultural lands shall be allowed to enroll in the program for BCAP crop production.

- Alternative 2 – Broad BCAP Implementation

Alternative 2 would enable anyone who meets the basic eligibility requirements as outlined in the 2008 Farm Bill provisions governing BCAP to participate in a BCAP project area. In addition, existing BCFs and crops would be supported, including small and pilot BCFs, and all bio-based products derived from eligible materials would qualify under this alternative. New non-agricultural lands (e.g. NIPF) would be allowed to enroll in the program for BCAP crop production.

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Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Socio-economic and Land Use Resources	Under the No Action Alternative, the BCAP Establishment and Annual Payments Program would not be implemented for the establishment and production of dedicated energy crops. There would be no significant changes to current land use, farm prices, or farm revenue measures. Dedicated energy crops would be established only in limited demonstration-scale quantities with other public and private funding sources. In the short term, it would be unlikely that domestic production for bioenergy would meet	Under Alternative 1, the BCAP Establishment and Annual Payments Program would be implemented on a more restrictive or targeted basis. Project areas would be authorized for those that support only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres. No new non-agricultural lands would be allowed to enroll for BCAP crop production. Modeling indicates that at the national level, direct impacts to	Alternative 2 expands the BCAP Establishment and Annual Payments Program, allowing anyone who meets basic eligibility requirements of the BCAP provisions in the 2008 Farm Bill to participate. In addition, existing BCFs and crops would be supported, including small and pilot BCFs, and all bio-based products derived from eligible materials would qualify under this alternative. New non-agricultural lands would be allowed to enroll and the number of cropland acres would not be capped.	To mitigate the effects to the socioeconomic conditions, the proposed rule has proposed that vegetative wastes, such as wood wastes and wood residues, collected or harvested from both public and private lands should be limited to only those that would not otherwise be used for a higher-value product. This specifically excludes wood wastes and residues derived from mill residues or other production processes that create residual by-products that are typically used as inputs for higher value-added	Cumulative effects to socioeconomic conditions and land use would be highly dependent upon the location of the BCAP project areas and level of funding; however, overall the benefits associated with the establishment and production of dedicated energy crops should outweigh the losses associated with the land use shifts from traditional row crops. With limited funding, BCAP projects areas would be few and would be anticipated to provide local positive effects to the socioeconomic

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Socio-economic and Land Use Resources (cont'd)	the demand for the Energy Independence and Security Act (EISA) of 2007 advanced biofuels components.	realized Net Farm Income are expected to remain unchanged from that of the No Action Alternative due to limited funding. However, net returns are likely to improve for those producers selected as part of a BCAP project area. Total net returns for most potential project locations are positive, ranging between $2.7 and 7.3 million in Year 1 of the program. Modeling shows that positive Net Returns would still be expected over the long term (Year 3), indicating that the BCAP project areas remain capable of supplying a BCF with required	Significant changes are expected in net revenues as total revenue values increase more than the feedstock production costs and as feedstock production reduces the supply of other crops and subsequently increases their prices. Price increases are most significant for wheat, corn, and soybeans, with price changes expected to increase by 15 to 20 percent. The addition of forestry resources as feedstock would reduce pressures on crop prices somewhat, as would any future increase in crop yields. It is expected that	production. Additionally, industrial or other process wastes or by-products, such as black liquor or pulp liquor that is a waste by-product of the pulp and kraft paper manufacturing process, would not be included in the definition of biobased products because they are not significantly composed of organic or biological products collected or harvested from land. The proposed rule also continues the exclusion of commercially-produced timber, lumber, wood, or other finished products that otherwise would be used for higher value	conditions from the conversion to dedicated energy crops; however, the effects would be balanced through the losses associated with input suppliers for traditional crops Under Alternative 1. The limited funding assumption and the county acreage limitation would not induce national level changes in agricultural prices. Under Alternative 2, the greater funding for BCAP could create numerous BCAP project areas with the potential to affect national crop prices. Alternative 2 would encourage greater

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Socio-economic and Land Use Resources (cont'd)		feedstock. Alternative 1 would cause land use changes only at the local level (i.e., county or multi-county region). Land use changes range between 22,000 to 44,000 acres of crop (e.g., corn, wheat, soy, etc.) and hay land being converted to dedicated energy crops (switchgrass) from that of the No Action Alternative. Economic indirect impacts under this alternative vary by plant location. Growing dedicated energy crops and subsequent land use changes for those crops, in a region	government commodity payments would increase due to the price impacts triggered by the increased demand for cropland. Land use shifts, especially among the major crops, are expected under this alternative. Modeling indicates that by 2023, planting of energy dedicated crops will increase to over 30 million acres, while the amount of land planted in wheat and soybeans will decrease approximately 15 million acres. Of the estimated 350 million acres in use as pastureland, approximately nine million acres would	products. Also urban wood wastes have been excluded per the 2008 Farm Bill	regionalization, which could encourage more land use changes to dedicated energy crops, where traditional row crops only produced marginally positive income streams. Also, the Matching Payments Program has encouraged the use of woody biomass as a feedstock for many of the BCFs qualified during the NOFA period. More than 3.1 million tons of biomass were from woody resources during the NOFA period (85.6 percent of total biomass collected). Only 4.3 percent of woody resources were

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Socio-economic and Land Use Resources (cont'd)		would impact the agricultural sector by the creation of a new market. It is estimated that producing a dedicated energy crop would require \$60/dry ton (approximately \$10 million) to establish the crop. In order to receive payments to establish a dedicated energy crop, producers must first convert their land from traditional crops. This would result in negative impacts within the community as inputs from the traditional crops are not purchased. Costs vary based on the community and the amount of land use changes required and	shift to the production of dedicated energy crops. There would be both positive and negative indirect impacts from the establishment of dedicated energy crops which would flow through the rest of the economy. While payments for the establishment of dedicated crops is estimated to be \$11 billion and the matching payments component of BCAP is expected to create an estimated 280,000 jobs, the costs associated with land use changes required to meet the demand for dedicated energy crops and crop		derived from Federal lands, with the remainder from non-Federal lands. During the short-term, these resources could be an important source of feedstock, until the sustainable harvest of dedicated energy crops would be available.

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Socio-economic and Land Use Resources (cont'd)		range between $1.5 million to $ 5 million. Total economic impacts range between $19 million and $28 million. Net positive impacts for the top five plants are between $21 million and $25 million for their region. However, land use changes would create negative impacts, through reduced purchases of inputs for traditional farming, within a region ranging from $2.5 million to $10 million depending on location.	residues may bring a decline of $3.2 billion and a loss of 41,000 jobs. However, the total economic impact from implementation of Alternative 2 is estimated to be $88.5 billion and the creation of nearly 700,000 jobs.		

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife*	Under the No Action Alternative the BCAP Establishment and Annual Payments Program would not be implemented and financial assistance would not be provided for the conversion of cropland and potentially other non-agricultural lands to the establishment and production of dedicated energy crops. No additional negative impacts to vegetation or wildlife would occur as a result of BCAP. The potential benefits to wildlife from the conversion of traditional crops to some types of biofuel	Under Alternative 1, the BCAP Establishment and Annual Payments Program would be implemented on a limited basis, specifically only supporting a limited number of BCFs in five total Land Resource Regions (LRR) selected out of an initial pool of 18 LRRs. The exact amount of land that may be converted is limited to 25 percent of the acreage within each county being eligible for BCAP payments. This equates to a relatively small amount of vegetation being converted from traditional crops or	Under Alternative 2, the BCAP Establishment and Annual Payments Program would be implemented on a broad scope, with potential regional impacts and across several ecosystems. Direct impacts to vegetation include the potential conversion of non-cropland to dedicated energy crops. Energy crops include perennial herbaceous species, short rotation woody crops (SRWC), and annual herbaceous crops. The amount and type of land, both traditional cropland and non-cropland, converted to dedicated	As detailed by the 2008 Farm Bill, a Conservation Plan or Forestry Stewardship Plan are fundamental components for ensuring appropriate and sustainable agricultural practices for specific programs. A BCAP Conservation Plan or Forest Stewardship Plan or equivalent that includes Conservation Practice Standards and sustainable agriculture practices shall be developed before implementation to reduce the negative impacts to biological resources. Dedicated energy crops shall be chosen	Changes to vegetation structure and type could cause potential negative cumulative effects on native fish and wildlife through fragmented, degraded, or destroyed habitats. Cumulative effects to wildlife will be localized and site-specific as not all species are harmed by conversion of land to more intensive uses. While the footprints of the areas considered under conversion are relatively small (less than one percent of the area inside the 50-mile buffer), potential impacts may occur if land configuration and relative location of converted areas combined with existing

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*	crops such as switchgrass or short-rotation woody crops SRWC would be unrealized. However, there would also be no loss of native habitat as could potentially occur under Alternative 2, which allows new non-agricultural lands to be converted into dedicated energy crops.	pastureland to approved dedicated energy crop species. Under this alternative conversion of new non-agricultural lands into the BCAP program is disallowed. It is unlikely there would be significant negative impacts to wildlife populations from the conversion to dedicated energy crops at a regional scale. However, the potential always exists for site-specific fluctuations in wildlife populations without the proper adaptive management techniques being applied during the establishment and harvesting stages of	energy crop production would depend on which areas are designated as Project Areas to meet BCF requirements. Conversion may have both negative and positive impacts. The loss of forest land or native grasslands would decrease the habitat quality for several wildlife species. Yet, as described in Alternative 1, many of the dedicated energy crop options have a higher habitat quality than traditional crops. The types of impacts to wildlife during the establishment of dedicated energy crops would be similar	based on local ecosystems to minimize potential disturbance to native wildlife species and vegetation by providing habitats comparable to those found in natural habitats. Sustainable agricultural techniques shall be used to reduce negative impacts to biological resources and include incorporation of conservation buffers into and along the borders of currently producing agricultural fields. Buffers shall be designed and tailored towards local ecosystems and site-specific conservation	habitat fragmentation patterns could have a multiplicative effect on the overall regional habitat fragmentation values. The establishment of new crops in areas previously fallow or cropped with a different style of agriculture may cause direct mortality and range shifting at the local scale of wildlife. The use of Best Management Practices (BMPs) and environmental assessments would prevent and minimize significant impacts; however, fragmentation is unavoidable. Cumulative impacts to

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Biological Resources *Vegetation, Wildlife (cont'd)*		crop production. The proper use of adaptive management and appropriate mitigation techniques related to agricultural processes can help minimize any potential negative direct effects. There are not expected to be large scale impacts to regional wildlife populations because of the limited scope of land use change under this alternative. Indirect impacts to wildlife are related to habitat change. Some degree of wildlife mortality from collisions or nest destruction from farm equipment is unavoidable. Provided establishment and	to those described in Alternative 1; yet, with the potential to occur at a much broader scale. Again, the scale of this impact is dependent on the types and amount of land converted to dedicated energy crops. Negative impacts to large mammals, small mammals, reptiles and amphibians, and invertebrates are not expected to be significant. Similarly, impacts to birds are not expected to impact population densities. However, the largest potential negative impact to grassland birds would occur during	needs. Specific county Natural Resources Conservation Service (NRCS) Conservation Practice Standards, as well as State or county specific technical notes and specific guidance on mitigation measures shall be incorporated in the Conservation Plan and Forest Stewardship Plan or equivalent. Applicable NRCS Conservation Practice Standards shall be followed on lands where conserving wildlife species is an objective of the landowner or Forest Stewardship Plan. Site - specific	vegetation would occur from the conversion of native pastureland or native vegetation to dedicated energy crops. The cap on the amount of acreage that may be used for dedicated energy crops under Action Alternative 1 (i.e. 25 percent in any single county within the 50-mile radius) also is designed to reduce these impacts. Similarly, because of the limited funding that would only provide for a limited number of BCFs, the amount of land that potentially would be converted is negligible. Direct impacts to wildlife would occur by

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Biological Resources *Vegetation, Wildlife (cont'd)*		harvest of feedstock does not occur during the Primary Nesting Season (PNS), these impacts should be minimized. Reptiles and amphibians could experience negative and positive responses to the conversion to dedicated energy crops. The increase of native vegetation may increase the abundance of invertebrates, a source of food for many reptiles and amphibians. There may be short-term reductions in population sizes the year that conversion occurs from agricultural activity	conversion or harvesting activities. Provided these activities do not occur during the PNS, and the small portion of grasslands in potential BCAP Project Area locations, impacts to grassland birds are minimal. As with Alternative 1, provided established provisions, standards, and guidelines are followed and the BCAP Conservation Plan, Forest Stewardship Plan, or equivalent, are adapted to resource conditions, Alternative 2 would have no significant negative impacts on vegetation or wildlife.	environmental evaluation on the project site in conjunction with either informal or formal consultation with the appropriate U.S. Fish and Wildlife Service (USFWS) office would protect species included on the endangered species list. Proper maintenance of heavy machinery to be used during implementation of the practices would limit the possibility of oil and gas leaks which may damage vegetation or wildlife habitats. Use of BMPs such as washing vehicles upon leaving and entering a work area would minimize	conflicts with haying machinery that may result in mortality. Under Alternative 1, direct impacts are expected to occur during the establishment and harvest stages of BCAP crops; yet, these impacts are expected to be short-term and localized. Indirect impacts. These habitat changes would impact such aspects as food availability, type and quantity of cover for escape and breeding, and the availability of adequate nesting sites. Wildlife in lands adjacent to the dedicated energy cropland may either be

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*		from collisions or crushing by farm equipment. The techniques described above, if properly planned and applied, are designed to minimize the impacts to wildlife of these activities. Likewise, because of the limited implementation under this alternative, these impacts will not be regional nor are they anticipated to affect regional wildlife population levels. Impacts to invertebrates are related to habitat, and will vary based on specific lifestyle and habitat preference. Direct impacts to invertebrates are		the potential to spread invasive or noxious plant species. Other eligible crops, such as animal wastes, food and yard wastes, and algae, have site specific requirements in regards to potential for environmental effects. To lessen potential effects associated with animal wastes, appropriate guidance from the EPA concerning confined animal feeding operation practices and standard industry practices associated with animal production should be followed to ensure that collection of materials does not adversely impact localized vegetation	positively or negatively impacted depending on the habitat quality provided by the biofuel crops. Cumulative effects through implementation of Alternative 2 would lead to direct and indirect impacts to vegetation and wildlife at a regional scale. As with Alternative 1, direct impacts are not expected to impact wildlife at a population level; however, the significance of indirect impacts are dependent on potential land use changes. The quantity and habitat quality of any land converted

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Biological Resources *Vegetation, Wildlife (cont'd)*		dependent on the degree of exposure and the mobility of a given species. Impacts from the establishment include destruction of nest sites, crushing, and the removal of food sources. These impacts can be reduced if activities are not conducted during periods of highest florescence or when flowers are in bloom. Impacts to aquatic wildlife are associated with the dangers of sedimentation, and nutrient and agricultural chemical deposition into water bodies. However, provided established procedures for erosion and runoff control are		and wildlife resources through secondary effects associated with water and air quality. Algae production, due to the specialized nature of the demonstration practices currently in effect, should move to minimize the use of potable water supplies where feasible and ensure that ponded areas do not become inadvertent wildlife hazardous due to trapping and drowning.	from native grasses, forest land or pastureland for dedicated energy crops will determine the level of cumulative impacts. Under Alternative 2, depending upon the level of land use changes, the cumulative impacts to vegetation and wildlife could be significant. No cumulative impacts under the No Action Alternative would occur as the program would not convert land from one use to a dedicated energy crop.

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*		followed, these potential impacts are not expected to be significant. Due to the small scope of this alternative, and provided established provisions, standards, and guidelines are followed, and the BCAP Conservation Plan, Forest Stewardship Plan, or equivalent, are adapted to resource conditions, Alternative 1 would have no significant negative impacts on vegetation or wildlife.			
Air Quality	Under the No Action Alternative, changes to Greenhouse Gases (GHG) emissions or	Positive changes to air quality are expected under Alternative 1. However, since the	Implementing Alternative 2 on a broader scale would reduce overall direct	BMPs associated with dedicated energy crop production include the use of limited and no	In general, the maturation of the biofuels and bioenergy industries should result

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Air Quality (cont'd)	emissions of criteria pollutants from agricultural activities are not likely to change. There may be increased mobile source emissions and dust emissions from the transportation of current bioenergy materials from fields to qualified BCFs. However, since the number of qualified BCFs and the economically feasible distance to transport materials to these BCFs is limited, emissions would likely be restricted to a local scale.	scope of this alternative is limited, these changes would not be significant. Direct impacts relate to the energy and/or emissions from agricultural production activities. Under this alternative, energy consumption within the top five regions would be reduced by 3,664 Giga Joules (GJ) through the conversion to switchgrass when compared to the No Action Alternative. This energy change is minor, in most cases less than 0.1 percent. Carbon emissions were less than those of the No Action Alternative, yet small, usually less than 0.1	carbon equivalent emissions during perennial dedicated energy crop growth. However, it appears that overall emissions would increase as the amount of Soil Organic Carbon (SOC) decreases due to the loss of crop residue. Total energy use was approximately one to two percent higher in most years due to the indirect energy requirement for increased equipment manufacturing. Direct energy usage was either neutral or decreased over time. The effects of fugitive dust emissions during the establishment phase would be similar	tillage components, which decrease the potential for fugitive dust emissions associated with exposed ground cover. Also, all producers would follow local air quality regulations, which may define other BMPs associated with agricultural activities, including transportation, and chemical usage. As specified by the proposed rule, agricultural and forest landowners and operators must comply with any existing Conservation Plans, Forest Stewardship Plans, and any other applicable laws for any removal of eligible	in significantly positive energy balance in relation to first generation biofuels and bioenergy supported by grain feedstocks and fossil fuels. With a limited level of BCAP funding that would only provide for two commercial-scale facilities, the range of potential cumulative effects would be broad depending upon the location of the facilities. However, it was estimated that the BCAP program would generate net energy savings and greater soil carbon sequestration as lands are converted to dedicated energy

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Air Quality (cont'd)		percent. Due to the limited scale of conversion under this alternative, the amount of fugitive dust emissions would be minor, temporary, local, and nearly equal to that of the No Action Alternative. Yet, over the long term, given the conversion to perennial dedicated energy crops and reduction tillage, there would be a reduction in fugitive dust emissions. These effects would be positive, but minor. Limited indirect impacts would occur from emissions from equipment exhaust or other mobile sources necessary for the establishment of	to those of Alternative 1. After establishment, fugitive dust emissions would decrease due to the alteration of cropping systems to perennial species. In the long term, these effects would be on a regional scale and would be positive. Indirect impacts are similar to those of Alternative 1. Site-specific mitigation measures and BMPs as described in Alternative 1 would reduce potential impacts to Air Quality under Alternative 2.	material for use in a biomass conversion facility to receive matching payments.	crops. The effects were estimated to only be locally or regionally significant and not nationally significant. Under Alternative 2, the unlimited funding of the BCAP to support all scales of BCFs could lead to national level effects, such as a decline in soils carbon sequestration due to an increased use of crop residues to meet the EISA volume requirements. It was estimated that there would be benefits from the conversion of lands associated with total carbon flux and overall energy use, but there would also be negative effects from the greater use of

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Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Air Quality (cont'd)		dedicated energy crops. However, since machinery is already utilized on these fields, these impacts are similar to those of the No Action Alternative. Site-specific mitigation measures would be determined based on the local or regional Air Quality Control Region, as prescribed in the Conservation Plan or through local or state regulations concerning air emissions of criteria pollutants. BMPs to reduce mobile sources include proper maintenance of equipment and dust suppression activities.			residues, which would generate additional GHG emissions and reduce soil carbon sequestration. In the longer term, as more acreage is planted to dedicated energy crops and regionally competitive crops (i.e., SRWC), there would be some off-set from the anticipated soil carbon losses associated with residue removal and use.

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Soil Resources	Implementation of the No Action Alternative is not expected to change current cropping practices or species mix. Under this alternative, crops currently in use for bioenergy are Title I crops, Title I crop residues, and woody biomass. The removal of residues may negatively impact soil quality; however, this impact can be reduced through the use of fertilizers. The use of BMPs would be necessary to ensure adequate amounts of crop residues remain after harvest to minimize loss of SOM.	Under Alternative 1, a reduction in erosion from all sources is expected. Conversion of croplands from traditional crops to switchgrass is estimated to reduce topsoil loss from these acres by 0.4 inches per year; which equates to four inches over a ten year period. This results in the reduction of soil, nutrient, and chemical deposition into surface water bodies. Soil carbon would increase between 0.2 and 10.1 percent over that of the No Action Alternative. Indirect impacts under Alternative 1 would be increased biodiversity of soil biota as a result	Alternative 2 would result in reductions at both the local and regional level of soil erosion due to the transition from traditional crops to perennial vegetation used for dedicated energy crops. Perennial crops, and the use of corn stover and wheat straw, shift away from conventional tillage to no tillage practices. This shifting of tillage practices on an estimated 11 million acres, conserving approximately 40 million tons of soil each year over that of the No Action Alternative. As with Alternative 1, the biological diversity	BMPs associated with dedicated energy crop production include the use of limited and no tillage components, which decreases exposed ground cover and allows for greater retention of topsoil through perennial root systems. Other eligible crops, such as animal wastes, food and yard wastes, and algae, have site specific requirements in regards to potential for environmental effects. To lessen potential effects associated with animal wastes, appropriate guidance from the EPA concerning confined animal feeding	The implementation of BCAP would generate positive effects from a reduction in soil erosion and increased soil carbon sequestration from the conversion of Title I crops to perennial dedicated energy crops. The conversion to a perennial dedicated energy crop provide greater soil retention due to anticipated cropping practices and the plant structure holding soil in place. Under Alternative 1, with the limited BCAP funding, the benefits associated with reduced soil erosion would be only locally

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Soil Resources (cont'd)		of increased soil organic matter and the presence of perennial vegetation. The use of BMP's would further reduce the potential for soil loss. Provided established conservation standards, provisions and guidelines are implemented, Alternative 1 would have no significant negative impact on soil resources.	of the soil would also increase. As with Alternative 1, the use of BMP's would further reduce the potential for soil loss. Provided established conservation standards, provisions and guidelines are implemented, Alternative 2 would have no significant negative impact on soil resources.	operation practices and standard industry practices associated with animal production should be followed to ensure that collection of materials does not adversely impact soil resources through secondary effects associated with water and air quality. Algae production, due to the specialized nature of the demonstration practices currently in effect, should move to minimize the use of potable water supplies where feasible. As specified by the proposed rule, agricultural and forest landowners and	significant and would provide for positive changes to water quality, soil organisms biodiversity and overall biological diversity. Under Alternative 2, depending upon the level of crop residue use, the effects could be either insignificant or significant, cumulatively. When combined with the USFS measures to increase woody biomass utilization for bioenergy, there may be short term increases in soil erosion from forest lands in some regions; however, these should be minimal if harvest and management BMPs are

Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Soil Resources (cont'd)				operators must comply with any existing Conservation Plans, Forest Stewardship Plans, and any other applicable laws for any removal of eligible material for use in a biomass conversion facility to receive matching payments.	implemented per the Forest Stewardship Plan or the equivalent, and all applicable Federal, State, and local harvest regulations. Also, in some regions, soil erosion on forest lands would be insignificant due to the species and understory cover provided. The increased use of crop residues is anticipated to lead to changes in cropping practices, which should provide greater soil cover by standing crop residues and reduced tillage practices to promote residues use.

Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity	Under the No Action Alternative, the use of Title I crops and crop residues does not produce a significant change in either water quantity or quality. Overall, projected land use changes under the No Action Alternative does not indicate an increased amount of acreage requiring additional water resources or the use of additional nutrients or agricultural chemicals.	Under Alternative 1, direct impacts to water quality are expected from the changes to the use of nutrients and agricultural chemicals for the establishment and production of switchgrass in the potential BCAP project locations. Decreases in the use of potassium (3.1%), lime (4.0%), herbicides (5.5%), insecticides (11.2%), and other agricultural chemicals (3.6%) are expected; while the use of nitrogen (2.1%) and phosphorus (2.9%) within the top five project areas are expected to increase over that of the No	The direct and indirect impacts to water quality under Alternative 2 would be similar to those described in Alternative 1. However, as the amount of acreage converted from traditional crops to perennial crops increases, the benefits to both water quality and quantity increase. The same mitigation methods described in Alternative 1 would reduce potential impacts to water quality. Adherence to established conservation standards, provisions, and guidelines ensures Alternative 2 would	BMPs for dedicated energy crop production that reduce the amount of agricultural chemicals used for production benefit water quality through reduced transport in runoff. Also, the use of limited or no tillage cropping systems reduces the potential transported sediments by leaving ground cover on site and through the stability associated with perennial root systems. Agricultural irrigation systems are generally becoming more efficient allowing for an overall reduction in irrigated water uses, the inclusion of more dedicated energy crops	The conversion to a perennial dedicated energy crop provides greater water use efficiency than traditional row crops such as corn. This conversion would be anticipated to limit runoff from agricultural fields and potential need for irrigation past the initial establishment period. Under Alternative 1, with the limited BCAP funding, the benefits associated with increased water quality and decreased water quantity would be only locally significant and would provide for positive changes. Under Alternative 2, depending upon the

Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity (cont'd)		Action Alternative. The overall reduction in nutrients and agricultural chemical, erosion, total suspended solids (TSS), and sedimentation would provide positive impacts on water quality from implementation of this alternative. However, due to the limited amount of acreage under this alternative, these benefits would be local. The change in the quantity of water required under this alternative would be minimal. The amount of water used for irrigation in the top five	have no significant negative impact on water quality.	with lower water demands and higher water use efficiencies would benefit water quantity by reducing the levels necessary for production. Other eligible crops, such as animal wastes, food and yard wastes, and algae, have site specific requirements in regards to potential for environmental effects. To lessen potential effects associated with animal wastes, appropriate guidance from the EPA concerning confined animal feeding operation practices and standard industry practices associated with animal production should be followed to	level of crop residue use, the effects could be either insignificant or significant, cumulatively. The implementation of BCAP would generate positive effects from (1) a potential reduction of irrigated cropland acres, (2) greater water use efficiency on non-irrigated and irrigated acreage, and (3) a general reduction in agricultural chemical use from the conversion of Title I crops to perennial dedicated energy crops. The majority of water consumption associated with corn-

Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity (cont'd)		regions would only decrease approximately 0.25 over that of the No Action Alternative, saving an estimated 1.2 million gallons of water per day. When compared across all project area States, 23.6 million gallons of water per day would be conserved. Switchgrass does have a higher water use efficiency (WUE) than other traditional crops, and is highly tolerant of various water regimes and is more drought tolerant than traditional crops. Indirect impacts under Alternative 1 result from the reduction in		ensure that collection of materials does not adversely impact soil resources through secondary effects associated with water and air quality. Algae production, due to the specialized nature of the demonstration practices currently in effect, should move to minimize the use of potable water supplies where feasible. As specified by the proposed rule, agricultural and forest landowners and operators must comply with any existing Conservation Plans, Forest Stewardship Plans, and any other	based ethanol is from irrigation to grow the crop. A potential reduction in the amount of irrigated acres would reduce the total water consumption to produce ethanol. Also studies have indicated that conversion of biomass at co-generation or combined heat and power (CHP) power plants for electricity is more efficient in the reduction than conversion into transportation fuels. However, water consumption for this use should also be considered. Other studies indicate that traditional liquid

Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity (cont'd)		sedimentation, and nutrient and agricultural chemical deposition into surface water bodies that move down stream, benefiting larger water stream courses and regional water quality. In order to further reduce impacts to water quality, buffer strips comprised of mixed native species between biofuel crop fields and surface water bodies should be established for sediment and nutrient retention. Adherence to established conservation standards, provisions, and guidelines ensures Alternative 1 would have no significant		applicable laws for any removal of eligible material for use in a biomass conversion facility to receive matching payments. More specifically, this may include localized total maximum daily limits (TMDLs) into localized stream courses or drainage ways, which feed larger watershed sources. This would be a site specific category, since not all states have completed TMDLs for every watershed.	biofuels used as a fuel source for power generation are the most water inefficient when compared to traditional fuels, such as natural gas, which was the most water efficient.

Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity (cont'd)		negative impact on water quality.			
Recreation	Under the No Action Alternative there are no expected changes in Wildlife habitat. There will be no changes in recreation activities related to wildlife.	Under Alternative 1 there could be localized positive or negative impacts on wildlife habitat, but they are expected to be small due to the relatively small amount of land converted to energy crops. The impacts to recreation involving wildlife are expected to be small locally and also not significant at the regional or national level.	Under Alternative 2 there could be localized positive or negative impacts on wildlife habitat, but they are expected to be small due to the relatively small amount of land converted to energy crops. The impacts to recreation involving wildlife are expected to be small locally and also not significant at the regional or national level.	As mentioned in the proposed rule, the eligible crops practices could necessitate replacement or restoration of the practice if it is needed to achieve adequate erosion control, enhance water quality, wildlife habitat or increase protection of public wellheads. Also, given the site specific nature of the BCAP project areas and the practices best suited to those	Impacts to recreation could be positive or negative based on the locality for BCAP project regions. However, they would be small regionally and nationally under either alternative and would not substantively or cumulatively change the recreational aspects of participation in wildlife activities.

Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Recreation (cont'd)				conditions, effects to the abundance of wildlife for both consumptive and non-consumptive uses would vary. Practices that encourage more foraging habitat for game species could induce changes in relation to decreased traditional row crop fields; however, changes to pasture of hayland could indicate small adverse effects. As such, operators should be encouraged to comply with the goals for wildlife habitat enhancements associated with the Conservation Plans and Forestry Stewardship Plans, at the recommendation of	

Table ES-1. Summary of Environmental Consequences

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Recreation (cont'd)				the technical advisors (i.e., NRCS and FS).	

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ACRONYMS AND ABBREVIATIONS

2008 Farm Bill	Food, Conservation, and Energy Act of 2008
ACRE	Average Crop Revenue Election
APHIS	USDA Animal and Plant Health Inspection Service
ARRA	American Recovery and Reinvestment Act of 2009
BCAP	Biomass Crop Assistance Program
BCF	Biomass Conversion Facility
Bgal/d	Billion gallons per day
BLM	Bureau of Land Management
BMP	Best Management Practice
BRDB	Biomass Research Development Board
BRS	Biotechnology Regulatory Services
Btu	British thermal units
CAA	Clean Air Act
CATEX	Categorical Exclusion
CCC	Commodity Credit Corporation
CEAP	Conservation Effects Assessment Project
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CHST	collection, harvest, storage, and transportation
CO	Carbon monoxide
CO2	Carbon dioxide
CRIA	Civil Rights Impact Analysis
CRP	Conservation Reserve Program
CRS	Congressional Research Service
CSiTE	Carbon Sequestration in Terrestrial Ecosystems
CSU	Colorado State University
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
CZMP	Coastal Zone Management Plan
DOE	Department of Energy
DOT	Department of Transportation
DPEIS	Draft Programmatic Environmental Impact Statement
EA	Environmental Assessment
EBI	Environmental Benefits Index
ECP	Emergency Conservation Program
EERE	Office of Energy Efficiency and Renewable Energy
EIA	Energy Information Administration

EIS	Environmental Impact Statement
EISA	Energy Independence and Security Act
EO	Executive Order
EPA	Environmental Protection Agency
ERS	Economic Research Service
ESA	Endangered Species Act
FCA	Full Carbon Accounting
FCIC	Federal Crop Insurance Corporation
FDA	Food and Drug Administration
FEMA	Federal Emergency Management Agency
FPEIS	Final Programmatic Environmental Impact Statement
FR	Federal Register
FSA	Farm Service Agency
FSFL	Farm Storage Facility Loan
FSP	Forest Stewardship Plan
GDP	Gross Domestic Product
GE	Genetically Engineered
GHG	Greenhouse Gases
GIS	Geographical Information System
GJ	Giga Joules
HEC	Herbaceous Energy Crops
HEL	Highly Erodible Land
IAP	Interagency Agricultural Projections
IPCC	Intergovernmental Panel on Climate Change
LCA	Life Cycle Analysis
LRR	Land Resource Regions
mgy	million gallons per year
MLRA	Major Land Resource Areas
MOSS	Micro Oriented Sediment Simulator
MOU	Memorandum of Understanding
N2O	Nitrous oxide
NAAQS	National Ambient Air Quality Standards
NASS	National Agricultural Statistics Service
NECB	Net Ecosystem Carbon Budgets
NEB	Net Energy Balance
NEPA	National Environmental Policy Act
NFS	National Forest System
NHPA	National Historic Preservation Act
NLCD	National Land Cover Database

NO2	Nitrogen dioxide
NOFA	Notice of Funds Availability
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRCS	USDA Natural Resources Conservation Service
NREL	National Renewable Energy Laboratory
NRI	National Resource Inventory
O3	Ozone
ORNL	Oak Ridge National Laboratory
PARC	Partners in Amphibian and Reptile Conservation
Pb	Lead
PEIS	Programmatic Environmental Impact Statement
PHMSA	Pipeline and Hazardous Material Safety Administration
PIP	Plant-Incorporated Protectant
PL	Public Law
PM	Particulate Matter
PM2.5	Particles Less Than 2.5 Micrometers in Diameter
PM10	Particles Greater Than 2.5 Micrometers and Less Than Ten Micrometers in Diameter
POLYSYS	Policy Analysis System
PPA	Plant Protection Act
ppm	parts per million
REAP	Rural Energy for America Program
RD	USDA Rural Development
RFA	Renewable Fuels Association
RFS2	National Renewable Fuel Standards
ROI	Region of Influence
RPC	Regional Purchase Coefficient
SAM	Social Accounting Matrix
SCS	Soil Conservation Service
SHPO	State Historic Preservation Officer
SIP	State Implementation Plan
SO2	Sulfur dioxide
SRWC	Short Rotation Woody Crops
SSSA	Soil Science Society of America
SWAP	State Wildlife Action Plan
THPO	Tribal Historic Preservation Officer
TIO	Total Industry Output
TSS	Total Suspended Solids

USACE	U.S. Army Corp of Engineers
USC	U.S. Code
USCB	U.S. Census Bureau
USDA	U.S. Department of Agriculture
USDC	U.S. Department of Commerce
USDOI	U.S. Department of the Interior
USFS	U.S. Forest Service
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
USLE	Universal Soil Loss Equation
WTW	Well-to-wheels
WUE	Water Use Efficiency
Xerces	Xerces Society for Invertebrate Conservation

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1.0 PURPOSE AND NEED FOR THE PROPOSED ACTION

1.1 INTRODUCTION

The United States Department of Agriculture (USDA) Commodity Credit Corporation (CCC) proposes to implement the Biomass Crop Assistance Program (BCAP) enacted by Title IX - Section 9001 Energy - Section 9011 Biomass Crop Assistance Program of the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill). This legislation, which was passed into law on June 18, 2008, creates the BCAP and authorizes the program through September 30, 2013. BCAP is intended to assist agricultural and forest land owners and operators with the establishment and production of eligible crops including woody biomass in selected project areas for conversion to bioenergy, and the collection, harvest, storage, and transportation of eligible material to designated biomass conversion facilities (BCF) for use as heat, power, biobased products, or advanced biofuels. The BCAP is administered by the Farm Programs Division of the Farm Service Agency (FSA) on behalf of the CCC with the support of other Federal and local agencies. The BCAP is composed of two components: (1) the Matching Payments Program for collection harvest, storage, and transportation (CHST) of eligible materials, and (2) Establishment and Annual Payments Program associated with BCAP project areas. The CCC and FSA provided a Notice of Funds Availability (NOFA) for the Matching Payments Program of BCAP for eligible biomass material on June 11, 2009 (74 Federal Register [FR] 27767-27772) and on July 12, 2009 provided an additional notice concerning the implementing regulations for the Matching Payments Program. These notices can be located in Appendix A. The NOFA announced the availability of funds beginning in 2009 for certain provisions of BCAP allowing for matching payments to certain persons or entities for CHST of eligible material delivered to qualified BCFs in advance of full implementation of BCAP. FSA invited comments on the NOFA from all interested individuals and organizations over a 60-day comment period. On February 8, 2010 the proposed rule for full implementation of BCAP was published (75 FR 6264-6288) (Appendix B) which terminated and rescinded the NOFA published on June 11, 2009.

National Environmental Policy Act (NEPA) (Public Law [PL] 91-190, 42 United States Code [USC] 4321 et seq.) analysis was not done for the Matching Payment Program component of BCAP because the NOFA simply made funds available in accord with a statutory mandate and provided guidance for the Matching Payment Program. Although the scope of this analysis focuses solely on impacts associated with implementation of the Establishment and Annual Payments component of BCAP, the environmental impacts of the Proposed Action combined with the existing Matching Payments Program of BCAP will be analyzed in the cumulative impacts section of this Programmatic Environmental Impact Statement (PEIS).

This PEIS is being prepared by FSA on behalf of CCC to examine the potential environmental consequences associated with implementing the Establishment and Annual Payments Program of the BCAP authorized by the 2008 Farm Bill.

1.2 PURPOSE AND NEED INCLUDING THE PROPOSED ACTION

The primary purpose of BCAP is to promote the cultivation of perennial bioenergy crops and annual bioenergy crops that show exceptional promise for producing highly energy-efficient bioenergy or biofuels that preserve natural resources and that are not primarily grown for food or animal feed. The purpose of the Proposed Action is to establish and administer the Establishment and Annual Payments Program component of BCAP, as provided for by Title IX of the 2008 Farm Bill. Specifically, the establishment and production of dedicated energy crops for energy production including cellulosic ethanol by providing financial assistance to producers of eligible crops grown in an approved BCAP project area and harvested for conversion to bioenergy at a BCF. The need for the Proposed Action is to fulfill the CCC Charter Act (15 USC 714, et seq.) and FSA's responsibility as assigned by the Secretary of Agriculture (hereinafter referred to as Secretary) to administer the provisions of the 2008 Farm Bill.

1.3 THE NATIONAL ENVIRONMENTAL POLICY ACT PROCESS AND BCAP PEIS

This PEIS is an evaluation of the potential environmental consequences of implementing a new Federal program, BCAP, on a national scale. Because the specific locations of BCAP project areas and numbers of participants are not known, and the choice of specific program components cannot be determined at this time, this PEIS is prepared at a programmatic level. The BCAP PEIS will assist FSA and the CCC in determining (1) the conditions under which particular component actions of the program do not have the potential for significant environmental impacts and may be categorically excluded from further evaluation under NEPA; (2) those proposed actions that would require site-specific environmental reviews and compliance with applicable environmental laws in accordance with 7 Code of Federal Regulations (CFR) 799 and procedures established in the FSA Handbook on Environmental Quality Programs for State and County Offices (1-EQ Revision 2) (FSA 2009); and (3) those actions that may require an individual environmental assessment (EA) or environmental impact statement (EIS). The evaluation of future BCAP project specific potential environmental impacts would therefore tier from the BCAP PEIS.

The NEPA process begins when an agency develops a proposal to take an action that addresses a need. A Federal agency must prepare an EIS if it is proposing a major federal action that may significantly affect the quality of the natural and/or human environment. The first step in the EIS process is publication of a Notice of Intent (NOI), stating a federal agency's intention to prepare a PEIS. The first NOI for BCAP was published in the *Federal Register* (FR on October 1, 2008 (73 FR 57047-57048) with an amended NOI published on May 13, 2009 (74 FR 22510-22511). These NOIs can be located in Appendix C. Six public scoping meetings were held in six states in late May and early June, 2009 (see Section 2.2.1). The NOI provides a brief description of the proposed action and possible alternatives. It also describes the agency's proposed scoping process, including any meetings and how the public can get involved. After this notice, FSA began gathering public and agency comments (including those received at public meetings) relevant for alternative development and identification of environmental concerns. At the conclusion of the public meetings, a Draft PEIS was completed by FSA, taking into account the comments received during scoping, and was published for public and agency review and comment. The U.S. Environmental Protection Agency (EPA) is the agency responsible for publishing a Notice of Availability (NOA) in the Federal Register informing members of the public that the draft BCAP PEIS is available for a 45-day comment period. The NOA for the BCAP Draft PEIS was published by EPA on August 7th, 2009 (74 FR 151) and the descriptive notice was published on August 10, 2009 (74 FR 39915) (Appendix D).

When the public comment period on the Draft PEIS was finished, FSA analyzed comments, conducted further analysis as necessary in response to comments received, and prepared the Final PEIS. In this Final PEIS, FSA was responsible for responding to substantive comments received from other government agencies and members of the public. Please refer to Appendix E for FSA responses to substantive comments received on the Draft BCAP PEIS.

A NOA was published by the EPA in the *Federal Register* to announce the availability of this Final PEIS and to solicit comments from the public and government agencies for a 30-day period. Comments received will once again be reviewed by FSA and any substantive comments will be considered in the Record of Decision (ROD). The ROD will state CCC's decision whether to implement the proposed action, provide a basis for the decision, and describe how implementation will be accomplished. The basis for the decision includes a description of the alternatives considered; including the preferred alternative and the environmentally preferred alternative (Alternative 1), a description of the impacts identified by the EIS, and required mitigation measures that would be implemented. In the ROD, CCC will discuss all factors considered in arriving at their decision, including those of national policy.

1.3.1 USDA NEPA Guidance/Authority

This PEIS is being prepared in accordance with the NEPA (PL 91-190, 42 USC 4321 et seq.); implementing regulations adopted by the Council on Environmental Quality (CEQ) (40 CFR 1500-1508); and FSA implementing regulations, Environmental Quality and Related Environmental Concerns – Compliance with NEPA (7 CFR 799). According to CEQ guidance, the primary purpose of an EIS is to "provide full and fair discussion of significant environmental impacts and shall inform decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (40 CFR 1502.4). A Federal agency must prepare an EIS when a proposed action or program constitutes a major Federal action that may have significant impacts to the natural or human environment (40 CFR 1508.18).

1.3.2 Existing BCAP-Matching Payments Program

The Matching Payment Program provides eligible material owners matching payments for the sale and delivery of eligible material to a CHST-qualified BCF (Figure 1.3-1). Previously, matching payments were paid at a rate of $1 for each $1 per dry ton received from the qualified BCF by the eligible material owner, equal to not more than $45 per ton, and are only available for a period of two years from the date of application approval. The funds were made available per PL 110-246 (2008 Farm Bill) Section 9001 - Section 9011 (d) and the NOFA. On February 8, 2010 the proposed rule for full implementation of BCAP was published (75 FR 6264-6288) which terminated and rescinded the NOFA published on June 11, 2009.

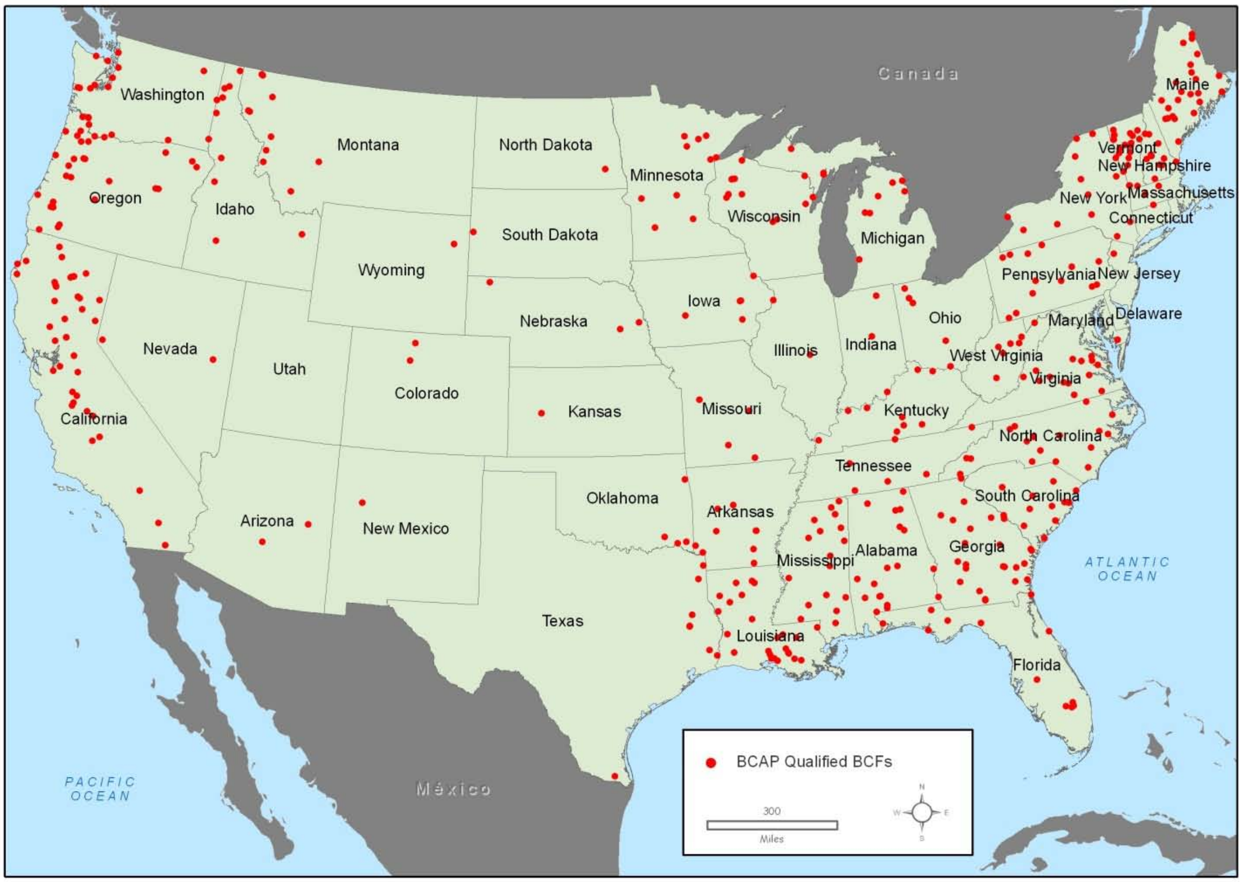


Figure 1.3-1. Locations of BCAP-Qualified BCFS as of 23 March 2010 (USDA 2010)

Under the proposed rule, the CCC is soliciting comments on three options for matching payments. Option 1 includes payments for a period not to exceed two years from the date the first payment is issued; payment at a rate of $1 for each $1 per ton received from a qualified BCF for the sale of eligible materials used to produce anything other than cellulosic ethanol in an amount up to $16 per ton; for materials used to make cellulosic ethanol the maximum amount would be up to $45 per ton. Option 2 includes payments for a period not to exceed two years from the date the first payment is issued; payment at a rate of $1 for each $1 per ton received from a qualified BCF for the sale of eligible materials up to $45 per ton; for BCFs converting vegetative waste materials to heat or power consumed by the facility, no payments would be made unless the material is converted to heat or power above the facility's historical baseline for heat or power production from renewable biomass. Option 3 includes payments for a period not to exceed two years from the date the first payment is issued; payment at a rate of $1 for each $1 per ton received from a qualified BCF for the sale of eligible materials up to $45 per ton for facilities that fully convert from fossil fuel consumption to renewable biomass consumption, for eligible materials that show exceptional promise for producing innovative advanced biofuels, renewable energy, or biobased products, or for every ton of renewable biomass consumption above the facility's established baseline; all other payments would be made up to $16 per ton for facilities that do not increase renewable biomass consumption over a historical baseline.

Biomass can be harvested from a wide variety of land types, including non-industrial private forest land, cropland, and other privately owned lands such as rangeland and pastureland, and certain Federal lands such as National Forests managed by the U.S. Forest Service (USFS) and certain lands administered by the Department of the Interior (DOI) Bureau of Land Management (BLM). Any forest land where biomass is being harvested for BCAP must be under a forest stewardship plan or an equivalent plan and following all State laws and local regulations for harvesting. Cropland where biomass is being harvested for this program must comply with the same highly erodible land (HEL) conservation requirements as Commodity Title I programs. Biomass harvest must follow all applicable State and Federal environmental laws and local regulations.

Owners of participating BCFs will enter into an agreement with the USDA that the facility can and will provide all relevant information on biomass delivery and use. The local FSA office then considers submitted materials and qualifies facilities based on their applications.

FSA county offices will keep and distribute public listings of qualified BCFs and the types of materials they are using to ensure open market access for producers. Then, biomass producers file an application with USDA to receive payments for providing biomass to a registered facility. Once biomass is sold, producers must submit proof of sale materials, verified by the qualified BCF, proof of material ownership, all applicable HEL compliance forms, and an approved forest stewardship plan or the equivalent, or a BCAP conservation plan to FSA to receive the payment.

The NOFA and additional notices were published in response to the Presidential Directive issued to the Secretary of Agriculture directing an aggressive acceleration of investment in and production of biofuels. The Presidential directive requested that the Secretary of Agriculture take steps to the extent permitted by law to expedite and increase production of and investment in biofuel development by making the renewable energy financing available in the 2008 Farm Bill available within 30 days. This included guidance and support for CHST assistance of eligible materials for use in qualified BCF. The NOFA and additional notices were the first in a multi-step process to provide guidance to interested parties on funding for CHST pursuant to the Presidential Directive consistent with the 2008 Farm Bill. The NOFA and additional notices provided a general summary of the provisions that would be used to administer payments for CHST in advance of the rule on BCAP (please see Appendix A). Specifically, they provided policies and processes for (1) providing payments for the CHST of eligible material, to qualified BCFs, and (2) described the process for qualifying CHST BCFs. The Matching Payments Program was implemented under the guidance of the Executive Vice President, CCC, and the Deputy Administrator for Farm Programs, FSA (Deputy Administrator). For a list of definitions applicable to the Matching Payment Program please refer to Appendix B, §1450.2 Definitions. The USDA determined that making these funds available as soon as possible was in the public interest, and that withholding funds for CHST to provide for public notice and comment would unduly delay the provisions of the benefits associated with the program. On February 8, 2010 the proposed rule for full implementation of BCAP was published (75 FR 6264-6288) which terminated and rescinded the NOFA published on June 11, 2009.

The Matching Payment Program was determined not to be a major Federal action per the NEPA definition since (1) there was no discretionary authority to implement the program terms; it was implemented per the direct language of the 2008 Farm Bill and (2) that the materials collected during the Matching Payment Program were currently being utilized in the marketplace for a similar, if not the same, purpose. The Matching Payment Program incentivized an existing activity, which was fully seen from the data collected during the NOFA authority, to continue production during current economic conditions. The data from the NOFA indicates that approximately 80 percent of the BCFs qualified were collecting renewable biomass materials prior to the NOFA, indicating only a small number of qualified BCFs either were new facilities, facilities newly brought on-line, but were in the construction phases prior to the NOFA, or were facilities that restarted production from an off-line state due to the incentive created by the Matching Payments Program encouraging delivery of the feedstock. There is an indication from the data that there was a redirection of some existing materials from pulp and paper manufacturers to wood pellet mills.

1.3.3 Resource Specific Guidance

A variety of laws, regulations, and Executive Orders (EO) apply to actions undertaken by Federal agencies and form the basis of the analysis prepared in this PEIS. These include but are not limited to:

- National Historic Preservation Act;
- Endangered Species Act;
- Migratory Bird Treaty Act;
- Magnuson-Stevens Fishery Management and Conservation Act;
- Clean Water Act;
- Clean Air Act;
- EO 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low Income Populations;
- EO 11988, Floodplain Management;

- EO 11990, Protection of Wetlands;
- EO 13112, Invasive Species;
- EO 13175, Consultation and Coordination With Indian Tribal Governments;
- Coastal Zone Management Act.

1.3.4 Other Related Actions, Federal Permits, and Licenses

1.3.4.1 Other Related Actions

Other Federal agency actions directly related to BCAP implementation are administered by USDA agencies such as Rural Development (RD) and the USFS and include programs such as the Biorefinery Expansion Program; the Farm Storage Facility Loan Program, the Forest Biomass for Energy Program, the Bioenergy Program for Advanced Biofuels, a Pilot Energy Crop Insurance Study, and tax credits for production of cellulosic biofuel. Table 1.3-1 summarizes the other Federal agency actions directly related to BCAP implementation and existing or planned NEPA documents evaluating the environmental impacts of these programs.

1.3.4.2 Federal Permits, Licenses and other Entitlements

Other Federal permits, licenses, and other entitlements which must be obtained in implementing the Proposed Action are required under the following:

<u>Section 404 of the Clean Water Act</u>

The U.S. Army Corps of Engineers (USACE) regulates the placement of dredged or fill material in waters of the U.S., which includes some wetlands, pursuant to 33 CFR parts 320-332. Work and structures that are located in, or that affect, navigable waters of the U.S, including work below the ordinary high water in non-tidal waters are also regulated by the USACE.

<u>Section 402 National Pollutant Discharge Elimination System</u>

The EPA currently regulates storm water discharges from construction sites that are 1 acre or larger. Documenting project compliance with the National Pollutant Discharge Elimination System (NPDES) general permit involves the preparation of a Storm Water Pollution Prevention Plan and submittal of a Notice of Intent to Discharge to EPA.

<u>Section 401 Water Quality Certification</u>

Pursuant to Section 401 of the Clean Water Act (CWA), Federal permits for projects in wetlands or waterways must be certified by the state licensing or permitting agency to ensure that state water quality standards are met. Projects requiring a Section 404 or Section 402 also need a Section 401 permit.

Table 1.3-1. Other Federal Actions Directly Related to BCAP

Program	Establishment/Administration	Program Summary
Biorefinery Assistance (Biorefinery Expansion)	2008 Farm Bill Title IX, Section 9003 / USDA Rural Development, in consultation with Department of Energy (DOE)	Provides competitive grants, not to exceed 30% of project cost, for the development and construction of demonstration-scale biorefineries that convert renewable biomass to advanced biofuels. Provides loan guarantees of up to 90% of principle and interest for the development, construction and retrofitting of commercial-scale biorefineries. Mandates $75 million in FY 2009 and $245 million in FY 2010, through the CCC, for loan guarantees. Biorefineries are full fuel production phase facilities that include biomass conversion operations eligible under BCAP.
Forest Biomass for Energy	2008 Farm Bill Title IX, Section 9012 / USDA Forest Service	Authorizes new competitive research and development programs that encourage use of forest biomass for energy; priority project areas include: (1) developing technology and techniques to use low-value forest biomass for energy production, (2) developing processes to integrate energy production from forest biomass into biorefineries, (3) developing new transportation fuels from forest biomass, and (4) improving growth and yield of trees intended for renewable energy. Authorizes the appropriation of $15 million annually for FY 2009 through 2012.
Bioenergy Program for Advanced Biofuels	2008 Farm Bill Title IX, Section 9005 / USDA Rural Development	Authorizes payments to eligible agricultural producers for the expanded production of advanced biofuels (biofuels derived from renewable biomass other than corn-kernel starch). Eligible producers entering into a contract are paid based on the quantity and duration of advanced biofuel production and on the net nonrenewable energy content of the advanced biofuel. Provides $55 million in FY 2009 and 2010, $85 million in FY 2011, and $105 million in FY 2012. The bill also authorizes an additional $25 million per year from FY 2009 through 2012.

Table 1.3-1. Other Federal Actions Directly Related to BCAP (cont'd)

Program	Establishment/Administration	Program Summary
Farm Storage Facility Loan (FSFL)	2008 Farm Bill Title I, Subtitle F, Section 1614 / USDA through FSA	Provides low-interest loans for producers to build or upgrade farm storage and handling facilities. The costs for building or upgrading farm storage and handling facilities include such expenses as price and sales tax, shipping and delivery charges, site preparation costs, installation, and new material and labor for concrete pads. This program is eligible for producers that produce corn, grain sorghum, rice, soybeans, oats, peanuts, wheat, or minor oilseeds harvested as whole grain. Also eligible are corn, grain sorghum, wheat, oats or barley harvested as other-than-whole grain. The FSA completed an Environmental Assessment of the FSFL Program in August 2009.
Pilot Energy Crop Insurance Study	2008 Farm Bill Title XII, Section 12023/USDA Risk Management Agency	Requires the Federal Crop Insurance Corporation (FCIC) to contract for studies of insurance policies for energy crops, aquaculture, poultry, apiary (bees), and skip-row cropping practices (for corn and sorghum in Central Great Plains).
Tax Credit for Production of Cellulosic Biofuel	2008 Farm Bill Title XV, Section 15321	Provides temporary cellulosic biofuels production tax credit of up to $1.01/gallon through Dec 31, 2012 to any producer of qualified cellulosic biofuel.
Feedstock Flexibility Program for Bioenergy Producers	2008 Farm Bill Title IX, Section 9010 / USDA through FSA	Subsidizes the use of sugar for the production of biofuels through federal purchases of surplus sugar for sale to bioenergy producers.

New Source Review under the Clean Air Act

There are three types of permits under the New Source Review (NSR) administered by the EPA or designated state or local air pollution control agencies. Prevention of Significant Deterioration (PSD) permits are for major new sources or existing sources making major modifications within attainment areas. Nonattainment NSR permits are required for new major sources or existing major sources making major modifications within nonattainment areas. The third type of permit is the minor source permits. These permits are required to ensure that local and regional air quality is not significantly adversely affected by new sources of air pollution.

USDA APHIS Permit-Introduction of Genetically Engineered Organisms

USDA Animal Plant Health Inspection Service (APHIS) issues permits for importation, interstate movement, or environmental release of certain genetically engineered (GE) organisms. A developer wishing to introduce a GE organism must obtain the necessary authorization before proceeding. Depending on the nature of the GE crop, an applicant files either a notification or a permit application for APHIS review.

USDA USFS Special Use Permit

The Agency's special-uses program authorizes uses on NFS land that provide a benefit to the general public and protect public and natural resources values. The USFS carefully reviews each application to determine how the request affects the public's use of NFS land. Normally, NFS land is not made available if the overall needs of the individual or business can be met on nonfederal lands.

USDA USFS and DOI BLM Timber Sales Contracts, Hazardous Fuels Reductions, and Treatment and Disposal of Unmerchantable Material

Both the USFS and the BLM initiate timber sales contracts to provide active management to Federally owned forests and woodlands throughout the U.S. These timber sales contracts are awarded through a Federal procurement process, which has been analyzed and approved through Agency NEPA regulations, associated with land use management plans of individual land units and for individual timber sales contracts. Other healthy forest initiatives include hazardous fuels reductions and the treatment and disposal of unmerchantable materials, which undergo NEPA analysis at a management unit level or site specific level.

Forest Stewardship Plans or the Equivalent

The USFS indicates that approximately 45 percent (354 million acres) of forest land U.S. is under non-industrial private ownership. To assist in the multi-resource management of these resources the Cooperative Forestry Assistance Act of 1978 authorized the Forest Stewardship Program to provide technical assistance through State forestry agencies to NIPF landowners. One of the primary tenets for enrolled acres of USDA programs is conservation and management of private lands. As such, acres enrolled in either the Establishment and Annual Payments or the Matching Payments programs would be required to show BCAP conservation plans, including forestry management plans. Forestry management plans that would be accepted include Forest Stewardship Plans approved by State Foresters, American Tree Farm Certification, Sustainable Forestry Initiative Certification, State Best Management Practices, and other similar programs, if available.

Alcohol Fuel Producers Permits and Industrial Distilled Spirits Plant

The Department of the Treasury Alcohol and Tobacco Tax and Trade Bureau (TTB) oversees the permitting of alcohol fuel producers and industrial distilled spirits plants. Both types of producers must receive permits under various TTB regulations and Internal Revenue Codes. Part of the process to obtain a permit is an environmental information analysis and a water quality analysis. BCFs that produce alcohol fuels or industrial spirits that request qualification from the USDA must have all required TTB operating and revenue permits and provide those permits for review.

Transportation

The Department of Transportation's (DOT) Pipeline and Hazardous Material Safety Administration (PHMSA) is responsible for regulating and ensuring the safe and secure movement of hazardous materials to industry and consumers by all modes of transportation, including pipelines. Special permits (formerly called waivers) may be issued to individual operators in response to petitions. They waive parts of PHMSA regulations if the petitioner demonstrates and PHMSA agrees that doing so is consistent with pipeline safety. They are usually contingent on specific requirements set forth in the permit.

Local Permits

All producers must comply with State and local regulations for planning, operating, and maintaining operations within their local areas.

1.3.5 Cooperating Agencies

Cooperating agencies as defined by the CEQ include any Federal agency other than the lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in proposed legislation, a proposed action, or reasonable alternative (40 CFR 1508.5). Cooperating agencies may include a State or local agency with similar qualifications, at the invitation of the lead Federal agency. Additionally, the BLM and EPA provided review and guidance on the PEIS. The following agencies are cooperating with FSA and the CCC in the BCAP PEIS:

- USDA RD
- USDA APHIS
- USDA USFS
- USDA NRCS

1.3.5.1 Rural Development

The USDA RD mission statement is to, “increase economic opportunity and improve quality of life for all rural Americans.” Under the 2008 Farm Bill RD was delegated authority for five of the programs relating specifically with rural energy and the advancement of rural energy opportunities. More specifically, RD has authority over Section 9003, Biorefinery Assistance, which is directly related to the BCAP implementation, as well as the following, Section 9004, Repowering Assistance; Section 9005, Bioenergy Program for Advanced Biofuels; Section 9007, Rural Energy for America Program (REAP); and Section 9009, Rural Energy Self-Sufficiency Initiative. RD would be responsible for site specific NEPA requirements associated with the Biorefinery Assistance Program.

1.3.5.2 Animal and Plant Health Inspection Service

The USDA APHIS is responsible for protecting United States' agriculture from pests and diseases under the authority of the Plant Protection Act (PPA), Title IV of the Agricultural Risk Protection Act of 2000 (APHIS 2002). The PPA gives the Secretary of Agriculture, through delegated authority to APHIS, the ability to prohibit or restrict the importation, exportation, and the interstate movement of plants, plant products, certain biological control organisms, noxious weeds, and plant pests. APHIS issues permits for the importation, interstate movement, or environmental release of specific GE plants. Permit applications provide details about the nature of the GE organism to be introduced and measures that will be taken to prevent the spread and establishment of the organism in the environment; all applications are reviewed by APHIS experts. APHIS issues the permit for the introduction of GE organisms (including plants, insects or microbes) that may pose a plant pest risk; hence, APHIS has regulatory authority over potential implementation of GE-modified BCAP biomass crops.

1.3.5.3 Forest Service

The USDA USFS manages a portfolio of more than 193 million acres of national forest and grasslands throughout the U.S. The USFS is directly involved in the BCAP implementation due to the potential for woody biomass to be used as a crop type. The USFS provides assistance to private woodland owners and maintains a large staff of scientists related to all aspects of forest health, forest economics, and other issues. The USFS would be responsible for NEPA analyses associated with timber contract sales, hazardous fuel reduction actions, and the treatment and disposal of unmerchantable materials, all of which could be considered eligible materials under the Matching Payments Program.

1.3.5.4 Natural Resource Conservation Service

The USDA NRCS is a technical Agency which was established in 1935 as the Soil Conservation Service (SCS) to carry out a continuing program of soil and water conservation. The Secretary of Agriculture organized NRCS in 1994 through authority provided in the Federal Crop Insurance Reform and the Department of Agriculture Reorganization Act of 1994. NRCS combines the authorities of the former SCS as well as additional programs that provide financial assistance for natural resource conservation. The NRCS is directly involved with BCAP implementation through the technical assistance provided to private landowners associated with conservation planning and crop suitability for specific regions.

1.4 BIOMASS OVERVIEW

Biomass is defined in the 2008 Farm Bill as any organic matter that is available on a renewable or recurring basis. It includes all plants and plant derived materials, including agricultural crops and trees, wood and wood residues, grasses, aquatic plants, animal manure, municipal residues, and other residue materials. Renewable biomass according to the proposed rule (75 FR 6264-6288) is the following:

(1) Materials, pre-commercial thinnings, or invasive species from National Forest System land and BLM land that:

(i.) Are byproducts of preventive treatments that are removed to reduce hazardous fuels, to reduce or contain disease or insect infestation, or to restore ecosystem health;

(ii.) Would not otherwise be used for higher-value products; and

(iii.) Are harvested in accordance with applicable law and land management plans and the requirements for old-growth maintenance, restoration, and management direction of sections 102(e)(2), (3), and (4) of the Healthy Forests Restoration Act of 2003 (16 U.S.C. 6512) and large-tree retention provisions of subsection (f); or

(2) Any organic matter that is available on a renewable or recurring basis from non-Federal land or land belonging to an Indian or Indian Tribes that is held in trust by the U.S. or subject to a restriction against alienation imposed by the U.S. including:

(i.) Renewable plant material (including feed grains, other agricultural commodities, other plants and trees, or algae);

(ii.) Waste materials, including

(A.) Crop residue;

(B.) Other vegetative waste material (including wood waste and wood residue that would not otherwise be used for higher-value products);

(C.) Animal waste and byproducts (including fats, oils, greases, and manure); and

(D.) Food waste and yard waste.

The EPA under the Energy Independence and Security Act of 2007 (EISA) defines renewable biomass as each of the following (including any incidental, *de minimis* contaminants that are impractical to remove and are related to customary feedstock production and transport):

(1) Planted crops and crop residue harvested from existing agricultural land cleared or cultivated prior to December 19, 2007 and that was non-forested and either actively managed or fallow on December 19, 2007.

(2) Planted trees and tree residue from a tree plantation located on non-Federal land (including land belonging to an Indian tribe or an Indian individual that is held in trust by the U.S. or subject to a restriction against alienation imposed by the U.S.) that was cleared at any time prior to December 19, 2007 and actively managed on December 19, 2007.

(3) Animal waste material and animal byproducts.

(4) Slash and pre-commercial thinnings from non-Federal forestland (including forestland belonging to an Indian tribe or an Indian individual, that are held in trust by the U.S. or subject to a restriction against alienation imposed by the U.S.) that is not ecologically sensitive forestland.

(5) Biomass (organic matter that is available on a renewable or recurring basis) obtained from the immediate vicinity of buildings and other areas regularly occupied by people, or of public infrastructure, in an area at risk of wildfire.

(6) Algae.

(7) Separated yard waste or food waste, including recycled cooking and trap grease, and materials described in §80.1426(f)(5)(i).

The Department of Energy (DOE) Energy Efficiency and Renewable Energy (EERE) Program defines biomass as agricultural and forestry residues, municipal solid wastes, industrial wastes, and terrestrial and aquatic crops grown solely for energy purposes used to produce bioenergy.

Plants (on land or in water) use the light energy from the sun to convert water and carbon dioxide to carbohydrates, fats, and proteins along with small amounts of minerals (Oak Ridge National Library [ORNL] 2009a). The carbohydrate component in biomass consist of three primary constituents: cellulose, hemicellulose and lignin which can be broken down by enzymes, acids, or other compounds to simple sugars, and then fermented to produce ethanol or other types of bioenergy (Moller 2005). Biomass can also be converted to a synthesis gas through a process called gasification. This synthesis gas, using a Fischer-Tropsch process, produces several different hydrocarbon compounds, such as gasoline, diesel, and ethanol (Siuru 2008).

Biomass has the potential to provide an alternative to petroleum because it is a renewable resource that is more evenly distributed over the Earth's surface than finite energy sources, and is available on a continuous basis, unlike solar and wind, which may use more environmentally friendly technologies (DOE 2009a). Biomass is unique among renewable energy sources in that it can be converted to carbon-based fuels and chemicals, in addition to electric power (Perlack *et al.* 2005).

1.4.1 Biomass Resource Base

The existing biomass resource base is composed of a wide variety of forestry and agricultural resources, industrial processing residues, and municipal solid and urban wood residues (Figure 1.4-1), not all of which would be available for inclusion in BCAP. Forest resources include residues produced during the harvesting of forest products, fuel wood extracted from forestlands, and forest resources that could become available through initiatives to reduce fire hazards and improve forest health. Agricultural resources include grains used for biofuels production, animal wastes and byproducts (e.g., fats, oils, greases, and manure), and crop residues derived primarily from corn and small grains (e.g., wheat straw). A variety of regionally significant crops, such as cotton, rice, and fruit can also be a source of crop residues. Municipal and urban wood residues are widely available and include a variety of materials — yard and tree trimmings, land-clearing wood residues, wooden pallets, packaging materials, and construction and demolition debris (Perlack *et al*. 2005).

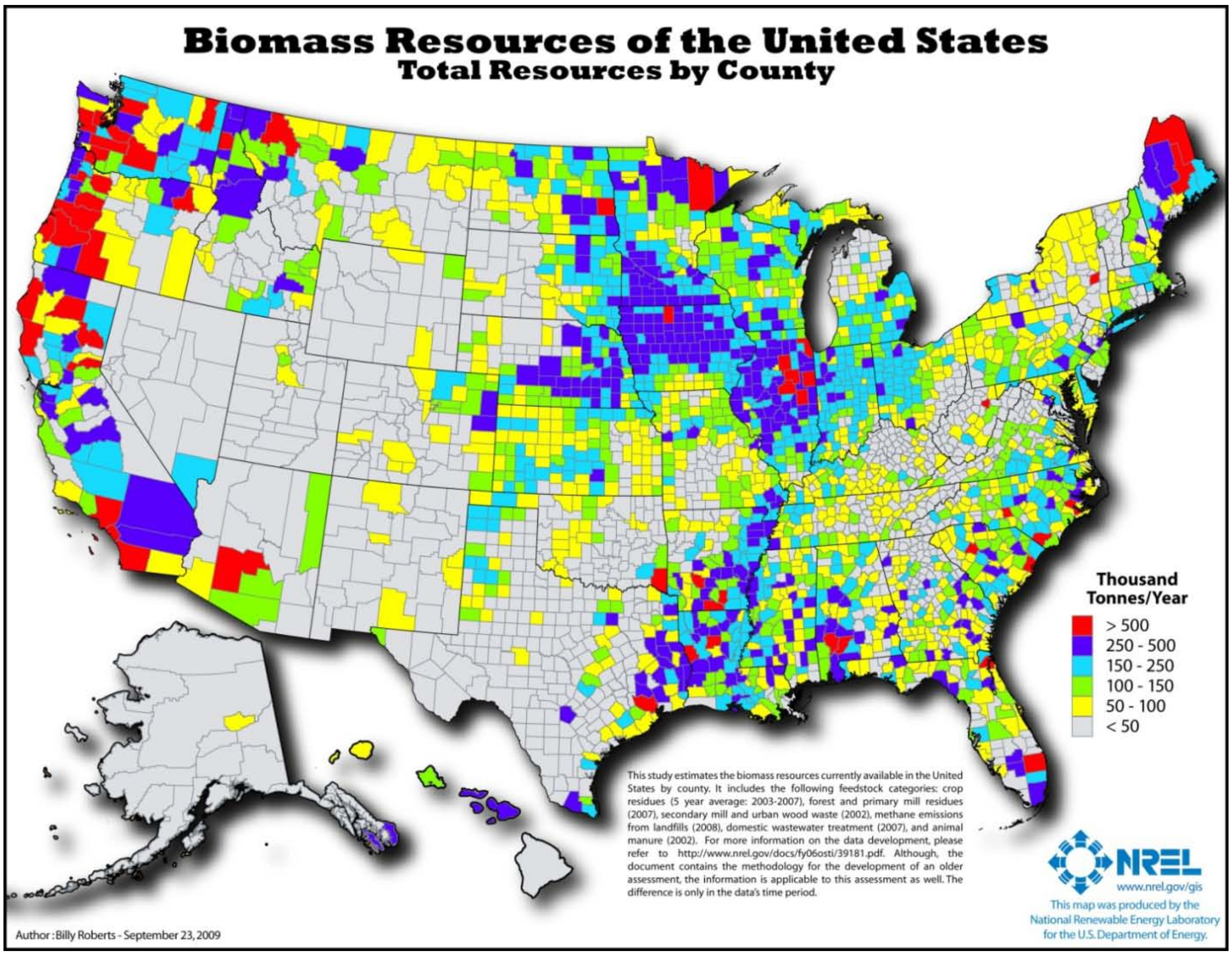


Figure 1.4-1. Distribution of Potential Existing Biomass Resources (Milbrant 2005)

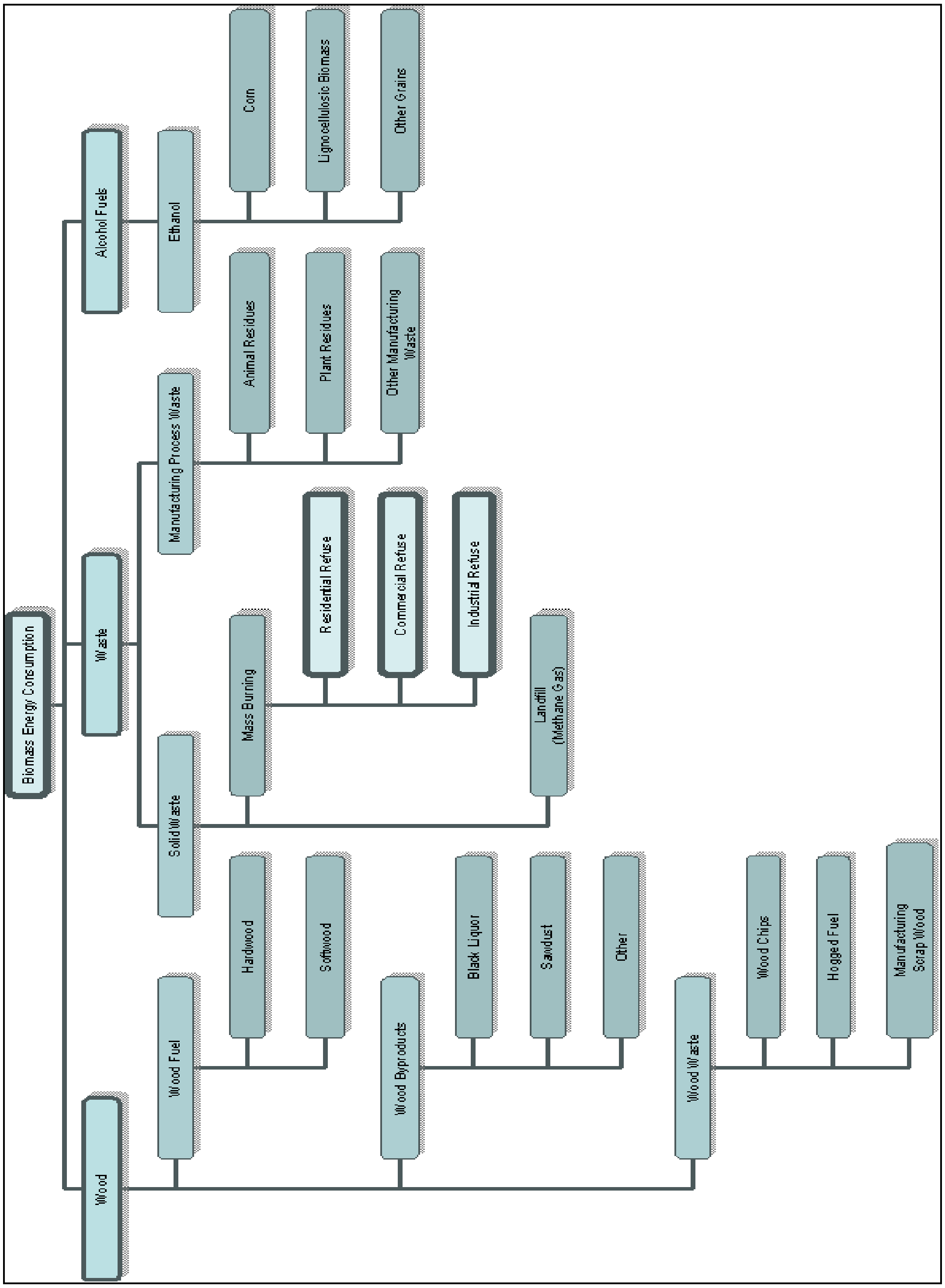
Under BCAP, an eligible crop as used for the Establishment and Annual Payments Program would be a crop of renewable biomass, as detailed previously, but which excludes Title I commodities. These commodities include whole grains derived from barley, corn, grain sorghum, oats, rice, or wheat; honey, mohair, oilseeds such as canola, crambe, flaxseed, mustard seed, rapeseed, safflower seeds, soybeans, sesame seed, and sunflower seed; peanuts; pulse crops such as small chickpeas, lentils, and dry peas; dairy products; sugar; wool; and cotton boll fiber. Also, an eligible crop cannot be any plant that the USDA has determined to be either a noxious weed or an invasive species. Under the BCAP Matching Payments Program *Eligible materials* include renewable biomass, with the exclusion of the Title I commodities listed above; animal waste and byproducts of animal waste including fats, oils, greases, and manure; food waste and yard waste; and algae.

1.4.2 Converting Biomass to Energy

Currently, renewable biomass can be converted into heat, power, biofuels (i.e., ethanol or biodiesel) or biobased products from three main components - wood, waste, and alcohol fuels. Figure 1.4-2 provides a brief overview of the main feedstocks for these components as depicted by the U.S. Energy Information Administration (EIA 1992). There are a number of available technological options to make use of a wide variety of biomass types as a renewable energy source. Conversion technologies may release the energy directly, in the form of heat or electricity, or may convert it to another form, such as liquid biofuel or combustible biogas. While for some classes of biomass resources there may be a number of usage options, for others there may be only one appropriate technology. By producing multiple products, a biorefinery can take advantage of the differences in biomass components and intermediates and maximize the value derived from the biomass feedstock. A biorefinery is a facility that integrates biomass conversion processes and equipment to produce fuels, power, and chemicals from biomass. The biorefinery concept is analogous to today's petroleum refineries, which produce multiple fuels and products from petroleum (National Renewable Energy Laboratory [NREL] 2009).

1.4.2.1 Biofuels

Biomass can be converted directly into liquid fuels, or biofuels, for use in vehicles. The two most common types of biofuels are ethanol and biodiesel. Ethanol, an alcohol, is currently made in the U.S, primarily from the starch in corn grain and is most commonly used as an additive for petroleum-based fuels to reduce toxic air emissions and increase octane. Cellulosic ethanol is produced from sources other than starch in corn grain, such as woody biomass, corn stover, or switchgrass. Cellulosic ethanol is under intensive research and development by universities, several Federal agencies, and private businesses. Today, roughly half of the gasoline sold in the U.S. includes five to 10 percent ethanol. Ethanol is also available as an alternative fuel called E-85 which is an alternative fuel blend containing 83 percent ethanol in the summer and 70 percent ethanol in the winter. By early 2009, there were more than 1,900 E-85 fueling stations in 42 states (approximately 1.1 percent of all retail fueling stations) (National Biodiesel Board 2010).



Source: EIA 1992

Figure 1.4-2. Biomass Energy Resources Hierarchy

Biodiesel is made primarily from soybean oil and is typically blended at 20 percent with petroleum diesel. This fuel blend is called B-20 and is used chiefly by vehicle fleets, which get credit for using alternative fuel vehicles without having to purchase new vehicles. B-20 is also available to individual consumers with diesel **vehicles**. There are over 1,300 retail stations that offer B-20 in 48 states (National Biodiesel Board 2010).

1.4.2.2 Biopower

Biomass electrical generation or biopower is second only to hydropower as a renewable energy source. Most electricity generated using biomass today is by direct combustion using conventional boilers. These boilers burn primarily waste wood products generated by the agriculture and wood-processing industries. When burned, the wood waste produces steam, which is used to spin a turbine. The spinning turbine activates a generator that produces electricity. Some coal-fired power plants also add biomass to their coal-burning process (i.e., co-firing) to reduce the emissions produced by burning the coal (DOE 2009b). Figure 1.4-3 illustrates the locations of wood pellet mills in the U.S., wood pellets being one product that can be burned to produce heat and power.

Biomass can also be gasified prior to combustion. Gases generally burn cleaner and more efficiently than solids, which allow removal of toxic materials. Gasification also makes it possible to use biomass in combined-cycle gas turbines, such as those used in the latest natural gas power plants. Using gasification, these natural gas power plants can achieve much higher efficiencies. Small modular biomass gasification systems are well suited for providing isolated communities with electricity. In addition, the decay of biomass in landfills produces gas (primarily methane) naturally, which can be harvested and burned in a boiler to produce steam for generating electricity.

1.4.2.3 Bioproducts

Researchers have discovered that the process for making biofuels also can be used to make antifreeze, plastics, glues, artificial sweeteners, and gel for toothpaste. Other important building blocks for biobased products include carbon monoxide and hydrogen. When biomass is heated with a small amount of oxygen present, these two gases are produced in abundance. Scientists call this mixture biosynthesis gas. Biosynthesis gas can be used to make plastics and acids, which can be used in producing photographic films, textiles, and synthetic fabric.

When biomass is heated in the absence of oxygen, it forms pyrolysis oil. A chemical called phenol can be extracted from pyrolysis oil. Phenol is used to make wood adhesives, molded plastic, and foam insulation (DOE 2009b).

1.4.3 Renewable Energy Use

In 2008, biomass production contributed 3.9 quadrillion British thermal units (Btu) of energy to the 73.5 quadrillion Btu of energy produced in the U.S., or about 5 percent of total energy production (Energy Information Association [EIA] 2009a). Because a substantial portion of U.S. energy was imported in 2008, biomass supplied

Figure 1.4-3. Location of U.S. Wood Pellet Mills (USDA 2010)

approximately 3.9 percent of the total energy consumption in the U.S., which includes both domestic production and imported energy sources (99.4 quadrillion Btu) (EIA 2009a). Dedicated biomass energy crop production is still in its infancy, but given the changing dynamics in assistance programs to generate long-term interest and sustainability of production, dedicated biomass energy crop production is anticipated to increase.

The DOE has partnered with industry in the *Save Energy Now Leader Program.* A Save Energy Now Leader is a U.S. company that has partnered with the DOE Industrial Technologies Program (ITP) to improve industrial energy efficiency. The Save Energy Now Leader companies sign a voluntary pledge to reduce their industrial energy and waste by 25 percent over the next 10 years. The pledge allows participants the flexibility to adopt methods for measuring and tracking energy data specific for their business operations. The ITP will provide technical and financial assistance to the participants as well as national recognition for companies that achieve the 25 percent reduction goal. As of March 2010, 42 companies have signed the pledge to become Save Energy Now Leaders, including companies which are BCFs.

1.4.3.1 Liquid Transportation Fuels (Biofuels) Use

The enactment of the EISA of 2007 (PL 110-140) requires an on-going increase in the percentage of renewable fuel use as part of the entire liquid fuel portfolio. The law increased the Renewable Fuel Standard (RFS) to 36 billion gallons of annual renewable fuel use by 2022 and requires that 60 percent of the new RFS be met by advanced biofuels, including cellulosic ethanol. The use of biomass fuels such as ethanol and biodiesel by the transportation sector is now at about 0.6 quadrillion Btu. This is less than the total amount of biofuels produced because some liquid biofuels are used by other sources (ORNL 2009b).

1.4.3.2 Current Electricity Generation

In 2008, biomass electrical generation or biopower accounted for nearly 45 percent of all renewable energy generated in the U.S. (excluding hydropower) (DOE 2009c). In 2008, 347 generating units (electric utilities and non-utilities [including independent power producers, combined heat and power producers, and other industrials]) used wood and wood derived fuels as the primary energy source with a nameplate capacity of 7,542 MW (net summer capacity of 6,734 MW, net winter capacity of 6,775 MW) (EIA 2009b). An additional 66 generating units used wood or wood derived fuels as a secondary fuel source. Also, 1,392 generating units were using other biomass (i.e., biogenic municipal solid waste, landfill gas, sludge waste, agricultural byproducts, other biomass solids, other biomass liquids, and other biomass gases (including digester gases, methane, and other biomass gases) as the primary fuel source with nameplate capacity of 4,942 MW (net summer capacity of 4,242 MW, net winter capacity of 4,323 MW) (*Ibid*). The majority of these generating units were using landfill gas and municipal solid waste as the primary fuel source. Twenty-one generating units were using agricultural crop byproducts, straw, and energy crops as the primary fuel source (396 MW nameplate capacity, net summer capacity of 336 MW, net winter capacity of 337 MW) (*Ibid*). An additional 50 generating units were using other biomass as a secondary fuel source. In the U.S. in 2008, there were 17,591 generating units with a total nameplate capacity of 1,102,604 MW (net summer capacity of 1,008,606 MW, net winter capacity of 1,046,443 MW) (*Ibid*). Wood and wood derived fuels and other biomass accounted for approximately 1.1 percent of the nameplate capacity of generating units in 2008 (*Ibid*).

1.4.3.3 Current Ethanol Production Facilities

Ethanol producing biorefineries use corn and other high starch sources to produce transportation fuels. The RFA reported 189 U.S. ethanol distilleries in operation and another 11 under construction, as of January 2010. Figure 1.4-4 shows the locations of U.S. ethanol production facilities.

Ethanol production has grown from 175 million gallons in 1980 to approximately 10.8 billion gallons by 2009 (RFA 2009). Growth in ethanol production in the 1980s averaged 22.3 percent; however, tremendous growth was documented in the early 1980s, with an increase of 40.0 percent from one year to the next, while in the late 1980s, growth slowed tremendously, to approximately 1.0 percent per year (RFA 2010a). Between

1999 and 2009, 139 new ethanol facilities have come on-line to reach an industry capacity of greater than 13.0 billion gallons per year (*Ibid*). In addition to domestic production, the U.S. has been importing ethanol at an average rate of 4.8 percent of domestic demand per year since 2002 (*Ibid*). During the period from 2002 to 2009, the average annual demand for ethanol in the U.S. has been growing at 26.3 percent (RFA 2010b).

Figure 1.4-4.Location of U.S. Ethanol Production Facilities (RFA 2010b)

The RFA commissioned a study of the economic effects of the ethanol industry; the study indicated that the ethanol industry in 2008 spent more than $28.6 billion, which flowed through the economy to create an additional $65.7 billion in gross domestic product (GDP), $19.9 billion in earnings, and more than 494,000 employment positions (LECG 2009). Additionally, the production and use of ethanol as a transportation fuel displaced approximately $32 billion in crude oil use in the U.S. (LECG 2009).

The majority of ethanol is currently, made from corn, but to significantly increase ethanol production the use of cellulosic feedstock such as agricultural residues, grasses, and wood will be needed. Research over the past several years has developed several technologies that have the capability of converting many types of cellulosic resources into a wide range of products. The goal for biorefineries is to produce both high-volume liquid fuels and high-value chemicals or products to address national energy needs while enhancing economic operations.

1.4.4 Projected Renewable Energy Use

The EIA prepares an energy outlook annually with projections of future use. The Annual Energy Outlook 2009 (AEO2009) indicates that projections for the use of liquid fuels is tempered by anticipating price increases in oil between 2007 to 2030, with estimates ranging from $50 to $200 per barrel (EIA 2009b). This fluctuation and current economic conditions lead to a general decline in the expansion of the use of liquid fuels to an approximate increase of only one million barrels per day between 2007 and 2030 with no growth anticipated in oil consumption. Anticipated growth in domestic biofuels production is anticipated to meet the demand for liquid fuels, while creating a projected decline in the net import share of overall liquid fuels to 41 percent by 2030 from 58 percent in 2007. The EIA in AEO2009 indicates that EISA's RFS (liquid fuels) and the use of Renewable Portfolio Standards (RPS) (electricity generation) at the state level will drive an increase in the total use of renewable fuels. The EIA anticipates an annual average growth of renewable fuels of 3.3 percent during the period, which is much faster than the overall anticipated increase in total energy use of 0.5 percent. The AEO 2010 preview indicates that the use of renewable energy will grow between 2008 and 2035, with approximately 41 percent of growth in electricity generation attributable to renewable energy. Additionally, the use of biofuels as a percentage of total liquid fuel consumption will increase with the energy efficiency regulations; though it would be unlikely that the RFS would be met by the 2022 deadline, requiring waivers and adjustments (EIA 2009c).

To stimulate progress in this direction, the DOE's Biomass Program awarded cost-sharing contracts in 2007 to six companies to develop commercial scale integrated biorefineries using cellulosic biomass. One of the commercial scale projects, Range Fuels, broke ground for construction of the first cellulosic ethanol biorefinery near Soperton, Georgia during 2007. An existing corn to ethanol company, Poet, LLC began construction of a cellulosic to ethanol unit at an existing facility in Scotland, South Dakota during 2007. To facilitate innovation in cellulosic biomass conversion technologies, DOE awarded nine cost-sharing contracts for the development of small-scale cellulosic biorefineries. Recipients ranged from existing pulp and paper companies and existing ethanol companies to new companies working in collaboration with universities and private sector supporters. Many new types of technologies are being developed by the small-scale biorefinery efforts. With the passage of the 2008 Farm Bill in May of 2008, USDA extended or instituted several programs that provide incentives for the development of advanced biofuels using cellulosic biomass (see Table 1.3-1).

1.5 ORGANIZATION OF THE PEIS

This PEIS assesses the potential impacts of the action and the No Action alternatives on potentially affected environmental and socioeconomic resources.

- **Chapter 1** provides background information relevant to the Proposed Action, and discusses its purpose and need.
- **Chapter 2** describes the alternatives, including the Proposed Action, and compares the alternatives.
- **Chapter 3** describes the baseline conditions (i.e., the conditions against which potential impacts of the Proposed Action and alternatives are measured) for each of the potentially affected resources.
- **Chapter 4** describes potential environmental consequences on these resources.
- **Chapter 5** includes analysis of cumulative impacts and irreversible and irretrievable resource commitments.
- **Chapter 6** discusses mitigation measures.
- **Chapter 7** is a list of references cited in the PEIS.
- **Chapter 8** lists the preparers of this document.
- **Chapter 9** contains a list of persons and agencies receiving this document and contacted during the preparation of this document.
- **Chapter 10** is an index of subjects discussed in the PEIS.
- **Chapter 11** contains a glossary of technical terms utilized.
- Appendices.

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2.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

2.1 PROPOSED ACTION

The Proposed Action is to establish and administer the Establishment and Annual Payments Program component of BCAP as mandated in Title IX - Section 9001 Energy - Section 9011 of the 2008 Farm Bill.

In accordance with Title IX - Section 9001 Energy - Section 9011 Biomass Crop Assistance Program of the 2008 Farm Bill legislation, the Secretary shall establish and administer the BCAP to:

- Support the establishment and production of eligible crops on eligible land for conversion to bioenergy in selected BCAP project areas; and
- Provide financial assistance to producers of eligible crops in a BCAP project area.

Eligible crops means crops of renewable biomass, but does not include:

- Any crop that is eligible to receive payments under Title I of the 2008 Farm Bill or subsequent amendments; or
- Any plant that has the potential to be invasive or noxious, or as determined further by the Secretary in consultation with other appropriate Federal or State departments or agencies.

A BCAP project area must have specific boundaries; which include producers with contract acreage that will supply a portion of the renewable biomass needed by a BCF; and are physically located within an economically feasible distance from the BCF. A qualified BCF means a facility that converts or proposes to convert eligible renewable biomass into heat, power, bio-based products, or advanced biofuels.

A detailed description of the actions required for establishment and administration of the Establishment and Annual Payments Program is presented in the following sections.

2.1.1 Project Area Application Requirements

CCC proposes to accept BCAP project area proposals on a continuous basis. The FSA will evaluate all proposals with the assistance of technical experts from other related federal agencies, such as the NREL of the DOE. This technical assistance will be important to determine the long-term viability of the BCF to ensure that the goals of BCAP are met.

2.1.1.1 Project Area Proposals

To be considered for selection as a BCAP project area, a project sponsor consisting of a group of producers or a BCF shall submit to the Secretary a proposal that minimally includes: (1) a description of the eligible land and eligible crops of each producer that will participate in the proposed BCAP project area; (2) a letter of commitment from a BCF that the BCF will use eligible crops intended to be produced in the BCAP project area;

(3) evidence that the BCF has sufficient equity available if the BCF is not operational at the time the project area proposal is submitted; and (4) other information that gives the Secretary a reasonable assurance that the BCF will be in operation by the time that the eligible crops are ready for harvest.

Though not specifically required, project area proposals are to include a description of the general conservation and/or forest stewardship measures that would be implemented under producer contracts. This information is necessary to ensure that all eligible crops would be grown in an environmentally acceptable manner. Additionally, the CCC finds it imperative that the project must demonstrate the ability to support the development of specific product types from renewable biomass with long-term economic viability and the ability to comply with environmental and regulatory requirements. An economic impact assessment could be part of the proposal package to document the anticipated timing and number of jobs to be created and retained and the availability to attract additional private sector investment within the project area.

Projects, at a minimum, must demonstrate the ability to support the development and production of heat, power, biobased product, or advanced biofuels from renewable biomass production. The BCF must comply with all environmental and regulatory requirements for the production of heat, power, biobased product, or advanced biofuels from renewable biomass. In addition, the project must demonstrate that sufficient quantity of eligible crops will be grown within an economically viable distance from the BCF and that the crops can be grown in an environmentally acceptable manner as determined by CCC. Whether a project area is within a viable distance from a BCF will depend upon the eligible crops being established and produced, as well as other transportation and logistics matters which must be on a case-by-case basis.

2.1.1.2 Project Area Selection Criteria

BCAP project area proposals would be evaluated by an interdisciplinary interagency review panel, which would determine the sufficiency of information submitted and the level of environmental review (i.e., NEPA review and subsequent interagency coordination) necessary to meet the overall objectives and goals of BCAP, while meeting sustainable production and conservation standards according to prevailing Federal laws and EOs (e.g., protected species, wetlands, cultural resources, etc.). The following criteria would be submitted and reviewed to be considered an acceptable project area for BCAP:

- The volume of the eligible crops proposed to be produced in the proposed project area and the probability that such crops will be used for BCAP purposes;
- The volume of renewable biomass projected to be available from sources other than the eligible crops grown on contract acres;
- The anticipated economic impact in the proposed project area, such as the number of jobs created and retained;
- The opportunity for producers and local investors to participate in the ownership of the BCF in the proposed project area;

- The participation rate by beginning or socially disadvantaged farmers or ranchers;
- The impact on soil, water, and related resources, such as effect on nutrient loads, or soil erosion;
- The variety in biomass production approaches within a project area, including agronomic conditions, harvest and postharvest practices; and monoculture and polyculture crop mixes;
- The range of eligible crops among project areas; and
- Ability to promote the cultivation of perennial bioenergy crops and annual bioenergy crops that show exceptional promise for producing highly energy-efficient renewable energy, advanced biofuels or biobased products, that preserve natural resources, and that are not primarily grown for food or animal feed.

2.1.2 Project Area Eligible Crops

After CCC approves a project area, persons and legal entities within the specific geographic boundaries of that area could be eligible for payment for the establishment and production of eligible crops. To be eligible for payment, participants would need to enroll the land under BCAP contracts. The 2008 Farm Bill defines an eligible crop as a crop of renewable biomass and also included a list of certain types of renewable biomass that would be ineligible for the BCAP. It specifically excludes Title I crops and noxious or invasive plants as eligible crops.

BCFs may suggest the exact species and varieties of eligible crops allowable in a BCAP project area, provided that the crops are included in the BCAP definition of eligible crop. Project area proposals may limit the nature and types of eligible crops to be planted within a project area. FSA State Committees will consult with the State Technical Committees for recommendations concerning the invasive and noxious status of otherwise eligible crops for the purposes of BCAP.

2.1.3 Project Area Eligible Producers

Producers would enter into BCAP contracts and be eligible to receive establishment payments, as a form of cost-share, to convert agricultural lands or nonindustrial private forest lands to the production of eligible crops. In addition, producers could also be eligible for annual payments for the production of eligible crops used for conversion to renewable energy. The details for what is required to qualify for the annual payments would be specified in the individual contract between CCC and a producer, and would typically include, at minimum, provisions for the implementation of a conservation plan, forest stewardship plan, or equivalent where required. Demonstrated compliance with the conservation or forest stewardship plan or equivalent is required. Producers that already have established BCAP eligible crops when this program starts may enter into a contract for annual payments to continue growing those crops; however, establishment payments would not be authorized.

Project sponsors, regardless of whether they are a BCF or a group of producers, could also be considered as a producer and be eligible to receive establishment and annual payments. However, the sponsor would have to own or operate eligible land to be eligible to enroll as a producer under a BCAP contract and be eligible to receive establishment and annual payments. State-owned BCFs would not be eligible for a BCAP contract because the 2008 Farm Bill specifies that State-owned land is ineligible for establishment and annual payments; however, materials from State-owned lands within or near project areas could be used as an additional supply for the BCF to normalize inputs over seasonal fluctuations as part of the Matching Payments Program.

The agreement between the project sponsor and CCC is not a contract and the project sponsor is not paid by CCC for being a sponsor, whereas the producers in the project area (who may also be the sponsor), are eligible for payment for the establishment and production of eligible crops. Therefore, BCFs that act as project sponsors would not be subject to general Federal contracting requirements as a condition of a project area approval.

2.1.3.1 Conservation Plan or Forest Stewardship Plan (or Equivalent)

Contract acreage will be subject to minimum contract terms which include, but are not limited to, the implementation of a required BCAP conservation plan and/or forest stewardship plan (or the equivalent); and compliance with highly erodible and wetland conservation requirements of 7 CFR Part 12. An example of forest stewardship plan is provided in Appendix F.

Land use restrictions would not apply to contract acreage, provided that CCC determines that the land uses would be consistent with the conservation plans and/or forest stewardship plans (or the equivalent) and any other BCAP conservation requirements.

- The producer must obtain a BCAP conservation and/or forestry plan that complies with CCC guidelines and is approved by the appropriate conservation district as defined in part 7 CFR 1410 for the land to be entered in the BCAP. If the conservation district declines to review the BCAP conservation plan, or disapproves the conservation plan, such approval may be waived by CCC.
- The practices and management activities included in the BCAP conservation and/or forestry plan and agreed to by the producer must be implemented in a cost-effective manner that meets BCAP goals and purposes.
- If applicable, a tree planting plan must be developed and included in the BCAP conservation and/or forestry plan. The tree planting plan may allow a reasonable time to complete plantings, as determined by CCC.
- All BCAP conservation or forestry plans and revisions of such plans will be subject to approval by CCC.

2.1.3.2 Site Specific Environmental Evaluation

In addition to the required BCAP conservation and/or forest stewardship plan (or the equivalent), all producers must follow all environmental rules and regulations as required through participation in other USDA programs, such as the Conservation Reserve Program (CRP) or the Emergency Conservation Program (ECP). NEPA regulations contain requirements to ensure the proper level of environmental analysis is completed prior to implementation of Federal actions that have the potential to significantly impact the quality of the human environment, like those associated with BCAP. There are several levels of documentation that provide compliance with NEPA. The level of environmental review depends on the nature, complexity, and scope of the proposed activity. CCC uses the environmental evaluation (or environmental review) process to determine the appropriate level of NEPA analysis and documentation required.

Certain activities, which have been demonstrated through prior analysis to not significantly affect the quality of the human environment, may qualify as Categorical Exclusions (CATEX). However, the site-specific activities associated with the implementation of BCAP do not qualify as CATEX. Therefore, FSA's regulation on environmental quality (7 CFR 799.10(c)) applies which provides that:

> *"FSA will independently determine by an environmental evaluation whether an environmental assessment (EA) of an EIS is required …where the presence of extraordinary circumstances or other unforeseeable factors indicate that some other level of environmental review may be appropriate."*

Each project sponsor will be required to complete the BCAP Environmental Screening worksheet. This worksheet will provide the necessary environmental information to FSA so they can accurately and expeditiously complete an environmental evaluation for enrollment of a particular site in BCAP. This worksheet can also be used in conjunction with the BCAP conservation and/or forest stewardship plan (or the equivalent) to develop methods/activities that could mitigate any potential minor site specific environmental effects for individual producers applying to the program while still meeting the overarching goal of BCAP and NEPA.

If through completion of the environmental evaluation, it is determined that there is no potential for the proposed BCAP activity to significantly impact the quality of the human environment, the environmental evaluation serves as CCC's documented compliance with NEPA as well as the requirements of other environmental laws, regulations, and EOs.

However, if after completion of the environmental evaluation it is determined that protected resources could potentially be adversely impacted, consistent with FSA's internal guidance, then no further action can occur until the BCAP applicant completes an EA. EAs will be required when the results of the environmental evaluation are unclear as to whether the proposed activities will significantly impact the quality of the human environment.

If the EA determines that there could be a significant effect on the quality of the human environment then a proposed BCAP project area or site specific EIS could be necessary. These EIS' and all EA's would be tiered to this Programmatic EIS consistent with 40 CFR 1508.28.

2.1.4 Project Area Contract Acreage and Terms

A producer within the project area would enter into a contract with CCC to commit acres, which would then be called contract acreage, to establish and/or produce eligible crops. Contract durations may be up to five years for annual and non-woody perennial crops, and up to 15 years for woody perennial crops.

In accordance with the 2008 Farm Bill, contract terms include, but are not limited to:

- Compliance with highly erodible and wetland conservation requirements contained in the 2008 Farm Bill and in 7 CFR Part 12;
- Implementation of conservation plan as defined in 7 CFR 1410.2, a forest stewardship plan as defined in 16 U.S.C. 2103 (a), or an equivalent plan as determined by the Deputy Administrator;
- A commitment to provide information to promote the production of eligible crops and the development of biomass conversion technology; and
- Other information deemed appropriate by CCC, such as the preservation of cropland bases and yield history.

Contract durations may be up to 5 years for annual and non-woody perennial crops, and up to 15 years for woody perennial crops. CCC proposes flexibility to adjust the terms of the contract length on a per project basis in order to ensure the most efficient use of government funding. The establishment time period may vary due to the type of crop, agronomic conditions (establishment time frame, winter hardiness, etc), and other factors. CCC would establish the time frame based on the recommendations received from the State Technical Committee.

The contracts would take into account an establishment period appropriate for an existing crop's harvest or for the planting of a planned crop. BCAP contracts and conservation plans would be designed in an effort to promote the production of a long-term source of biomass feedstock that can be harvested and collected in a reasonable period of time. The expectation, which will be reflected in the contract, is that eligible crops funded under BCAP will produce at least one harvest for biomass within the period of the contract.

Contracts would be subject to modification and payment reductions if any of the contract terms are violated. Participants that choose to voluntarily withdraw from BCAP before the duration of their contract has ended would be subject to early contract termination penalties and payment refunds.

In exchange for signing BCAP contracts, CCC will cost-share with participants not more than 75 percent of the cost of establishing non-woody and woody perennial crops, pay an annual payment for enrolled land, and provide for the preservation of cropland base and yield history applicable to the land enrolled in the BCAP contract.

2.1.5 Eligible and Ineligible Land

The contract acreage would consist of only the eligible lands that are covered under the producer's contract with the CCC. The 2008 Farm Bill defined eligible land for project areas as agricultural land and nonindustrial private forest land (NIPF), subject to certain exclusions. BCAP eligible agricultural land includes cropland, grassland, pastureland, rangeland, hayland, and other lands on which food, fiber, or other agricultural products are produced or capable of being produced for which a valid conservation plan exists or is implemented. Agricultural lands with already established energy crops or already contracted for energy crops or planned energy crops would be eligible lands for contract acreage.

NIPF is defined, in accordance with the 2008 Farm Bill, as rural land with existing tree cover, or suitable for growing trees, owned by any private individual, group, association, corporation, Indian tribe, or other private legal entity. This definition includes properties such as privately held tree farms or private forest landowners' cooperatives but excludes corporations whose stocks are publicly traded or legal entities principally engaged in the production of woody products.

As specified in the 2008 Farm Bill, Federal or State-owned lands are considered to be ***ineligible*** lands for the Establishment and Annual Payments Program; therefore, CCC proposes to exclude all Federal and State-owned land from the Establishment and Annual Payments Program of BCAP. Land considered ***ineligible*** to be enrolled under a BCAP contract in accordance with exclusions in the 2008 Farm Bill include native sod; and land that is already enrolled in CCC's CRP, Wetlands Reserve Program, or Grassland Reserve Program. Native sod within the proposed BCAP rules is land on which the plant cover is composed principally of native grasses, grass like plants, forbs, or shrubs suitable for grazing and browsing; and that has never been tilled for the production of an annual crops as of the date of the publication of the Final Rule in the Federal Register.

2.1.6 BCAP Payments

The Establishment and Annual Payments Program of BCAP would have two types of producer payments, establishment payments and annual payments.

2.1.6.1 Establishment Payments

Consistent with the 2008 Farm Bill, establishment payments of not more than 75 percent of the cost for establishing a perennial crop, which could include woody biomass, would include:

- The costs of seed and stock for perennials;

- The cost of planting the perennial crop;
- For NIPF, the costs of site preparation and tree planting; and
- Other proposed establishment activities that could include, but would not be limited to, site preparation for non-tree planting and supplemental or temporary irrigation.

In addition, partial payments could be authorized when identifiable components of the contract are completed; and supplemental establishment payments may be authorized if necessary. Consistent with the 2008 Farm Bill, establishment payments would not be authorized for annual crops. In addition, prior to receiving establishment payments, producers must have planted their crops and must provide their FSA county office with copies of receipts and invoices related to the cost of establishing their crops.

Establishment payments will only be made for new woody perennial crops with a projected initial harvest time occurring within the length of the contract period. Existing eligible dedicated energy crops on agricultural lands and NIPF would not be eligible for establishment payments; however, they could be eligible for annual payments until the crop is ready for delivery to a qualified BCF.

2.1.6.2 Annual Payments

Annual payments would be calculated on (i) a weighted average soil rental rate for cropland; (ii) the applicable marginal pastureland rental rate for all other land except for NIPF; and (iii) for NIPF, the average county rental rate for cropland as adjusted for forestland productivity. The payments are intended to support production of eligible crops.

Annual payments would be reduced:

- By 25 percent if an eligible crop is delivered to the BCF
- On a dollar-for-dollar basis if an eligible crop is used for purposes other than the production of energy at the biomass conversion facility;
- On a dollar-for-dollar basis if the producer receives a matching payment;
- On a dollar-for-dollar basis if the producer violates a term of the contract; or
- On a dollar-for-dollar basis if other circumstances as determined by CCC.

The purpose of the payment reduction is to avoid duplication payments but as described below, the annual payment reduction for delivery to a BCF or for matching payments would be 25 percent, because the purpose of BCAP is to encourage biomass energy production. If the harvest production is harvested and sold for any other reason, a dollar-for-dollar reduction would apply, not to exceed the total annual payment. Annual payments would be made in such an amount and in accordance with the time schedule agreed upon within the BCAP contract.

2.1.7 BCAP Reporting Requirements

The 2008 Farm Bill includes a provision that requires the Secretary to submit a report to the Committee on Agriculture of the House of Representatives and the Committee on Agriculture, Nutrition, and Forestry of the Senate on the dissemination by the Secretary of the best practice data and information gathered from participants receiving assistance under the BCAP no later than four years after enactment of the law.

2.2 ALTERNATIVES DEVELOPMENT

Scoping is a process used to identify the scope and significance of issues related to a Proposed Action while involving the public and other key stakeholders in developing alternatives and weighing the importance of issues to be analyzed in the PEIS. Those involved in the scoping process include Federal, State and local agencies, interested non-governmental organizations, producers eligible for the program, and the public. Scoping can help to resolve any conflicts or concerns prior to making a decision to implement an action. FSA has conducted both internal and external scoping of the Proposed Action and preliminary alternatives for the implementation and administration of the BCAP.

2.2.1 Agency and Public Scoping

Under the NEPA, the EIS process provides a means for the public to provide input on program implementation alternatives and on environmental concerns. CCC first provided notice of its intent (NOI) to prepare the proposed BCAP PEIS in the Federal Register on October 1, 2008 (73 FR 57047-57048). CCC provided an amended NOI to prepare the proposed BCAP PEIS in the Federal Register on May 13, 2009 (74 FR 22510-22511) and solicited public comment on the proposed PEIS for BCAP. Six public scoping meetings were held in May and June 2009 to solicit comments for the development of alternatives and to identify environmental concerns. FSA performed a density analysis of likely BCAP participation to determine those areas that would utilize the program and meetings were planned for these six locations. Public meetings were held in Washington, Texas, Iowa, Louisiana, Georgia, and New York in the cities and dates as presented in Table 2.2-1. The PEIS has taken into consideration comments gathered in the scoping process initiated with the October 1, 2008 NOI to develop the alternatives proposed for the administration and implementation of BCAP.

Announcements of the scoping meetings were posted in the *Federal Register*, State and county FSA offices, and the FSA website prior to the meetings. A public website was created that provided program information, scoping meeting locations and times, and an electronic form for submitting comments via the internet. A presentation was given at each meeting followed by a comment period for attendees. Printed program information and comment forms were made available at the meetings, along with cards providing the public comment website address. Meetings were attended by the FSA National Environmental Compliance Manager or FSA Federal Preservation Officer, and were recorded by a court reporter.

2.2.2 Scoping Issues

All comments received during the scoping process were recorded and categorized, as applicable, to the stated purpose and need for the Proposed Action, the Proposed Action itself, preliminary alternatives, and environmental resource areas. The comments were evaluated by FSA to determine the scope and significance of each issue and the depth at which it would be analyzed in the PEIS. The scoping comments received have been summarized in a matrix provided in Appendix G.

Table 2.2-1. BCAP PEIS Public Meeting Locations and Dates

Date	Public Meeting City	Public Meeting Location
28 May 2009	Olympia WA	Red Lion Hotel 2300 Evergreen Park Drive, Olympia, WA 98502
2 June 2009	Amarillo, TX	Hilton Garden Inn 9000 I-40 West, Amarillo, TX 79124
4 June 2009	Alexandria, LA	Alexander Fulton Hotel 701 4th Street Alexandria, LA 71301
8 June 2009	Des Moines, IA	Renaissance Savery Hotel 401 Locust Street Des Moines, IA 50309
10 June 2009	Albany, GA	Hilton Garden Inn 101 S. Front Street Albany, GA 31701
11 June 2009	Syracuse, NY	Hilton Garden Inn 6004 Fair Lakes East Syracuse, NY 13057

2.2.3 Comments Received on the Draft PEIS

FSA also solicited comments from the public and agencies on the Draft BCAP PEIS. All the comments received during the DPEIS comment period were recorded and then categorized based upon environmental resource area, social value, or economic importance. That breakdown was then evaluated by FSA to determine the scope and significance of each comment, and the depth at which it would be addressed in this PEIS. FSA responded to all substantive comments received and either expanded the PEIS to address the comment or explained as to why the PEIS was not expanded or clarified in accordance with the comment. A detailed comment and response report is provided as Appendix E of this Final PEIS.

The Draft PEIS received comments from five Federal agencies, three private individuals, 25 organizations or corporations, and one comment from the Government of Canada. These 35 commenters generated 191 comments. The individual comments included Air Quality (22), Biological Resources (41), Cumulative Effects (9), Mitigation (4), Additional Language or Further Clarification (14), Other (39), Proposed Action and Alternatives (24), Purpose and Need (10), Recreation (1), Resources Eliminated from Detailed Study (3), Socioeconomics and Land Use (21), Soil Resources and Quality (11), and Water Quantity and Quality (10).

Comments concerning Air Quality included GHG emissions from biomass burning, carbon sequestration, soil carbon, carbon sinks, primary/criteria air pollutants, and wind erosion. Biological resources comments included effects to protected species, primary nesting season (PNS) considerations, conversion of forest lands, conversion of grasslands, GE organisms, cumulative effects to vegetation and wildlife, types of crops planted, grassland birds, and invasive and noxious species. Cumulative effects comments included effects to higher-value product feedstocks, effects from forest land conversion, and associated and related programs at the state level. Mitigation comments included new tools to assess the values of biomass production at the site specific level to generate the BCAP Conservation Plan and a request for greater details. Other comments received included mechanisms associated with CHST, monitoring programs, conversion of CRP acres, the inclusion of crop residues, greater description of forestry resources, agricultural plastics, more precise definitions of eligible crops and lands, and the use of only one crop type as an example of eligible crops. Several comments were received on the number of alternatives presented and analyzed. Comments on Socioeconomics and Land Use included the effects on existing BCF, the use of residues, and the inclusion of SRWC into the models. Soil-related comments included increased erosion potential, soil carbon sequestration, and the role of agricultural residues in soil formation. Water-related comments included water quantity for BCF use, erosion and pesticide transport, irrigation use, and Gulf of Mexico hypoxia.

2.3 BCAP ESTABLISHMENT AND ANNUAL PAYMENTS PROGRAM ALTERNATIVES ANALYZED

Analysis of the potential impacts of not implementing a given proposed action is required by NEPA under 40 CFR 1502.14(d) and serves as an environmental baseline against which the impacts of action alternatives for program implementation may be compared. The criteria utilized to select an action alternative for analysis include:

- Meets basic purpose and need of the proposed action;
- Is achievable within the legislated time constraints for the program;
- Is achievable within the budget appropriated for the program; and
- Does not violate any existing laws

2.3.1 No Action Alternative

The No Action Alternative is carried forward in this PEIS in accordance with 40 CFR 1502.14(d) to represent the environmental baseline against which to compare the other alternatives. The No Action Alternative assumes that no Federal program for the Project Areas Program component of BCAP would be implemented and assesses the potential impacts this could have on the natural and human environment. This alternative does not meet the purpose and need as described above, but is carried forward to provide a baseline against which the impacts of the Proposed Action can be assessed.

2.3.2 Action Alternatives

Two alternatives are proposed for the administration and implementation of BCAP. The components of each alternative are presented in Table 2.3-1.

2.3.2.1 Alternative 1 – Targeted BCAP Implementation (Preferred Alternative; Environmentally Preferred Alternative)

Under Alternative 1, BCAP would be implemented on a more restrictive or targeted basis. BCAP project areas would be authorized for those projects that support only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres. No new non-agricultural lands shall be allowed to enroll in the program for BCAP crop production. This would mean that NIPF would need to be maintained in existing tree cover, established in short rotation woody crops (SRWC), or left suitable for growing trees and not converted into cropland or the equivalent of cropland for an herbaceous dedicated energy crop. An additional limitation is imposed by the relatively small funding for implementation of a BCAP program provided in the preliminary FY 2010 President’s budget, which could limit the number of viable areas analyzed under this alternative. Similar to the CRP administered by FSA, the number of acres enrolled in BCAP project areas for crop production shall be limited to no more than 25 percent of the cropland in a given county. Payment rates would be limited to an amount sufficient to provide some risk mitigation. To participate in a BCAP project area, a BCF that produces advanced biofuels must ensure the fuel meets the greenhouse gas test included in the EISA of 2007, that is, a defined percent of the full life cycle reduction in greenhouse gas gained over the production and use of conventional fuels.

Table 2.3-1. Action Alternatives Summary

Alternative 1: Targeted Implementation of BCAP	Alternative 2: Broad Implementation of BCAP
BCFs supported by BCAP project areas are limited to producing energy.	All bio-based products produced by a BCF in BCAP project areas can be supported.
No new non-agricultural lands allowed for BCAP project area crop production.	New non-agricultural lands allowed for BCAP project area crop production.
Cropland acres enrolled in the program would be capped at 25 percent of cropland acres within a given county.	Cropland acres enrolled in the program would not be capped.
Advanced biofuels produced by BCAP project area BCFs must meet the greenhouse gas test.	Advanced biofuels produced by BCAP project area BCFs do not need to meet the greenhouse gas test.
Only new BCFs are allowed to be part of BCAP project areas and only newly established crops on BCAP contract acres are eligible crops.	Existing BCFs that meet BCAP eligibility requirements are supported.
Only large commercial BCFs would be allowed in BCAP project areas.	Small and Pilot BCFs would qualify for BCAP project areas.
Payments would be limited to provide some risk mitigation.	Payments would completely replace lost potential income from non-BCAP crops.

2.3.2.2 Alternative 2 – Broad BCAP Implementation

Alternative 2 would enable anyone who meets the basic eligibility requirements as outlined in the 2008 Farm Bill provisions governing BCAP to participate in a BCAP project area. In addition, existing BCFs and crops would be supported, including small and pilot BCFs, and all bio-based products derived from eligible materials would qualify under this alternative. New non-agricultural lands (e.g. NIPF) would be allowed to enroll in the program for BCAP crop production. As such, NIPF could be planted to herbaceous species, thereby utilizing standard agricultural practices, rather than forestry practices to produce a crop. This alternative would still exclude the conversion of native sod into BCAP acreage and any other land considered ineligible in accordance with the 2008 Farm Bill. Additionally, the number of cropland acres within a county allowed to enroll in the program would not be capped.

To maximize program participation, payments would be sufficient to completely replace the potential income from non-BCAP crop production. Advanced biofuels produced by a BCF participating in a BCAP project area need only meet the less restrictive definition provided in Title IX of the 2008 Farm Bill which does not include the greenhouse gas test as specified in the EISA.

2.4 APPROACH TO ANALYSIS

The geographic scale of potential BCAP Project Area sites encompasses the entire United States and its territories and as a result land use changes, farming practices, weather conditions, soil types, water resources, natural ecosystems, and economies will vary widely at the site-specific level. Therefore, this PEIS will assess the potential impacts of implementing the Project Area component of BCAP on a broad scale and requires that certain assumptions be made to assess the impacts of the program.

Since the BCAP supports the production of dedicated energy crops, this analysis will focus only on the potential impacts associated with crop production and not the impacts associated with conversion of biomass into various types of energy (i.e. ethanol, electricity, burning for combined power and heat, etc). This PEIS evaluates the impacts of establishing a bioenergy crop (on BCAP eligible lands) and managing, and transporting to a BCF a specific crop from each of the three broad classes of cellulosic energy crops (woody crops, perennial herbaceous, and annual herbaceous). Hybrid poplar and willow (woody species), switchgrass (perennial herbaceous species), and forage sorghum (annual herbaceous species) were chosen because they have the most widely available data; it is feasible that they can be established within the time frame of the program, and represent likely energy crops that would be grown for biofuels/bioenergy across varied regions of the United States. These representative dedicated energy crops in no way represent the entire range of possible bioenergy crops that could qualify as an eligible crop under the BCAP. The production of switchgrass, forage sorghum, hybrid poplar, and willow utilize agricultural practices that are similar to those used in traditional crop agriculture with some variations in equipment and techniques. Production operations and multi-year characteristics for each selected bioenergy crop will vary.

Although algae is an eligible crop under the Establishment and Annual Payments Program component of BCAP, it currently is not considered to be technically feasible to be at a production stage (i.e., harvest) within the five year contract period for a contract signed by the end of fiscal year (FY) 2012, the expiration of the BCAP. As such, algae as an eligible crop is briefly discussed, but is not included in the detailed analysis within in this document.

Additionally, existing forestry resources not produced for a higher-value product on NIPF would be eligible for the Annual Payments. These resources are identified by approximate locations throughout the U.S. through association with private forest lands as detailed within the Forest Inventory and Analysis data publicly provided by the USFS.

2.5 ENERGY CROP PRODUCTION OPERATIONS

The following sections provide a general overview of the management practices for each of the representative energy crops and a brief summary of the inputs required for corn, the traditional feedstock for ethanol. Corm is a Title I crop and as such is not eligible for

BCAP. It is briefly discussed here to provide a counter point to impacts of the representative eligible crops discussed in this PEIS.

Each example species requires specific establishment practices, growth needs, and harvesting requirements that are site-specific. Therefore, each area or site in production of these bioenergy crops will have different management practices. For example, if switchgrass was produced on fields in the southeast, where former land use was either idle land or pasture; three cultivations would not be required. Also, the use of pesticides depends upon specific state guidelines and the EPA approval of the herbicides involved. Crop maintenance in some regions will also have more targeted fertility recommendations and some areas may harvest for biomass the first year and not wait until year two.

2.5.1 Corn

Corn or maize is a plant indigenous to North America domesticated by the Native peoples from 7,500 to 12,000 years ago. Corn accounts for more than 90 percent of total value and production of feed grains in the U.S. (Economic Research Service [ERS] 2009). Corn is grown as an annual crop with planting occurring in the spring with timing varied by location. Corn can be planted using traditional tillage methods or using modified no-till methods. Corn production usually requires inputs of fertilizers and pesticides for optimum larger-scale production. The 2005 Field Crops Summary Agricultural Chemical Usage provided application tables for corn in 19 states (USDA 2006). Table 2.5-1 illustrates the average fertilizer inputs for corn by state and the combined total. Table 2.5-2 illustrates the average pesticide inputs by state and the combined total. Figure 2.5-1 provides an illustration of fertilized corn acres where corn accounts for at least 25 percent of the cropland acres in a county.

The 2008 Farm and Ranch Irrigation Survey indicated that approximately 12 million acres of irrigated lands were for corn (21.8 percent of total irrigated acres) (USDA 2009a). In 2008, approximately 86 million acres were planted in corn (ERS 2009), indicating that approximately 13.9 percent of corn acres planted were irrigated. Of the irrigated acres in corn, the average water use per acre was approximately 1.0 acre-feet (*Ibid*).

Table 2.5-1. Average Fertilizer Inputs for Corn by State, 2005

Location	Nitrogen	Phosphorus	Potassium	Sulfur
	pounds/acre			
Colorado	128.9	35.2	18.2	9.1
Georgia	146.3	69.3	104.3	17.5
Illinois	145.7	76.8	114.2	30.8
Indiana	147.3	76.6	124.8	9.8
Iowa	140.4	64.6	83.9	7.0
Kansas	136.2	38.1	36.8	8.5
Kentucky	171.8	77.4	90.3	0.0
Michigan	127.3	45.3	81.4	7.8
Minnesota	139.0	60.2	71.2	12.5
Missouri	159.5	61.0	74.5	17.0
Nebraska	138.1	37.2	20.7	13.7
New York	66.8	38.1	44.6	0.0
North Carolina	124.4	45.9	82.3	8.1
North Dakota	121.3	44.4	24.8	8.0
Ohio	161.5	74.9	100.9	7.7
Pennsylvania	91.2	47.1	47.8	37.0
South Dakota	113.0	43.9	25.4	9.5
Texas	146.3	44.5	18.5	11.6
Wisconsin	107.8	37.2	60.1	10.9
Total	137.8	58.0	83.2	12.7

Source: USDA 2006

Table 2.5-2. Average Pesticide Inputs for Corn by State, 2005

Location	Herbicide	Insecticide
	pounds/acre	
Colorado	1.5	1.0
Georgia	2.0	0.7
Illinois	2.6	0.2
Indiana	2.5	0.3
Iowa	2.0	0.1
Kansas	2.3	0.2
Kentucky	2.5	0.1
Michigan	2.3	0.5
Minnesota	1.4	0.2
Missouri	2.6	0.1
Nebraska	2.2	0.3
New York	2.4	0.7
North Carolina	2.3	1.0
North Dakota	0.8	----
Ohio	2.7	0.7
Pennsylvania	2.6	0.5
South Dakota	1.4	0.4
Texas	1.7	0.5
Wisconsin	1.7	0.2
Total	2.1	0.3

Source: USDA 2006

2.5.2 Hybrid Poplar and Willow (Woody Species)

2.5.2.1 Hybrid Poplar

Hybrid poplar (Figure 2.5.1) is a SRWC that is specially bred and selected for fast growth and is a cross between native cottonwoods, the most common being *Populus deltoides* crossed with *Populus trichocarpa* (Sun Grant BioWeb 2009). SRWC are species that typically are planted and harvested in less than 15 years.

The types and timing of site preparation depend on the condition of the site (Table 2.5-3). Fields being converted from conventional crop cover will not need the heavy work that a field in grass will. An herbicide such as glycophosphate is applied in middle to late July of the year before planting and after the herbicide has taken effect (usually 10 to 15 days). Prior to planting the soil is tilled to a certain depth because no-till planting of hybrid has been shown to be unsuccessful (University of Minnesota 2002). Depending on site conditions tillage can be accomplished with equipment such as a heavy disk, chisel, or moldboard plow.

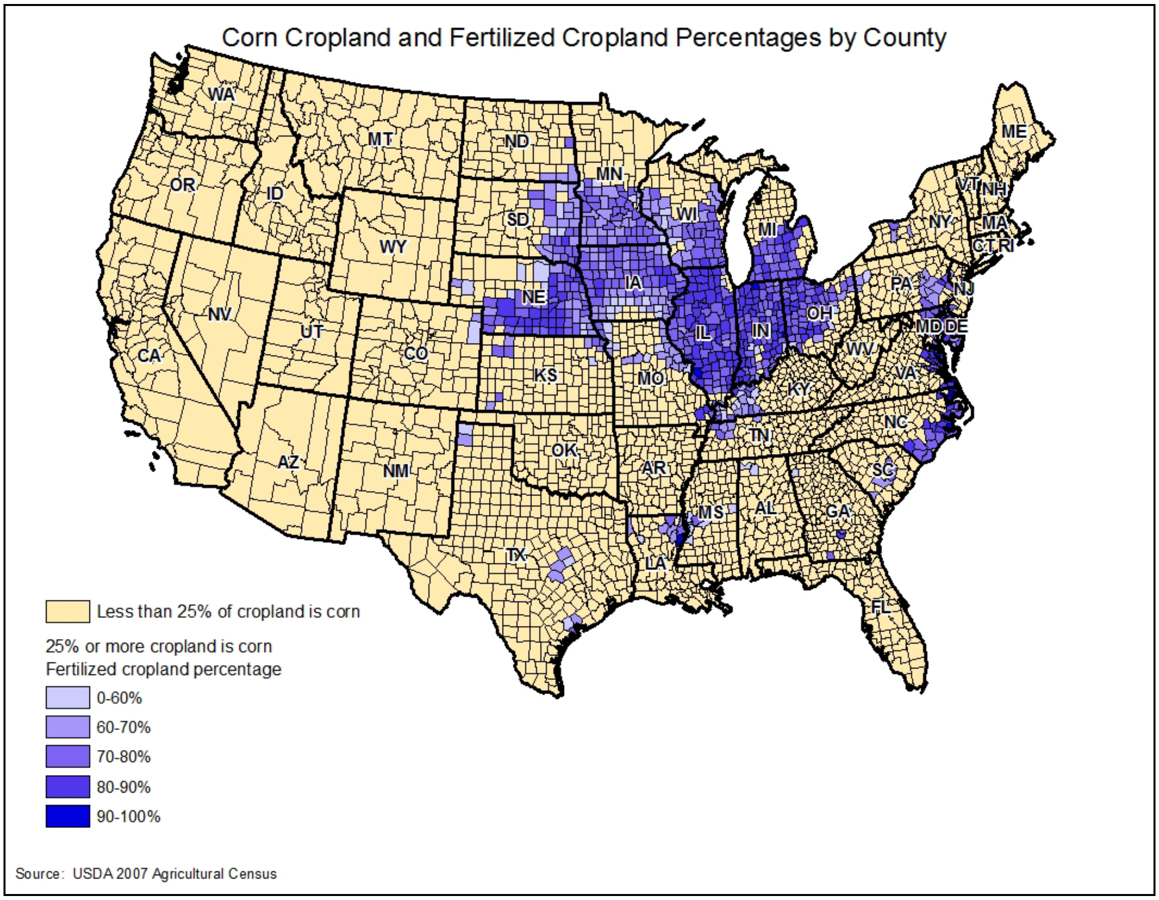


Figure 2.5-1. Corn Cropland and Fertilized Cropland Percentages by County (USDA 2009b)

Hybrid poplars attain their best growth on deep, fertile, alluvial soils with adequate moisture. Successful hybrid poplar production is also dependent upon weed control. Weeds and grasses must be controlled during the first two to four years of growth or until the canopy is well developed. Once the canopy is well developed, shade is very effective in reducing weed competition. In field-sized operations, the site preparation practices used in traditional agriculture result in an ideal seedbed for poplar planting. The type of herbicide used depends upon the weed species present and grower selection. Herbicides and other weed control measures are administered until the plantation closes canopy and natural shading begins to occur (De La Torre Ugarte *et al.* 2003). The assumed harvesting system is one in which trees are felled, crushed, field dried, baled, moved, loaded, hauled, and unloaded. Per the BCAP proposed rule, establishment payments would only be made once on land previously allowed, unless the replacement or restoration of the practice is needed to achieve adequate erosion control, enhance water quality, wildlife habitat, or increase protection of public wellheads; or if the failure

Table 2.5-3. Management Practices for Hybrid Poplar

Former Land Use: Traditional Crops	Former Land Use: Currently Idled or Planted to Pasture
Crop Establishment Year One	
Perform Tillage twice with a disk.	Apply the Herbicide glycophosphate (2 lb a.i./ac)
Manual planting of cuttings (8' x 10' spacing; 545 trees/ac)	Perform Tillage once with a moldboard plow and twice with a disk.
Apply the Herbicide Fusilade (quart/ac) or Transline (pint/ac)	Manual planting of cuttings (8' x 10' spacing; 545 trees/ac)
Apply the Herbicide Linuron (1.5 lb a.i./acre in LS) or Oust (0.15 lb a.i./acre elsewhere)	Apply the Herbicide Fusilade (quart/ac) or Transline (pint/ac) in all regions
Perform 3 cultivations	Perform 3 cultivations
Crop Maintenance	
Fertilize with Nitrogen (75 lb/ac in yr 3 in PNW; 75 lb/ac in yr 4 elsewhere)	Fertilize with Nitrogen (75 lb/ac in yr 3 in PNW; 75 lb/ac in yr 4 elsewhere)
Fertilize with lime in yr 3 (1 ton/ac in SE, APP; 1.5 ton/acre in NP, SP; none elsewhere)	Fertilize with lime in yr 3 (1 ton/ac in SE, APP; 1.5 ton/acre in NP, SP; none elsewhere)
Fertilize once with Potassium in yr 3 (35 lb/ac in LS; 50 lb/ac in CB, APP; 40 lb/ac in SE; 15 lb/ac in NP, PNW; and 25 lb/ac SP) and once with Phosphorous in yr 3 (20 lb/ac in LS, SE, PNW; 15 lb/ac in NP, SP; 25 lb/ac in APP; 50 lb/ac in CB)	Fertilize once with Potassium in yr 3 (35 lb/ac in LS; 50 lb/ac in CB, APP; 40 lb/ac in SE; 15 lb/ac in NP, PNW; and 25 lb/ac SP) and once with Phosphorous in yr 3 (20 lb/ac in LS, SE, PNW; 15 lb/ac in NP, SP; 25 lb/ac in APP; 50 lb/ac in CB)
Perform 2 cultivations in yr 2 (all regions but PNW where it is 1)	Perform 2 cultivations in yr 2 (all regions but PNW where it is 1)
Perform 1 cultivation in yr 3 (all regions but PNW where it is 0)	Perform 1 cultivation in yr 3 (all regions but PNW where it is 0)
One application of an insecticide such as Sevin in yr 2 (all regions but PNW where none is applied)	One application of an insecticide such as Sevin in yr 2 (all regions but PNW where none is applied)
Harvest (feller buncher, skid, chip, blow into truck) (yr 10 in LS, CB, NP, NE; yr 8 in SE, SP; yr 6 in PNW)	Harvest (feller buncher, skid, chip, blow into truck) (yr 10 in LS, CB, NP, NE; yr 8 in SE, SP; yr 6 in PNW)
Following harvest, one application of the herbicide glycophosphate (2 lb a.i./ac) and perform tillage with a forestry disk	Following harvest one application of the herbicide glycophosphate (2 lb a.i./ac)

NE = CT, NH, NJ, NY, MA, ME, PA, RI, VT
CB = IA, IL, IN, MO, OH LS = MI, MN, WI
OK, TX
NP = MT, ND, SD, WY PNW = OR, WA

APP = DE, KY, MD, NC, TN, VA, WV
SE = AL, AR, FL, GA, LA, MS, SC SP = CO, KS, NE,

a.i. = active ingredient
ac = acre
lbs = pounds
Source: Economic Impacts of Bioenergy crop production on U.S. Agriculture (De La Torre Ugarte *et al.* 2003)

of the original practices was due to reasons beyond the control of the participant (e.g., drought, flooding, hail, etc.), as determine by the CCC. Therefore, if two planting and harvests could be conducted under the 15-year woody species contract per the BCAP proposed rule, establishment payments would only be made for one planting.

2.5.2.2 Willow

Willow (*Salix* spp.) (Figure 2.5-2) can be grown throughout the eastern U.S. and grow best on loamy soils. Like hybrid poplar, successful establishment of willow biomass plantings is dependent upon effective weed control until the canopy is well developed. However, suitable varieties and appropriate management practices required for large-scale commercial production in the Plains and Southern U.S. regions have not yet been developed. The willow plants used for energy production are hybrid shrubs, rather than the trees often associated with the species. Willow production is expected to involve a close-spaced, coppice system developed predominantly in Europe, where willow is being commercially produced for energy. Planting and harvesting of willow utilize specially designed machinery that is commercially available in Europe. Table 2.5-4 lists the management practices for willow.

Source: Gomez 2005

Figure 2.5-2. Hybrid Poplar (left) and Willow (right)

Table 2.5-4. Management Practices for Willow

Former Land Use: Traditional Crops and Currently Idled or Planted to Pasture
Crop Establishment Year One
Perform tillage twice with a disk
Mechanical planting (6,200 trees/ac)
One application of the herbicide glycophosphate (2 lb a.i./acre)
1x Goal (1 lb a.i./acre)
Crop Maintenance (Years 2-22)
Fertilize once with Nitrogen (100 lb/ac in yrs 2, 5, 8, 11, 14, 17, 20)
Harvest once in yrs 4, 7, 10, 13, 16, 19, 22 (Claas-Jaguar; blow into trailer; load into chip van)
After final harvest, apply the herbicide glycophosphate (2 lb a.i./ac) and perform tillage twice with a heavy forestry disk and once with a harrow rake

a.i. = active ingredient
ac = acre
lbs = pounds
Source: Economic Impacts of Bioenergy crop production on U.S. Agriculture (De La Torre Ugarte *et al.* 2003)

2.5.3 Switchgrass Perennial (Perennial Herbaceous Species)

Source: Iowa State 2009a

Figure 2.5-3. Switchgrass

Switchgrass (*Panicum virgatum*) (Figure 2.5-3) is a perennial warm-season grass traditionally used as forage either grazed or hayed, with some applications for animal bedding. Its native range includes the U.S. east of the Rocky Mountains and extends into Mexico and Canada. It is a dominant species of the remnant tall grass prairies in the U.S. Switchgrass is genetically diverse and includes both lowland and upland varieties. Currently, switchgrass is grown on limited acreage for CRP and as forage. Existing research plots have produced yields as high as 15 dry tons per acre per year (dt/ac/yr) and have averaged over 10 dt/ac/yr for six years and the potential to increase yields is viewed as high. Switchgrass can be planted, managed, and harvested in a manner similar to traditional hay crops using existing agricultural equipment. Table 2.5-5 summarizes the input requirements for establishing and managing switchgrass.

Table 2.5-5. Management Practices for Switchgrass

Former Land Use: Traditional Crops	Former Land Use: Currently Idled or Planted to Pasture
Crop Establishment Year One	
Perform tillage once with a disk, and once with a grain drill	One application of the herbicide, glycophosphate (2 lb a.i./ac)
Seed at 5.75 lb seed/ac (Alamo in SE, APP, SP; Cave-in-Rock in NP; Pathfinder in CB, LS)	Perform tillage twice with a disk.
Fertilize once with lime (1 ton/ac in LS, CB; 2 ton/ac in SE, APP; 0 elsewhere).	1.15 grain drill
Fertilize once with phosphorus (15 lb/ac P in all regions) and nitrogen (20 lb/dry ton yield in SE; 25 lb/dt yield in SP; 0 elsewhere).	5.75 lb seed/acre (Alamo in SE, APP, SP; Cave-in-Rock in NP; Pathfinder in CB, LS)
One application of the herbicide, 2,4-D (1 lb a.i./acre in all regions)	Perform three cultivations
One application of the insecticide Plateau (2 lb a.i./acre in all regions)	Fertilize with lime (1 ton/ac in LS, CB; 2 ton/ac in SE, APP; 0 elsewhere).
Harvest using equipment such as mow, rake, 4x6 round bale and move to side of field and stack.	Fertilize with phosphorus (15 lb/ac P in all regions) and N (20 lb/dry ton yield in SE; 25 lb/dt yield in SP; 0 elsewhere)
	Apply Plateau (2 lb a.i./acre in all regions)
	Harvest using equipment such as mow, rake, 4x6 round bale and move to side of field and stack.
Crop Maintenance (Years 2-10)	
Fertilize with potassium (25 lb/ac in years 3, 6, and 9 east of the Mississippi River; however no potassium applications west of the Mississippi River) and nitrogen (25 lb/dry yield ton annually in SP; 20 lb/dry ton yield annually elsewhere)	Fertilize with potassium (25 lb/ac in years 3, 6, and 9 east of the Mississippi River; however, no potassium applications west of the Mississippi River) and nitrogen (25 lb/dry yield ton annually in SP; 20 lb/dry ton yield annually elsewhere)
Harvest annually using equipment such as a mow, rake, 4x6 round bale, move to side of field and stack.	Harvest annually using equipment such as a mow, rake, 4x6 round bale, move to side of field and stack.
In year 10 following harvest, one application of the herbicide glycophosphate (2 lb a.i./acre)	In year 10 following harvest, one application of the herbicide glycophosphate (2 lb a.i./acre)

NE = CT, NH, NJ, NY, MA, ME, PA, RI, VT
CB = IA, IL, IN, MO, OH LS = MI, MN, WI
OK, TX
NP = MT, ND, SD, WY PNW = OR, WA
APP = DE, KY, MD, NC, TN, VA, WV
SE = AL, AR, FL, GA, LA, MS, SC SP = CO, KS, NE,

a.i. = active ingredient
ac = acre
lbs = pounds
dt = dry ton

Source: Economic Impacts of Bioenergy crop production on U.S. Agriculture (De La Torre Ugarte *et al.* 2003)

As with other crops, controlling weeds, seed placement, and good seed-to-soil contact are among the key elements for the successful establishment of switchgrass. Establishing switchgrass often requires plowing, disking, spreading of fertilizers, planting, and an application of an herbicide. Establishing switchgrass into pasture sods or following crops with heavy surface residues is difficult and takes more preparation because heavy organic residues from roots and aboveground vegetation can provide a poor environment for switchgrass seedling establishment. Also, sods that appear killed by herbicides can bounce back through new rhizome and tiller production, plowing, disking, spreading of fertilizers, planting, and an application of an herbicide. Establishment should be sufficiently developed to ensure high survival and high crop productivity. Establishment in any existing crop cover requires complete kill of any existing vegetation and proper planting using a no-till drill. Fertilizers would then be surface applied and not soil incorporated. The application of fertilizers and harvesting (years 2 through 10) would be the only operations associated with growing perennial crops after they have been established. Switchgrass is harvested as hay once or twice during the growing season. This includes mowing, raking, round baling, moving and loading, and hauling.

2.5.4 Forage Sorghum (Annual Herbaceous Species)

Forage Sorghum (*Sorghum vulgare*) (Figure 2.5-4) is a large, warm-season, annual grass that is indigenous to Africa and its decedents are grown in the U.S. for grain, sugar, and biomass. Forage sorghum is best adapted to warm regions and is particularly noted for its drought tolerance compared to corn (Pennsylvania State University 1995). The minimum temperature for forage sorghum growth during the growing season is about 60F and highest yields occur when the mean temperatures during the growing season are between 75F and 80F. Forage sorghum breeding is aimed at maximizing total above ground biomass and producing less stalk, sugar, and fewer seeds. Depending upon the hybrid forage sorghum growth can range from 5 to 15 feet tall. Hybrids can be fertile and produce grain yields comparable to grain sorghum or they can be sterile and produce no growth. In the past, sweet sorghum cultivars have sometimes been the same or similar to the grain cultivars, except the seed heads are removed at emergence to allow for sugars to concentrate in the biomass. In this PEIS we are concentrating on forage sorghum varieties with emphasis on high biomass for production of cellulose as the end product. Forage sorghum can be established with a plow or disk however, this annual herbaceous species has performed

Source: Pioneer International 2007

Figure 2.5-4. Forage Sorghum

well in a no-till system when conditions are favorable (Pennsylvania State University 1995). Since forage sorghum yields are high, nitrogen fertilization requirements on some soils are high, although in some cases, high maximum yields in the Southeast on productive soils are achieved with less than 100 lbs nitrogen/acre. If it is assumed that nitrogen fertilization requirements will be 0.5% of standing biomass yield, the requirement would be about 155 lbs/acre. Harvesting of sorghum is assumed to take place in early fall utilizing a forage system (forage harvester and wagons) (Table 2.5-6).

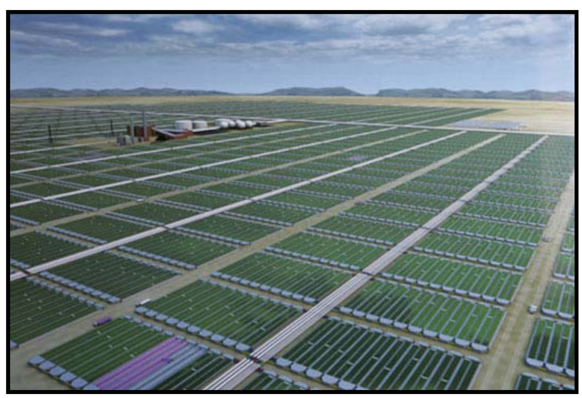
Table 2.5-6. Management Practices for Forage Sorghum

Crop Establishment
May be sown with no-tillage, minimum tillage or conventional tillage
Conventional tillage (8-12 lb/ac).
One application of the herbicide atrazine (1.12 – 2.75 lb a.i./ac) (Post planting, pre-emergence.)
Crop Maintenance
Fertilization dependent on irrigation and expected yield
Harvest annually

a.i. = active ingredient
ac = acre
lbs = pounds
Source: Marsalis 2006

2.5.5 Algae

Algae, as previously mentioned, are considered an eligible crop under BCAP and could be contracted under a five year contract for the Establishment and Annual Payment Program. Algae have recently received a lot of attention as a new biomass source for the production of renewable energy, particularly biofuels, although research into algae as an alternative fuel or energy source began during the oil crisis of the 1970s by NREL. The Aquatic Species Program, launched in 1978 as a research program funded by the United States Department of Energy (DOE), was tasked with investigating the use of algae for the production of energy. At the time, the main focus of the program was to research the feasibility of growing high-lipid algae for production of hydrogen using a variety of “waste-products”, such as carbon dioxide (CO_2) from coal plants, or seawater. The Aquatic Species Program



Source: Growdiesel Climate Care Council 2009

Figure 2.5-5. Open Algae Cultivation

shifted primary research towards studying oil production in 1982. However, the cost of producing oil from algae relative to petroleum diesel remained prohibitive to its potential as a biofuel, and the Aquatic Species Program was officially closed in 1996. In the early 2000s, research using algae again became popular, this time mainly through private industry, but also through the renewal of the DOE's Aquatic Species Program (NREL 2008).

Currently, the main method of algae mass production is in open cultivation systems (Figure 2.5-5), in areas where light and air are readily available. However, new research indicates that closed cultivation systems, hybrid (both closed and open, indoor and outdoor) systems, heterotrophic systems and integrated biofixation systems can be used to produce algae without a major increase in production costs (Ryan 2009).

During photosynthesis, algae and other photosynthetic organisms capture carbon dioxide and sunlight and convert it into oxygen and biomass. Some of the main characteristics which set algae apart from other biomass sources are that algae can have a high biomass yield per unit of light and area; can have a high oil or starch content; do not require agricultural land, fresh water is not essential, and nutrients can be supplied by wastewater and CO_2 by combustion gas (FAO 2009). The first distinction that needs to be made is between microalgae versus macroalgae (seaweed). Microalgae have many different species with widely varying compositions and live as single cells or colonies without any specialization. Although this makes their cultivation easier and more controllable, their small size makes subsequent harvesting more complicated. Macroalgae, in contrast, are less versatile but there are far fewer options of species to cultivate.

The benefits of using algae as a biofuel are wide spread. Algae can grow 20 to 30 times faster than food crops and with a harvesting cycle of 1–10 days, several harvests are permitted in a very short time frame, as opposed to yearly crops (Chisti 2007). Algae can also be grown on land that is not suitable for other established crops, such as, arid land, land with excessively saline soil, and drought-stricken land. Algae can be grown using water with a high saline content, and utilizing large amounts of the GHG, CO_2. It also contains a higher oil yield in gallons/acre; higher than any other terrestrial plant, and has the potential to be easily incorporated into the existing infrastructure, expediting a rapid displacement of petroleum (NREL 2008).

Despite the many different culture systems that have been developed over the years to meet the growing requirements for algae (light, carbon source, water, nutrients and a suitably controlled temperature) matching these ideal conditions for scaled systems is difficult. One important prerequisite to grow algae commercially for energy production is the need for large scale systems, which can range from very simple open air systems on- or offshore which expose the algae to the environment, to highly controllable, optimized but more expensive closed systems. The necessary technology for developing profitable algae-based fuel generation is still in various states of development and the final configuration is yet to be determined and demonstrated at the industrial scale (FAO 2009); and a cost-effective way to cultivate and harvest algae and produce significant amounts of biofuels has yet to be determined.

2.5.6 Non-Industrial Private Forest Lands

NIPF are eligible under the Establishment and Annual Payment Program and the Matching Payments Program of BCAP. Existing tree cover on NIPF would be eligible for woody species contracts with a term up to 15 years. NIPF products not intended for a higher-value product can receive matching payments for delivery up to two years from the date of the first matching payment per the BCAP proposed rule.

The USFS in the Forest Resources of the United States (2009) indicated that there are over 751 million acres of forest lands in the U.S. with approximately 423 million (56.3 percent) being private forest lands (both under corporate control and those private lands not under corporate control). Figure 2.5-6 illustrates the geographic distribution of private forest lands in the U.S. based on the most recent data available from the USFS EVALIDator application. Certain Federal lands managed by the USFS and the BLM can have forestry residues removed and included within the Matching Payment Program of BCAP, so long as all conditions of residue removal are met. Figure 2.5-7 illustrates the National Forest System lands and forest lands managed by BLM, which accounts for approximately 194.8 million acres (USDA 2010). Additionally, approximately 11 million acres of forest lands are controlled by county or municipal governments. NIPF accounts for approximately 284.9 million acres (37.9 percent) (Figure 2.5-8) (*Ibid*).

The USDA encourages sustainable management of resources, including forest lands. As such, lands enrolled in BCAP must meet the BCAP conservation plan or forestry stewardship plan or the equivalent requirement. These plans assist landowners in creating a long-term management plan that would be most successful for their specific resources and site conditions. Sustainable forestry practices vary by species and location; therefore, there is no standard set that will meet the conditions of all types of NIPF.

2.6 RESOURCES CONSIDERED BUT ELIMINATED FROM ANALYSIS

CEQ regulations (§1501.7(a) (3)) state that the lead agency shall identify and eliminate from detailed study the issues which are not significant or which have been covered by prior environmental review. In consideration of the site-specific environmental evaluation that must be completed prior to approval of a BCAP project area, and that the BCAP Environmental Screening worksheet and FSA Form AD-1026 Highly Erodible Land Conservation and Wetland Conservation Certification must be completed prior to BCAP project area approval, FSA has determined the Proposed Action has no potential, at a programmatic level, for significant impacts on certain resources as defined by §1508.27.

Additionally, the following laws and EOs relating to timber sales and forest health on Federally-managed forest lands by the USFS and the BLM are:

- Multiple-Use Sustained Yield Act of 1960;
- Forest and Rangeland Renewable Resources Planning Act of 1974;
- Healthy Forests Restoration Act of 2003; and
- Tribal Forests Protection Act of 2004.

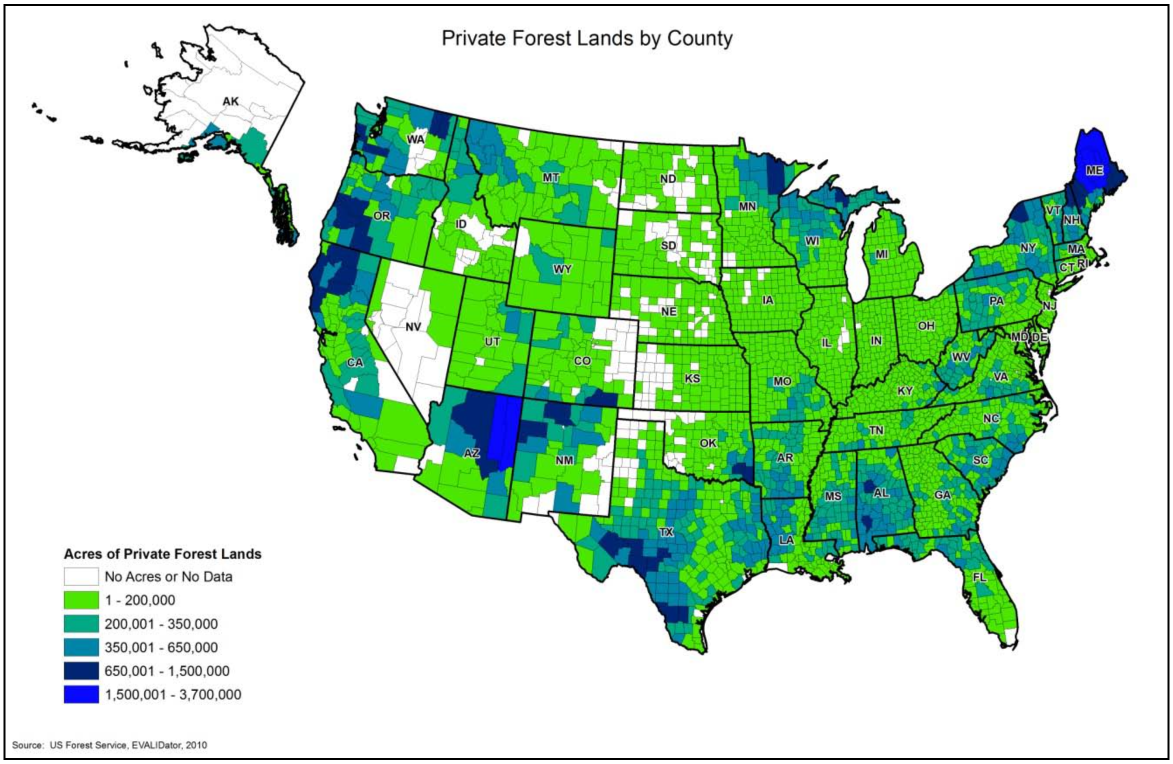


Figure 2.6-1. Private Forest Land by County (USFS 2010)

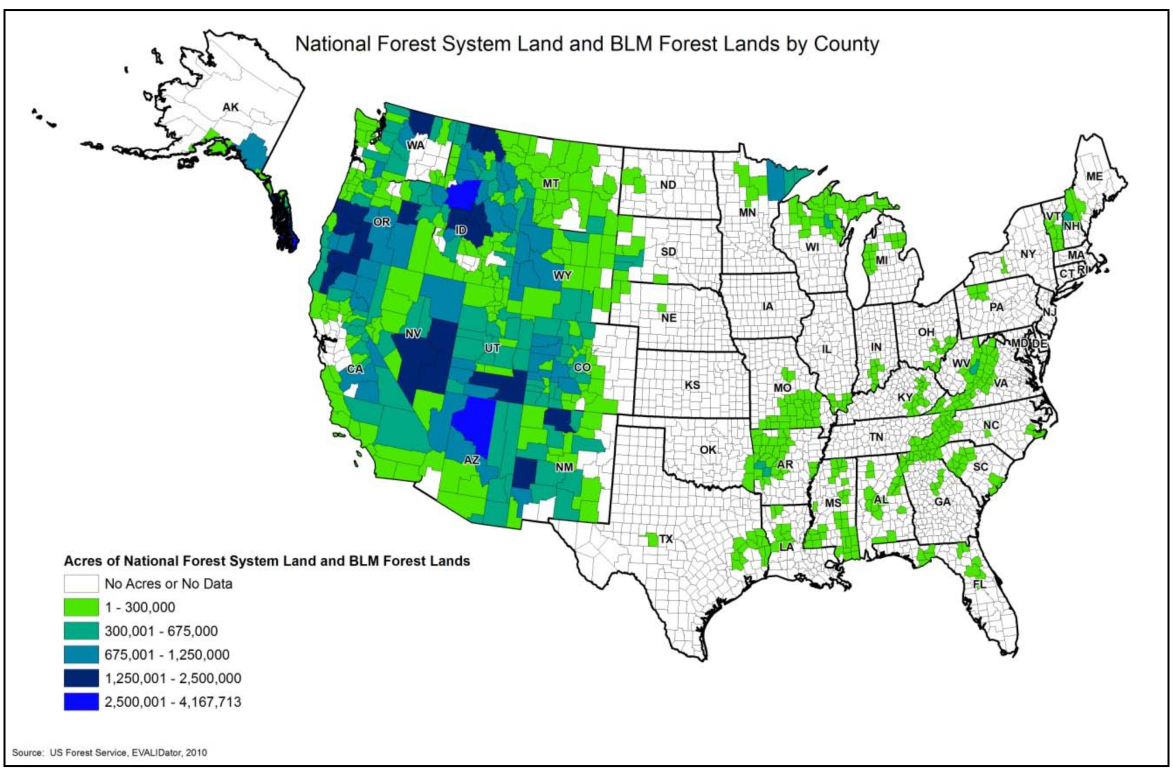


Figure 2.6-2. National Forest System Land and BLM Forest Lands by County (USFS 2010)

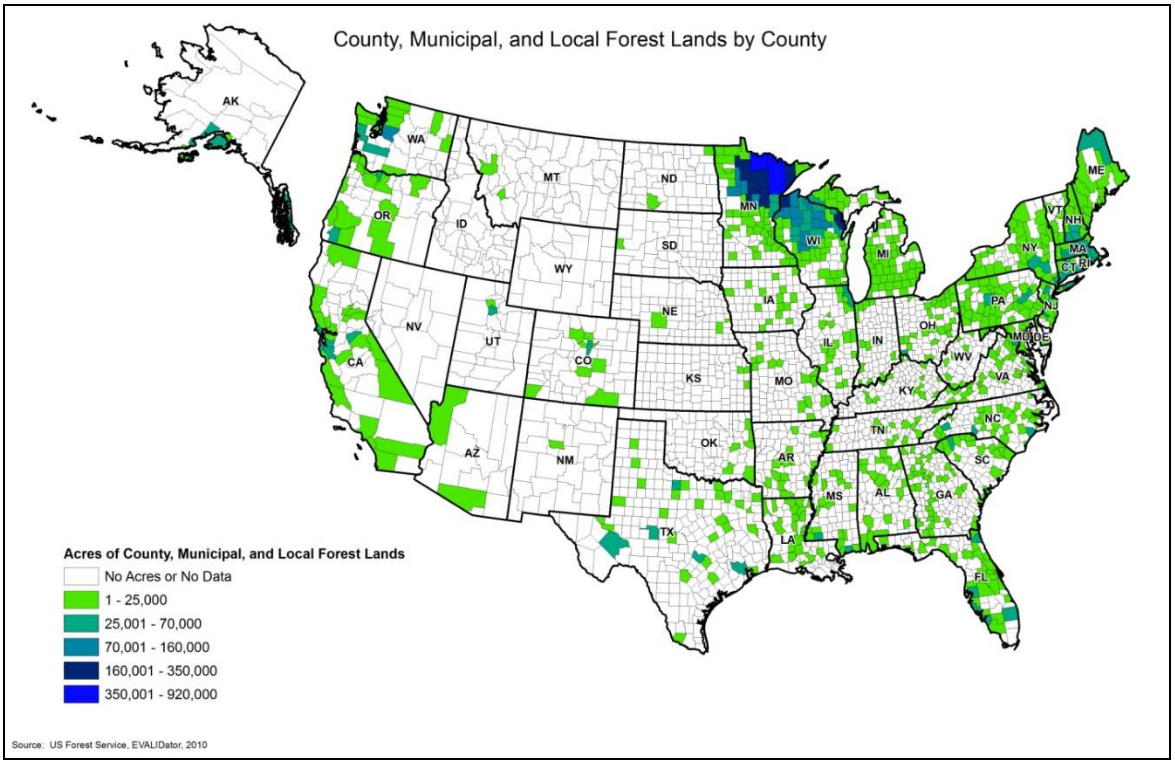


Figure 2.6-3. County, Municipal, and Locally Owned Forest Lands by County (USFS 2010)

Since the USFS and BLM must conduct a NEPA analysis associated with these activities occurring on National Forest System lands and lands managed by the BLM, the analysis of timber sales contracts and contracts for forest health management activities, which may provide eligible materials for the Matching Payments Program of BCAP, are eliminated from detailed analyses in this PEIS.

The following resources have therefore been eliminated from detailed analysis in this PEIS.

2.6.1 Wetlands

Wetlands are protected by the Clean Water Act (CWA). Before any BCAP project area may be approved, the applicant must complete FSA Form AD-1026 Highly Erodible Land Conservation and Wetland Conservation Certification. The form states that the BCAP participants would not use proceeds from any FSA farm loan, insured or guaranteed, or any USDA cost-share program, in such a way that might result in negative impacts to wetlands. As such, wetland conversions to biomass crops would be prohibited on acres enrolling within the Establishment and Annual Payments Program of BCAP. This PEIS does address potential indirect impacts associated with erosion, sedimentation, and use and transport of nutrients and herbicides, all of which could impact water quality, including wetlands. This resource has therefore been eliminated from further analysis.

2.6.2 Floodplains

Floodplains are defined by the Federal Emergency Management Agency (FEMA) as those low lying areas that are subject to inundation by a 100-year flood, a flood that has a one percent chance of being equaled or exceeded in any given year. Floodplains provide for flood and erosion control support that helps maintain water quality and contribute to sustaining groundwater levels. Floodplains also provide habitat for plant and animal species, recreational opportunities and aesthetic benefits. Activities within a floodplain have a potential to affect the flooding of lands downstream of the activity. As directed by EO 11988 Floodplain Management, Federal agencies are required to avoid, to the extent possible, adverse impacts associated with the occupancy and modification of floodplains and to avoid direct and indirect support of floodplain development. Development or improvement is subject to different regulations depending upon their location within the floodplain. Agricultural crop production has little potential to affect floodplain functions and values protected under EO 11988. Floodplains have therefore been eliminated from further consideration in the BCAP PEIS.

2.6.3 Coastal Zones

Congress passed the Coastal Zone Management Act of 1972 (CZMA) to establish the only national program to plan comprehensively for and manage development of the Nation's coastal land and water resources. Public access to coastal zones is protected under the Act. Federal actions that are likely to affect any land or water use or natural resource of the coastal zone must be consistent with the enforceable policies of a given State's Coastal Zone Management Plan (CZMP) as administered by that State. The requirement that BCAP project area approvals are contingent upon FSA Form AD-1026 Highly Erodible Land Conservation and Wetland Conservation Certification, conservation and forest management plans are required for BCAP biomass crop producers, and storage facilities must be constructed in accordance with local zoning, land use plans, and building codes, ensures compliance with the local Coastal Management Plan. This resource has therefore been eliminated from further analysis.

2.6.4 Prime and Unique Farmland

The Farmland Protection Policy Act of 1981 protects farmland defined as prime or unique from conversion to other uses and is administered by the Natural Resources Conservation Service (NRCS). In accordance with 1-EQ, FSA policy has exempted the following actions from requiring NRCS consultation under the Act: (1) the Proposed Action includes new facilities or improvements, but are for an agricultural purpose and affect only farmland; or (2) the Proposed Action involves renovating or repairing existing facilities, and the future use of these facilities remains unchanged from the original use of the facilities. Since BCAP supports the establishment of biomass agricultural crop production and any facilities constructed falls under these two exemptions, prime and unique farmland has been eliminated from further analysis.

2.6.5 Environmental Justice

EO 12898 Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations was issued by President Clinton in 1994. The purpose of the Environmental Justice EO is to ensure that minority and low-income populations are not adversely and disproportionately impacted by Federal actions. The FSA actively ensures that minority and low income populations have access and information about FSA programs. The FSA maintains an Outreach and Education Program (OEP), which provides information and technical assistance about FSA programs to farmers and ranchers. The OEP has a goal of increasing participation of underserved population including limited resource farmers and socially disadvantaged farmers. Additionally, OEP staff work with States' staff to encourage socially disadvantaged groups to participate in local governance activities, which is key to ensuring meaningfully participation of those groups in FSA programs. OEP staff also work with community groups, colleges, minority associations, and tribally-controlled colleges to provide technical assistance, training, and enhanced program delivery to those populations.

The FSA also has an Office of Civil Rights, which includes the Compliance and Program Analysis Branch. The Compliance Branch ensures nondiscrimination in delivery of programs, including CRP. The Compliance and Program Analysis Branch is required to review and approve each Civil Rights Impact Analysis (CRIA), which is required prior to issue of any significant new FSA regulation. CRIA are required by USDA Directive 4300-4 (2003). A copy of the CRIA on the draft proposed rule for BCAP is included in Appendix H. Prior to issuance of the final rule for BCAP, the CRIA will be reviewed to determine if any changes are required; and if so a revised CRIA will be developed.

The potential impacts of BCAP to environmental justice populations have been evaluated in a CRIA completed by USDA. Therefore, environmental justice has been eliminated from further analysis in this PEIS.

2.6.6 Cultural Resources

Section 106 of the National Historic Preservation Act of 1966 (as amended) (NHPA) and its implementing regulations (36 CFR §800) require federal agencies to take into account effects on historic properties in advance of approving any activity that has the potential to affect the historic qualities of the resource, and to provide the Advisory Council on Historic Preservation and the State Historic Preservation Officer (SHPO) or Tribal equivalent (THPO) an opportunity to comment prior to implementing the proposed program or project. Cultural resources can consist of prehistoric and historic districts, sites, buildings, structures or objects that may be archaeological, architectural or traditional cultural properties. Historic properties are generally at least 50 years of age or older, although some may achieve historic significance in more recent times. The site-specific environmental evaluation would verify the presence or absence of historic properties and consultation with the SHPO or THPO to ensure the proper consideration of these resources. As indicated previously, the BCAP Environmental Screening worksheet would assess the potential for effects to cultural resources at the project area and site specific level. Activities that could create deep soil penetrations, which could affect unknown buried cultural resources would be assessed by FSA, as the lead agency, for complying with Section 106 and all other applicable cultural resources laws and regulations.

2.6.7 Noise

Implementing the Proposed Action would not permanently increase ambient noise levels at or adjacent to BCAP fields, on NIPF, or constructed on farm BCAP storage facilities, as noise from heavy equipment is common on farms and in timber areas during harvest activities. The potential for increased noise levels associated with these types of BCAP activities would be minor, temporary, and localized. However, there is potential for a specific BCAP project to increase traffic through communities, which may increase ambient noise levels along existing transportation routes to a BCF. The NEPA compliance process for construction of a BCF built under the Biorefinery Assistance Program administered by RD requires a transportation analysis for how vehicles would access the facility, including an evaluation of potential associated noise impacts. Also, noise associated with forestry management activities on National Forest System lands and forest lands managed by BLM undergo site-specific NEPA analyses which address noise effects on these ecological systems; as such, they are being excluded from detailed analyses in this PEIS.

2.6.8 Other Protected Resources

The lands eligible for the Establishment and Annual Payments Program of BCAP are either privately owned or owned by county and local governments; therefore, there is limited potential for impacts to National Natural Landmarks, Federal Wilderness or Wilderness Study Areas, National parks, or Federal wildlife refuges. Also, there is limited potential of effects to these resources from the Matching Payments Program of BCAP, as site specific NEPA analysis would be conducted associated with timber sales contracts or forest health management activities on National Forest System lands and forest lands managed by BLM. Materials derived from reserved Federal lands, such as Wilderness Areas and Wildlife Refuges, would not be eligible for BCAP Matching Payments. For State-owned lands, the eligible material owner would need to show proof of ownership of the materials and compliance with all State and local regulations concerning those lands. As such, these other protected resources have been eliminated from further analysis.

2.7 COMPARISON OF THE ALTERNATIVES

Table 2.7-1 provides an overview of each analyzed alternative by resource area and also identifies mitigation or best management practices proposed, and cumulative effects for each analyzed resource area.

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Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Socio-economic and Land Use Resources	Under the No Action Alternative, the BCAP Establishment and Annual Payments Program would not be implemented for the establishment and production of dedicated energy crops. There would be no significant changes to current land use, farm prices, or farm revenue measures. Dedicated energy crops would be established only in limited demonstration-scale quantities with other public and private funding sources. In the short term, it would be unlikely that domestic production for	Under Alternative 1, the BCAP Establishment and Annual Payments Program would be implemented on a more restrictive or targeted basis. Project areas would be authorized for those that support only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres. No new non-agricultural lands would be allowed to enroll for BCAP crop production. Modeling indicates that at the national level,	Alternative 2 expands the BCAP Establishment and Annual Payments Program, allowing anyone who meets basic eligibility requirements of the BCAP provisions in the 2008 Farm Bill to participate. In addition, existing BCFs and crops would be supported, including small and pilot BCFs, and all bio-based products derived from eligible materials would qualify under this alternative. New non-agricultural lands would be allowed to enroll and the number of cropland acres	To mitigate the effects to the socioeconomic conditions, the proposed rule has proposed that vegetative wastes, such as wood wastes and wood residues, collected or harvested from both public and private lands should be limited to only those that would not otherwise be used for a higher-value product. This specifically excludes wood wastes and residues derived from mill residues or other production processes that create residual by-products that are typically used as inputs for higher value-added	Cumulative effects to socioeconomic conditions and land use would be highly dependent upon the location of the BCAP project areas and level of funding; however, overall the benefits associated with the establishment and production of dedicated energy crops should outweigh the losses associated with the land use shifts from traditional row crops. With limited funding, BCAP projects areas would be few and would be anticipated to provide local positive effects to the

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Socio-economic and Land Use Resources (cont'd)	bioenergy would meet the demand for the Energy Independence and Security Act (EISA) of 2007 advanced biofuels components.	direct impacts to realized Net Farm Income are expected to remain unchanged from that of the No Action Alternative due to limited funding. However, net returns are likely to improve for those producers selected as part of a BCAP project area. Total net returns for most potential project locations are positive, ranging between $2.7 and 7.3 million in Year 1 of the program. Modeling shows that positive Net Returns would still be expected over the long term (Year 3), indicating that the BCAP project areas remain capable	would not be capped. Significant changes are expected in net revenues as total revenue values increase more than the feedstock production costs and as feedstock production reduces the supply of other crops and subsequently increases their prices. Price increases are most significant for wheat, corn, and soybeans, with price changes expected to increase by 15 to 20 percent. The addition of forestry resources as feedstock would reduce pressures on crop prices somewhat, as	production. Additionally, industrial or other process wastes or by-products, such as black liquor or pulp liquor that is a waste by-product of the pulp and kraft paper manufacturing process, would not be included in the definition of biobased products because they are not significantly composed of organic or biological products collected or harvested from land. The proposed rule also continues the exclusion of commercially-produced timber, lumber, wood, or other finished products that otherwise would be	socioeconomic conditions from the conversion to dedicated energy crops; however, the effects would be balanced through the losses associated with input suppliers for traditional crops Under Alternative 1. The limited funding assumption and the county acreage limitation would not induce national level changes in agricultural prices. Under Alternative 2, the greater funding for BCAP could create numerous BCAP project areas with the potential to affect national crop prices.

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Socio-economic and Land Use Resources (cont'd)		of supplying a BCF with required feedstock. Alternative 1 would cause land use changes only at the local level (i.e., county or multi-county region). Land use changes range between 22,000 to 44,000 acres of crop (e.g., corn, wheat, soy, etc.) and hay land being converted to dedicated energy crops (switchgrass) from that of the No Action Alternative. Economic indirect impacts under this alternative vary by plant location. Growing dedicated energy crops and	would any future increase in crop yields. It is expected that government commodity payments would increase due to the price impacts triggered by the increased demand for cropland. Land use shifts, especially among the major crops, are expected under this alternative. Modeling indicates that by 2023, planting of energy dedicated crops will increase to over 30 million acres, while the amount of land planted in wheat and soybeans will decrease approximately 15 million acres. Of the estimated 350 million	used for higher value products. Also urban wood wastes have been excluded per the 2008 Farm Bill	Alternative 2 would encourage greater regionalization, which could encourage more land use changes to dedicated energy crops, where traditional row crops only produced marginally positive income streams. Also, the Matching Payments Program has encouraged the use of woody biomass as a feedstock for many of the BCFs qualified during the NOFA period. More than 3.1 million tons of biomass were from woody resources during the NOFA period (85.6 percent of total biomass

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Socio-economic and Land Use Resources (cont'd)		subsequent land use changes for those crops, in a region would impact the agricultural sector by the creation of a new market. It is estimated that producing a dedicated energy crop would require \$60/dry ton (approximately \$10 million) to establish the crop. In order to receive payments to establish a dedicated energy crop, producers must first convert their land from traditional crops. This would result in negative impacts within the community as inputs from the traditional crops are not purchased. Costs vary	acres in use as pastureland, approximately nine million acres would shift to the production of dedicated energy crops. There would be both positive and negative indirect impacts from the establishment of dedicated energy crops which would flow through the rest of the economy. While payments for the establishment of dedicated crops is estimated to be \$11 billion and the matching payments component of BCAP is expected to create an estimated 280,000 jobs, the costs		collected). Only 4.3 percent of woody resources were derived from Federal lands, with the remainder from non-Federal lands. During the short-term, these resources could be an important source of feedstock, until the sustainable harvest of dedicated energy crops would be available.

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Socio-economic and Land Use Resources (cont'd)		based on the community and the amount of land use changes required and range between $1.5 million to $ 5 million. Total economic impacts range between $19 million and $28 million. Net positive impacts for the top five plants are between $21 million and $25 million for their region. However, land use changes would create negative impacts, through reduced purchases of inputs for traditional farming, within a region ranging from $2.5 million to $10 million depending on location.	associated with land use changes required to meet the demand for dedicated energy crops and crop residues may bring a decline of $3.2 billion and a loss of 41,000 jobs. However, the total economic impact from implementation of Alternative 2 is estimated to be $88.5 billion and the creation of nearly 700,000 jobs.		

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife*	Under the No Action Alternative the BCAP Establishment and Annual Payments Program would not be implemented and financial assistance would not be provided for the conversion of cropland and potentially other non-agricultural lands to the establishment and production of dedicated energy crops. No additional negative impacts to vegetation or wildlife would occur as a result of BCAP. The potential benefits to wildlife from the conversion of traditional crops to	Under Alternative 1, the BCAP Establishment and Annual Payments Program would be implemented on a limited basis, specifically only supporting a limited number of BCFs in five total Land Resource Regions (LRR) selected out of an initial pool of 18 LRRs. The exact amount of land that may be converted is limited to 25 percent of the acreage within each county being eligible for BCAP payments. This equates to a relatively small amount of vegetation being converted from	Under Alternative 2, the BCAP Establishment and Annual Payments Program would be implemented on a broad scope, with potential regional impacts and across several ecosystems. Direct impacts to vegetation include the potential conversion of non-cropland to dedicated energy crops. Energy crops include perennial herbaceous species, short rotation woody crops (SRWC), and annual herbaceous crops. The amount and type of land, both traditional cropland and non-cropland,	As detailed by the 2008 Farm Bill, a Conservation Plan or Forestry Stewardship Plan are fundamental components for ensuring appropriate and sustainable agricultural practices for specific programs. A BCAP Conservation Plan or Forest Stewardship Plan or equivalent that includes Conservation Practice Standards and sustainable agriculture practices shall be developed before implementation to reduce the negative impacts to biological resources. Dedicated energy	Changes to vegetation structure and type could cause potential negative cumulative effects on native fish and wildlife through fragmented, degraded, or destroyed habitats. Cumulative effects to wildlife will be localized and site-specific as not all species are harmed by conversion of land to more intensive uses. While the footprints of the areas considered under conversion are relatively small (less than one percent of the area inside the 50-mile buffer), potential impacts may occur if land configuration and relative location of converted areas

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*	some types of biofuel crops such as switchgrass or short-rotation woody crops SRWC would be unrealized. However, there would also be no loss of native habitat as could potentially occur under Alternative 2, which allows new non-agricultural lands to be converted into dedicated energy crops.	traditional crops or pastureland to approved dedicated energy crop species. Under this alternative conversion of new non-agricultural lands into the BCAP program is disallowed. It is unlikely there would be significant negative impacts to wildlife populations from the conversion to dedicated energy crops at a regional scale. However, the potential always exists for site-specific fluctuations in wildlife populations without the proper adaptive management techniques being applied during the	converted to dedicated energy crop production would depend on which areas are designated as Project Areas to meet BCF requirements. Conversion may have both negative and positive impacts. The loss of forest land or native grasslands would decrease the habitat quality for several wildlife species. Yet, as described in Alternative 1, many of the dedicated energy crop options have a higher habitat quality than traditional crops. The types of impacts to wildlife during the establishment of	crops shall be chosen based on local ecosystems to minimize potential disturbance to native wildlife species and vegetation by providing habitats comparable to those found in natural habitats. Sustainable agricultural techniques shall be used to reduce negative impacts to biological resources and include incorporation of conservation buffers into and along the borders of currently producing agricultural fields. Buffers shall be designed and tailored towards local ecosystems and site-	combined with existing habitat fragmentation patterns could have a multiplicative effect on the overall regional habitat fragmentation values. The establishment of new crops in areas previously fallow or cropped with a different style of agriculture may cause direct mortality and range shifting at the local scale of wildlife. The use of Best Management Practices (BMPs) and environmental assessments would prevent and minimize significant impacts; however, fragmentation is

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*		establishment and harvesting stages of crop production. The proper use of adaptive management and appropriate mitigation techniques related to agricultural processes can help minimize any potential negative direct effects. There are not expected to be large scale impacts to regional wildlife populations because of the limited scope of land use change under this alternative. Indirect impacts to wildlife are related to habitat change. Some degree of wildlife mortality from collisions or nest destruction from farm	dedicated energy crops would be similar to those described in Alternative 1; yet, with the potential to occur at a much broader scale. Again, the scale of this impact is dependent on the types and amount of land converted to dedicated energy crops. Negative impacts to large mammals, small mammals, reptiles and amphibians, and invertebrates are not expected to be significant. Similarly, impacts to birds are not expected to impact population densities. However, the largest potential	specific conservation needs. Specific county Natural Resources Conservation Service (NRCS) Conservation Practice Standards, as well as State or county specific technical notes and specific guidance on mitigation measures shall be incorporated in the Conservation Plan and Forest Stewardship Plan or equivalent. Applicable NRCS Conservation Practice Standards shall be followed on lands where conserving wildlife species is an objective of the landowner or Forest Stewardship	unavoidable. Cumulative impacts to vegetation would occur from the conversion of native pastureland or native vegetation to dedicated energy crops. The cap on the amount of acreage that may be used for dedicated energy crops under Action Alternative 1 (i.e. 25 percent in any single county within the 50-mile radius) also is designed to reduce these impacts. Similarly, because of the limited funding that would only provide for a limited number of BCFs, the amount of land that potentially would be converted is

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*		equipment is unavoidable. Provided establishment and harvest of feedstock does not occur during the Primary Nesting Season (PNS), these impacts should be minimized. Reptiles and amphibians could experience negative and positive responses to the conversion to dedicated energy crops. The increase of native vegetation may increase the abundance of invertebrates, a source of food for many reptiles and amphibians. There may be short-term reductions in	negative impact to grassland birds would occur during conversion or harvesting activities. Provided these activities do not occur during the PNS, and the small portion of grasslands in potential BCAP Project Area locations, impacts to grassland birds are minimal. As with Alternative 1, provided established provisions, standards, and guidelines are followed and the BCAP Conservation Plan, Forest Stewardship Plan, or equivalent, are adapted to resource conditions, Alternative 2 would have no	Plan. Site - specific environmental evaluation on the project site in conjunction with either informal or formal consultation with the appropriate U.S. Fish and Wildlife Service (USFWS) office would protect species included on the endangered species list. Proper maintenance of heavy machinery to be used during implementation of the practices would limit the possibility of oil and gas leaks which may damage vegetation or wildlife habitats. Use of	negligible. Direct impacts to wildlife would occur by conflicts with haying machinery that may result in mortality. Under Alternative 1, direct impacts are expected to occur during the establishment and harvest stages of BCAP crops; yet, these impacts are expected to be short-term and localized. Indirect impacts. These habitat changes would impact such aspects as food availability, type and quantity of cover for escape and breeding, and the availability of adequate nesting sites.

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*		population sizes the year that conversion occurs from agricultural activity from collisions or crushing by farm equipment. The techniques described above, if properly planned and applied, are designed to minimize the impacts to wildlife of these activities. Likewise, because of the limited implementation under this alternative, these impacts will not be regional nor are they anticipated to affect regional wildlife population levels. Impacts to invertebrates are related to habitat, and	significant negative impacts on vegetation or wildlife.	BMPs such as washing vehicles upon leaving and entering a work area would minimize the potential to spread invasive or noxious plant species. Other eligible crops, such as animal wastes, food and yard wastes, and algae, have site specific requirements in regards to potential for environmental effects. To lessen potential effects associated with animal wastes, appropriate guidance from the EPA concerning confined animal feeding operation practices and standard industry practices associated with animal production	Wildlife in lands adjacent to the dedicated energy cropland may either be positively or negatively impacted depending on the habitat quality provided by the biofuel crops. Cumulative effects through implementation of Alternative 2 would lead to direct and indirect impacts to vegetation and wildlife at a regional scale. As with Alternative 1, direct impacts are not expected to impact wildlife at a population level; however, the significance of indirect

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*		will vary based on specific lifestyle and habitat preference. Direct impacts to invertebrates are dependent on the degree of exposure and the mobility of a given species. Impacts from the establishment include destruction of nest sites, crushing, and the removal of food sources. These impacts can be reduced if activities are not conducted during periods of highest florescence or when flowers are in bloom. Impacts to aquatic wildlife are associated with the dangers of sedimentation, and nutrient and		should be followed to ensure that collection of materials does not adversely impact localized vegetation and wildlife resources through secondary effects associated with water and air quality. Algae production, due to the specialized nature of the demonstration practices currently in effect, should move to minimize the use of potable water supplies where feasible and ensure that ponded areas do not become inadvertent wildlife hazardous due to trapping and drowning.	impacts are dependent on potential land use changes. The quantity and habitat quality of any land converted from native grasses, forest land or pastureland for dedicated energy crops will determine the level of cumulative impacts. Under Alternative 2, depending upon the level of land use changes, the cumulative impacts to vegetation and wildlife could be significant. No cumulative impacts under the No Action Alternative would occur as the program would not convert land from one use to a

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*		agricultural chemical deposition into water bodies. However, provided established procedures for erosion and runoff control are followed, these potential impacts are not expected to be significant. Due to the small scope of this alternative, and provided established provisions, standards, and guidelines are followed, and the BCAP Conservation Plan, Forest Stewardship Plan, or equivalent, are adapted to resource conditions, Alternative 1 would have no significant negative impacts on vegetation			dedicated energy crop.

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Biological Resources *Vegetation, Wildlife (cont'd)*		or wildlife.			
Air Quality	Under the No Action Alternative, changes to Greenhouse Gases (GHG) emissions or emissions of criteria pollutants from agricultural activities are not likely to change. There may be increased mobile source emissions and dust emissions from the transportation of current bioenergy materials from fields to qualified BCFs. However, since the number of qualified BCFs and the economically feasible	Positive changes to air quality are expected under Alternative 1. However, since the scope of this alternative is limited, these changes would not be significant. Direct impacts relate to the energy and/or emissions from agricultural production activities. Under this alternative, energy consumption within the top five regions would be reduced by 3,664 Giga Joules (GJ) through the conversion to switchgrass when	Implementing Alternative 2 on a broader scale would reduce overall direct carbon equivalent emissions during perennial dedicated energy crop growth. However, it appears that overall emissions would increase as the amount of Soil Organic Carbon (SOC) decreases due to the loss of crop residue. Total energy use was approximately one to two percent higher in most years due to the indirect energy	BMPs associated with dedicated energy crop production include the use of limited and no tillage components, which decrease the potential for fugitive dust emissions associated with exposed ground cover. Also, all producers would follow local air quality regulations, which may define other BMPs associated with agricultural activities, including transportation, and chemical usage. As specified by the	In general, the maturation of the biofuels and bioenergy industries should result in significantly positive energy balance in relation to first generation biofuels and bioenergy supported by grain feedstocks and fossil fuels. With a limited level of BCAP funding that would only provide for two commercial-scale facilities, the range of potential cumulative effects would be broad depending upon the

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Air Quality (cont'd)	distance to transport materials to these BCFs is limited, emissions would likely be restricted to a local scale.	compared to the No Action Alternative. This energy change is minor, in most cases less than 0.1 percent. Carbon emissions were less than those of the No Action Alternative, yet small, usually less than 0.1 percent. Due to the limited scale of conversion under this alternative, the amount of fugitive dust emissions would be minor, temporary, local, and nearly equal to that of the No Action Alternative. Yet, over the long term, given the conversion to perennial dedicated energy crops and reduction tillage, there	requirement for increased equipment manufacturing. Direct energy usage was either neutral or decreased over time. The effects of fugitive dust emissions during the establishment phase would be similar to those of Alternative 1. After establishment, fugitive dust emissions would decrease due to the alteration of cropping systems to perennial species. In the long term, these effects would be on a regional scale and would be positive. Indirect impacts are similar to those of Alternative 1.	proposed rule, agricultural and forest landowners and operators must comply with any existing Conservation Plans, Forest Stewardship Plans, and any other applicable laws for any removal of eligible material for use in a biomass conversion facility to receive matching payments.	location of the facilities. However, it was estimated that the BCAP program would generate net energy savings and greater soil carbon sequestration as lands are converted to dedicated energy crops. The effects were estimated to only be locally or regionally significant and not nationally significant. Under Alternative 2, the unlimited funding of the BCAP to support all scales of BCFs could lead to national level effects, such as a decline in soils carbon sequestration due to an increased use of crop residues to meet

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Air Quality (cont'd)		would be a reduction in fugitive dust emissions. These effects would be positive, but minor. Limited indirect impacts would occur from emissions from equipment exhaust or other mobile sources necessary for the establishment of dedicated energy crops. However, since machinery is already utilized on these fields, these impacts are similar to those of the No Action Alternative. Site-specific mitigation measures would be determined based on the local or regional Air Quality Control Region, as prescribed in the	Site-specific mitigation measures and BMPs as described in Alternative 1 would reduce potential impacts to Air Quality under Alternative 2.		the EISA volume requirements. It was estimated that there would be benefits from the conversion of lands associated with total carbon flux and overall energy use, but there would also be negative effects from the greater use of residues, which would generate additional GHG emissions and reduce soil carbon sequestration. In the longer term, as more acreage is planted to dedicated energy crops and regionally competitive crops (i.e., SRWC), there would be some off-set from the anticipated soil carbon losses

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Air Quality (cont'd)		Conservation Plan or through local or state regulations concerning air emissions of criteria pollutants. BMPs to reduce mobile sources include proper maintenance of equipment and dust suppression activities.			associated with residue removal and use.
Soil Resources	Implementation of the No Action Alternative is not expected to change current cropping practices or species mix. Under this alternative, crops currently in use for bioenergy are Title I crops, Title I crop residues, and woody biomass. The removal of residues may	Under Alternative 1, a reduction in erosion from all sources is expected. Conversion of croplands from traditional crops to switchgrass is estimated to reduce topsoil loss from these acres by 0.4 inches per year; which equates to four inches over a ten year period. This	Alternative 2 would result in reductions at both the local and regional level of soil erosion due to the transition from traditional crops to perennial vegetation used for dedicated energy crops. Perennial crops, and the use of corn stover and wheat straw, shift	BMPs associated with dedicated energy crop production include the use of limited and no tillage components, which decreases exposed ground cover and allows for greater retention of topsoil through perennial root systems. Other eligible crops,	The implementation of BCAP would generate positive effects from a reduction in soil erosion and increased soil carbon sequestration from the conversion of Title I crops to perennial dedicated energy crops. The conversion to a perennial dedicated energy crop

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Soil Resources (cont'd)	negatively impact soil quality; however, this impact can be reduced through the use of fertilizers. The use of BMPs would be necessary to ensure adequate amounts of crop residues remain after harvest to minimize loss of SOM.	results in the reduction of soil, nutrient, and chemical deposition into surface water bodies. Soil carbon would increase between 0.2 and 10.1 percent over that of the No Action Alternative. Indirect impacts under Alternative 1 would be increased biodiversity of soil biota as a result of increased soil organic matter and the presence of perennial vegetation. The use of BMP's would further reduce the potential for soil loss. Provided established conservation standards, provisions and guidelines are	away from conventional tillage to no tillage practices. This shifting of tillage practices on an estimated 11 million acres, conserving approximately 40 million tons of soil each year over that of the No Action Alternative. As with Alternative 1, the biological diversity of the soil would also increase. As with Alternative 1, the use of BMP's would further reduce the potential for soil loss. Provided established conservation standards, provisions and guidelines are implemented,	such as animal wastes, food and yard wastes, and algae, have site specific requirements in regards to potential for environmental effects. To lessen potential effects associated with animal wastes, appropriate guidance from the EPA concerning confined animal feeding operation practices and standard industry practices associated with animal production should be followed to ensure that collection of materials does not adversely impact soil resources through secondary effects associated with water and air quality.	provide greater soil retention due to anticipated cropping practices and the plant structure holding soil in place. Under Alternative 1, with the limited BCAP funding, the benefits associated with reduced soil erosion would be only locally significant and would provide for positive changes to water quality, soil organisms biodiversity and overall biological diversity. Under Alternative 2, depending upon the level of crop residue use, the effects could be either insignificant or significant,

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Soil Resources (cont'd)		implemented, Alternative 1 would have no significant negative impact on soil resources.	Alternative 2 would have no significant negative impact on soil resources.	Algae production, due to the specialized nature of the demonstration practices currently in effect, should move to minimize the use of potable water supplies where feasible. As specified by the proposed rule, agricultural and forest landowners and operators must comply with any existing Conservation Plans, Forest Stewardship Plans, and any other applicable laws for any removal of eligible material for use in a biomass conversion facility to receive matching payments.	cumulatively. When combined with the USFS measures to increase woody biomass utilization for bioenergy, there may be short term increases in soil erosion from forest lands in some regions; however, these should be minimal if harvest and management BMPs are implemented per the Forest Stewardship Plan or the equivalent, and all applicable Federal, State, and local harvest regulations. Also, in some regions, soil erosion on forest lands would be insignificant due to the species and

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Soil Resources (cont'd)					understory cover provided. The increased use of crop residues is anticipated to lead to changes in cropping practices, which should provide greater soil cover by standing crop residues and reduced tillage practices to promote residues use.
Water Quality and Quantity	Under the No Action Alternative, the use of Title I crops and crop residues does not produce a significant change in either water quantity or quality. Overall, projected land use changes under the No Action Alternative does not	Under Alternative 1, direct impacts to water quality are expected from the changes to the use of nutrients and agricultural chemicals for the establishment and production of switchgrass in the potential BCAP project	The direct and indirect impacts to water quality under Alternative 2 would be similar to those described in Alternative 1. However, as the amount of acreage converted from traditional crops to perennial crops	BMPs for dedicated energy crop production that reduce the amount of agricultural chemicals used for production benefit water quality through reduced transport in runoff. Also, the use of limited or no tillage cropping systems	The conversion to a perennial dedicated energy crop provides greater water use efficiency than traditional row crops such as corn. This conversion would be anticipated to limit runoff from agricultural fields and potential

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity (cont'd)	indicate an increased amount of acreage requiring additional water resources or the use of additional nutrients or agricultural chemicals.	locations. Decreases in the use of potassium (3.1%), lime (4.0%), herbicides (5.5%), insecticides (11.2%), and other agricultural chemicals (3.6%) are expected; while the use of nitrogen (2.1%) and phosphorus (2.9%) within the top five project areas are expected to increase over that of the No Action Alternative. The overall reduction in nutrients and agricultural chemical, erosion, total suspended solids (TSS), and sedimentation would provide positive impacts on water quality from	increases, the benefits to both water quality and quantity increase. The same mitigation methods described in Alternative 1 would reduce potential impacts to water quality. Adherence to established conservation standards, provisions, and guidelines ensures Alternative 2 would have no significant negative impact on water quality.	reduces the potential transported sediments by leaving ground cover on site and through the stability associated with perennial root systems. Agricultural irrigation systems are generally becoming more efficient allowing for an overall reduction in irrigated water uses, the inclusion of more dedicated energy crops with lower water demands and higher water use efficiencies would benefit water quantity by reducing the levels necessary for production. Other eligible crops, such as animal wastes, food and yard wastes,	need for irrigation past the initial establishment period. Under Alternative 1, with the limited BCAP funding, the benefits associated with increased water quality and decreased water quantity would be only locally significant and would provide for positive changes. Under Alternative 2, depending upon the level of crop residue use, the effects could be either insignificant or significant, cumulatively. The implementation of BCAP would generate positive effects from (1) a potential reduction of irrigated

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity (cont'd)		implementation of this alternative. However, due to the limited amount of acreage under this alternative, these benefits would be local. The change in the quantity of water required under this alternative would be minimal. The amount of water used for irrigation in the top five regions would only decrease approximately 0.25 over that of the No Action Alternative, saving an estimated 1.2 million gallons of water per day. When compared across all project area States, 23.6 million gallons of		and algae, have site specific requirements in regards to potential for environmental effects. To lessen potential effects associated with animal wastes, appropriate guidance from the EPA concerning confined animal feeding operation practices and standard industry practices associated with animal production should be followed to ensure that collection of materials does not adversely impact soil resources through secondary effects associated with water and air quality. Algae production, due to the specialized	cropland acres, (2) greater water use efficiency on non-irrigated and irrigated acreage, and (3) a general reduction in agricultural chemical use from the conversion of Title I crops to perennial dedicated energy crops. The majority of water consumption associated with corn-based ethanol is from irrigation to grow the crop. A potential reduction in the amount of irrigated acres would reduce the total water consumption to produce ethanol. Also studies have indicated

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity (cont'd)		water per day would be conserved. Switchgrass does have a higher water use efficiency (WUE) than other traditional crops, and is highly tolerant of various water regimes and is more drought tolerant than traditional crops. Indirect impacts under Alternative 1 result from the reduction in sedimentation, and nutrient and agricultural chemical deposition into surface water bodies that move down stream, benefiting larger water stream courses and regional water quality. In order to further		nature of the demonstration practices currently in effect, should move to minimize the use of potable water supplies where feasible. As specified by the proposed rule, agricultural and forest landowners and operators must comply with any existing Conservation Plans, Forest Stewardship Plans, and any other applicable laws for any removal of eligible material for use in a biomass conversion facility to receive matching payments. More specifically, this may include localized	that conversion of biomass at co-generation or combined heat and power (CHP) power plants for electricity is more efficient in the reduction than conversion into transportation fuels. However, water consumption for this use should also be considered. Other studies indicate that traditional liquid biofuels used as a fuel source for power generation are the most water inefficient when compared to traditional fuels, such as natural gas, which was the most water efficient.

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Water Quality and Quantity (cont'd)		reduce impacts to water quality, buffer strips comprised of mixed native species between biofuel crop fields and surface water bodies should be established for sediment and nutrient retention. Adherence to established conservation standards, provisions, and guidelines ensures Alternative 1 would have no significant negative impact on water quality.		total maximum daily limits (TMDLs) into localized stream courses or drainage ways, which feed larger watershed sources. This would be a site specific category, since not all states have completed TMDLs for every watershed.	

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Recreation	Under the No Action Alternative there are no expected changes in Wildlife habitat. There will be no changes in recreation activities related to wildlife.	Under Alternative 1 there could be localized positive or negative impacts on wildlife habitat, but they are expected to be small due to the relatively small amount of land converted to energy crops. The impacts to recreation involving wildlife are expected to be small locally and also not significant at the regional or national level.	Under Alternative 2 there could be localized positive or negative impacts on wildlife habitat, but they are expected to be small due to the relatively small amount of land converted to energy crops. The impacts to recreation involving wildlife are expected to be small locally and also not significant at the regional or national level.	As mentioned in the proposed rule, the eligible crops practices could necessitate replacement or restoration of the practice if it is needed to achieve adequate erosion control, enhance water quality, wildlife habitat or increase protection of public wellheads. Also, given the site specific nature of the BCAP project areas and the practices best suited to those conditions, effects to the abundance of wildlife for both consumptive and non-consumptive uses would vary. Practices	Impacts to recreation could be positive or negative based on the locality for BCAP project regions. However, they would be small regionally and nationally under either alternative and would not substantively or cumulatively change the recreational aspects of participation in wildlife activities.

Table 2.7-1. Alternatives Comparison Matrix

Resource	No Action	Alternative 1	Alternative 2	Mitigation Measures/ Best Management Practices	Cumulative Effects
Recreation (cont'd)				that encourage more foraging habitat for game species could induce changes in relation to decreased traditional row crop fields; however, changes to pasture of hayland could indicate small adverse effects. As such, operators should be encouraged to comply with the goals for wildlife habitat enhancements associated with the Conservation Plans and Forestry Stewardship Plans, at the recommendation of the technical advisors (i.e., NRCS and FS).	

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3.0 AFFECTED ENVIRONMENT (BY RESOURCE AREA)

3.1 SOCIOECONOMICS AND LAND USE

3.1.1 Land Use

3.1.1.1 Definition of the Resource

Land use analysis primarily details the interactions of humans and their environment, both natural and human-induced. Such analyses address how different land uses currently interact and if there would be conflict between new and existing land uses. In urban areas, land uses are primarily controlled for public health and safety concerns through land use zoning mechanisms. In rural areas, land use restrictions may be developed at a county or regional scale, or land use restrictions may not exist or be limited to special public health and safety concerns. Land use within this document is being described as the acreage within cropland, permanent pasture, or forest land, since any of these lands uses could be converted into a dedicated energy crop land use with some special land use restrictions (i.e., native sod).

Land use according to the Food and Agricultural Organization of the United Nations (FAO) is based upon function or the purpose for which the land is being used. Land use can therefore be defined as a series of activities undertaken to produce one or more goods or services (FAO 1997). Further, the FAO (1997) indicates that a given land use may take place on one, or more than one, piece of land and several land uses may occur on the same piece of land. Defining land use in this way provides a basis for precise and quantitative economic and environmental impact analysis and permits precise distinctions between land uses, if required. Land cover, according to the FAO (1997) is the observed physical cover as seen from the ground or through remote sensing, including the vegetation (natural or planted) and human constructions (buildings, roads, etc.) which cover the earth's surface.

In the context of this analysis, **Land use shifts** indicate the changes in what is planted in a particular area of cropland. If crop “b” replaces crop “a” in a particular acre or group of acres, then a land use shift from “a” to “b” has taken place. Land use shifts occur as farmers make production decisions based on the economic use of the land taking into account agricultural policy and environmental considerations.

Direct land use shifts occur in response to prices or regulations that impact directly a crop, while indirect changes occur in response to changes in prices or land shifts affecting other crops. In this analysis we will deal with both direct and indirect land use shifts occurring in cropland in the continental US.

3.1.1.2 Existing Conditions

The 2007 Agricultural Census estimates the amount of land in agricultural land uses in the U.S. Table 3.1-1 illustrates the agricultural lands uses by state and the total within the U.S. Table 3.1-2 illustrates the forest land resources as described in the Forestry Resources of the United States (USFS 2009) in addition to total land area and other lands. Table 3.1-3 further defines forest lands by ownership class to illustrate the potential acreage of NIPF approximated by the Private, Non-Corporate ownership category.

Table 3.1-1. Agricultural Land Uses in the U.S. by State

State	Farms (Number)	Land in Farms (1,000 acres)	Agricultural Land Use Category (1,000 acres)			
			Total Cropland	Total Woodland	Permanent pasture and rangeland	Farmsteads, buildings, livestock facilities, ponds, roads, wasteland, etc
Alabama	48,753	9,034	3,143	3,375	2,017	498
Alaska	686	882	86	42	738	16
Arizona	15,637	26,118	1,205	280	22,901	1,732
Arkansas	49,346	13,873	8,432	2,239	2,638	564
California	81,033	25,365	9,465	1,271	13,275	1,354
Colorado	37,054	31,605	11,484	1,382	17,830	909
Connecticut	4,916	406	164	125	33	84
Delaware	2,546	510	433	46	7	25
Florida	47,463	9,232	2,953	2,330	3,221	727
Georgia	47,846	10,151	4,478	3,713	1,342	618
Hawaii	7,521	1,121	178	79	738	126
Idaho	25,349	11,497	5,919	532	4,603	444
Illinois	76,860	26,775	23,708	1,429	887	751
Indiana	60,938	14,773	12,716	1,020	543	494
Iowa	92,856	30,748	26,316	1,193	1,915	1,323
Kansas	65,531	46,346	28,216	793	15,933	1,404
Kentucky	85,260	13,993	7,278	3,107	2,912	695
Louisiana	30,106	8,110	4,691	1,189	1,544	686
Maine	8,136	1,348	529	661	62	96
Maryland	12,834	2,052	1,405	373	156	117
Massachusetts	7,691	518	187	213	48	70
Michigan	56,014	10,032	7,804	1,196	377	655
Minnesota	80,992	26,918	21,949	1,862	1,470	1,637
Mississippi	41,959	11,456	5,531	3,611	1,639	675
Missouri	107,825	29,027	16,406	4,414	6,864	1,342
Montana	29,524	61,388	18,242	2,284	40,003	859
Nebraska	47,712	45,480	21,486	410	22,620	965
Nevada	3,131	5,865	754	36	4,855	220
New Hampshire	4,166	472	129	278	34	31
New Jersey	10,327	733	489	131	54	59
New Mexico	20,930	43,238	2,334	2,869	37,598	437

Table 3.1-1. Agricultural Land Uses in the U.S. by State (cont'd)

State	Farms (Number)	Land in Farms (1,000 acres)	Agricultural Land Use Category (1,000 acres)			
			Total Cropland	Total Woodland	Permanent pasture and rangeland	Farmsteads, buildings, livestock facilities, ponds, roads, wasteland, etc
New York	36,352	7,175	4,315	1,560	715	586
North Carolina	52,913	8,475	4,895	2,202	942	436
North Dakota	31,970	39,675	27,527	234	10,419	1,495
Ohio	75,861	13,957	10,833	1,474	1,047	603
Oklahoma	86,565	35,087	13,008	2,468	18,713	898
Oregon	38,553	16,400	5,010	1,730	9,148	511
Pennsylvania	63,163	7,809	4,870	1,718	732	489
Rhode Island	1,219	68	24	29	6	8
South Carolina	25,867	4,889	2,151	1,827	617	294
South Dakota	31,169	43,666	19,094	259	23,026	1,288
Tennessee	79,280	10,970	6,047	2,043	2,545	335
Texas	247,437	130,399	33,667	7,100	87,217	2,414
Utah	16,700	11,095	1,838	385	8,602	270
Vermont	6,984	1,233	517	503	137	76
Virginia	47,383	8,104	3,274	2,319	2,151	359
Washington	39,284	14,973	7,609	1,988	4,775	600
West Virginia	23,618	3,698	942	1,462	1,105	188
Wisconsin	78,463	15,191	10,116	2,920	1,066	1,088
Wyoming	11,069	30,170	2,576	396	27,012	185
United States	2,204,792	922,096	406,425	75,099	408,832	31,740

Source: USDA 2009b

Table 3.1-2. Forestry Resources within the U.S. by State, 2007

State	Total land area (1,000 acres)	Forest Resources within the United States (1,000 acres)						Other Land (1,000 acres)
			Timberland					
		Total Forest	Total	Planted	Natural Origin	Reserved Forest	Other Forest	
Alabama	32,435	22,693	22,580	6,329	16,251	106	8	9,742
Alaska	365,042	126,869	11,865	7	11,857	33,068	81,936	238,173
Arizona	72,764	18,671	3,361	10	3,351	1,891	13,419	54,092
Arkansas	33,324	18,830	18,480	2,984	15,496	234	116	14,494
California	99,599	32,817	19,144	1,355	17,789	5,834	7,708	66,783
Colorado	66,390	22,612	11,541	13	11,527	2,576	8,495	43,778

Table 3.1-2. Forestry Resources within the U.S. by State, 2007 (cont'd)

State	Total land area (1,000 acres)	Forest Resources within the United States (1,000 acres)						Other Land (1,000 acres)
		Total Forest	Timberland			Reserved Forest	Other Forest	
			Total	Planted	Natural Origin			
Connecticut	3,101	1,794	1,732	27	1,705	31	30	1,307
Delaware	1,251	383	376	16	359	0	7	868
Florida	35,026	16,147	15,552	5,344	10,208	497	98	18,879
Georgia	37,114	24,784	24,247	7,459	16,788	517	20	12,330
Hawaii	4,111	1,748	700	30	670	196	853	2,363
Idaho	52,909	21,430	16,203	158	16,044	3,975	1,253	31,479
Illinois	35,608	4,525	4,363	96	4,267	162	0	31,083
Indiana	22,980	4,656	4,533	171	4,362	123	0	18,324
Iowa	35,842	2,879	2,824	23	2,801	15	40	32,963
Kansas	52,488	2,106	2,028	39	1,988	1	76	50,383
Kentucky	25,426	11,970	11,648	84	11,564	285	38	13,455
Louisiana	27,880	14,222	14,116	4,260	9,857	80	26	13,658
Maine	19,752	17,673	17,163	381	16,782	318	192	2,079
Maryland	6,256	2,566	2,372	162	2,210	180	14	3,690
Massachusetts	5,018	3,171	2,947	36	2,910	131	93	1,846
Michigan	36,275	19,545	19,023	1,143	17,880	325	197	16,730
Minnesota	51,024	16,391	15,113	615	14,498	820	459	34,633
Mississippi	30,026	19,622	19,536	5,550	13,986	43	43	10,404
Missouri	44,093	15,078	14,674	84	14,591	241	164	29,014
Montana	93,306	25,014	19,790	187	19,604	3,939	1,284	68,293
Nebraska	49,206	1,245	1,174	34	1,140	10	61	47,961
Nevada	70,446	11,089	417	0	417	653	10,019	59,357
New Hampshire	5,740	4,850	4,674	25	4,649	128	48	890
New Jersey	4,748	2,132	1,876	6	1,870	160	96	2,616
New Mexico	77,674	16,682	4,359	0	4,359	1,704	10,619	60,992
New York	30,217	18,669	16,015	811	15,204	2,501	153	11,548
North Carolina	31,128	18,447	17,916	3,376	14,540	410	120	12,682
North Dakota	44,337	724	534	5	529	25	165	43,613
Ohio	26,207	7,894	7,644	387	7,258	228	22	18,313
Oklahoma	43,954	7,665	6,234	636	5,598	45	1,386	36,290
Oregon	61,181	30,169	24,617	5,610	19,006	2,357	3,174	31,011
Pennsylvania	28,683	16,577	16,018	766	15,253	458	100	12,105
Rhode Island	669	356	351	0	350	0	5	313
South Carolina	19,207	12,746	12,641	3,332	9,309	99	5	6,461
South Dakota	48,434	1,682	1,552	18	1,534	42	88	46,752
Tennessee	26,390	14,480	13,913	518	13,395	568	0	11,909
Texas	167,693	17,273	11,859	2,796	9,063	114	5,300	150,420

Table 3.1-2. Forestry Resources within the U.S. by State, 2007 (cont'd)

State	Total land area (1,000 acres)	Forest Resources within the United States (1,000 acres)						Other Land (1,000 acres)
		Total Forest	Timberland			Reserved Forest	Other Forest	
			Total	Planted	Natural Origin			
Utah	52,497	17,962	4,014	9	4,004	1,904	12,045	34,535
Vermont	5,920	4,618	4,482	34	4,448	114	21	1,302
Virginia	25,626	15,766	15,309	2,236	13,073	415	42	9,860
Washington	42,609	22,279	18,873	4,423	14,449	3,054	282	20,330
West Virginia	15,415	12,007	11,797	108	11,689	174	36	3,409
Wisconsin	34,791	16,275	16,042	929	15,113	107	126	18,516
Wyoming	62,062	11,445	5,997	48	5,949	3,784	1,664	50,617
United States	2,263,870	751,228	514,213	62,672	451,541	74,644	162,147	1,512,642

Source: USFS 2009.

Table 3.1-3. Forestry Resources by Ownership Class within the U.S. by State, 2007

State	All Ownership	Public							Private		
		Total Public	Federal				State	County and Municipal	Total Private	Private Corporate	Private Non-Corporate
			Total Federal	National Forest System	BLM	Other Federal					
Alabama	22,693	1,429	986	746	0	240	330	113	21,264	6,311	14,953
Alaska	126,869	90,994	63,423	10,455	16,954	36,014	27,469	101	35,875	31,777	4,098
Arizona	18,671	11,291	9,658	7,663	1,603	391	1,609	24	7,381	338	7,042
Arkansas	18,830	3,674	3,155	2,546	0	609	448	71	15,156	5,454	9,703
California	32,817	19,614	18,409	14,906	1,844	1,658	831	375	13,202	4,603	8,600
Colorado	22,612	17,252	16,590	11,259	4,893	438	603	58	5,360	614	4,746
Connecticut	1,794	411	0	0	0	0	257	154	1,383	235	1,148
Delaware	383	32	0	0	0	0	32	0	351	107	244
Florida	16,147	4,720	2,068	1,067	0	1,000	2,221	431	11,427	6,441	4,986
Georgia	24,784	2,343	1,758	736	0	1,022	356	230	22,440	7,965	14,475
Hawaii	1,748	593	12	0	0	12	573	8	1,155	124	1,031
Idaho	21,430	18,877	17,342	16,380	874	89	1,535	0	2,553	1,230	1,323
Illinois	4,525	795	368	290	0	78	204	223	3,730	221	3,509
Indiana	4,656	767	403	189	0	213	334	31	3,888	300	3,588
Iowa	2,879	327	104	0	0	104	163	60	2,552	41	2,511
Kansas	2,106	112	73	0	0	73	20	19	1,994	51	1,943
Kentucky	11,970	1,324	1,059	744	0	315	212	53	10,647	1,491	9,156
Louisiana	14,222	1,709	975	695	0	279	538	197	12,512	6,499	6,014
Maine	17,673	1,098	164	53	0	110	776	158	16,575	10,314	6,261
Maryland	2,566	609	72	0	0	72	424	113	1,957	495	1,462
Massachusetts	3,171	992	106	0	0	106	603	283	2,179	182	1,998
Michigan	19,545	7,427	2,958	2,640	0	318	4,118	351	12,117	2,660	9,458
Minnesota	16,391	9,277	2,789	2,459	1	329	4,400	2,089	7,114	1,193	5,921

Table 3.1-3. Forestry Resources by Ownership Class within the U.S. by State, 2007 (cont'd)

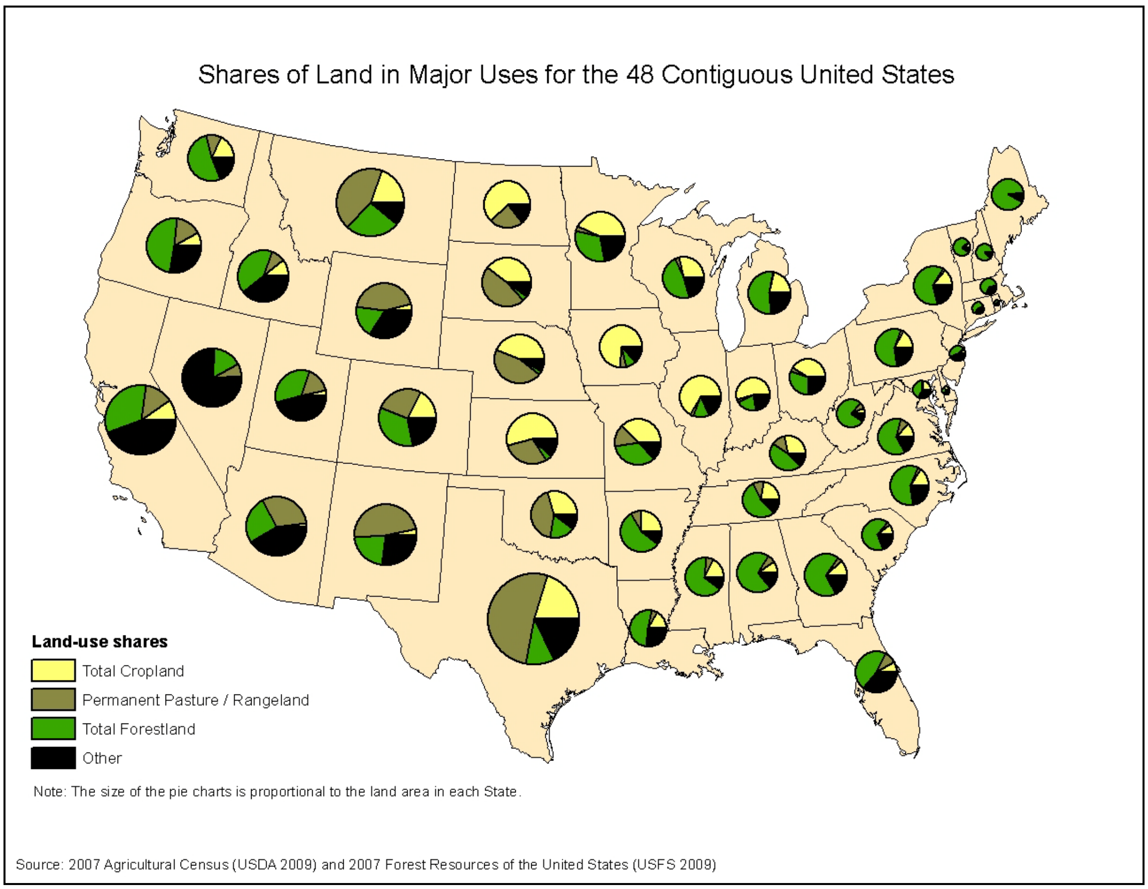
State	All Ownership	Public								Private		
		Total Public	Federal				State	County and Municipal	Total Private	Private Corporate	Private Non-Corporate
			Total Federal	National Forest System	BLM	Other Federal					
Mississippi	19,622	2,303	1,834	1,326	0	508	236	233	17,320	4,714	12,605
Missouri	15,078	2,686	1,838	1,493	0	345	784	63	12,393	638	11,755
Montana	25,014	17,987	17,175	14,999	1,148	1,028	799	13	7,026	2,193	4,834
Nebraska	1,245	153	81	48	0	33	52	19	1,092	7	1,085
Nevada	11,089	10,876	10,824	3,355	7,222	247	52	0	212	60	153
New Hampshire	4,850	1,204	773	719	0	54	265	166	3,646	803	2,844
New Jersey	2,132	810	106	0	0	106	531	173	1,322	517	805
New Mexico	16,682	10,351	9,522	8,092	1,120	309	825	3	6,331	0	6,331
New York	18,669	4,231	142	11	0	131	3,630	459	14,438	2,248	12,190
North Carolina	18,447	2,950	2,090	1,169	0	921	601	258	15,497	3,882	11,615
North Dakota	724	214	157	72	8	76	46	11	510	6	504
Ohio	7,894	921	276	225	0	50	423	222	6,973	909	6,064
Oklahoma	7,665	665	499	245	0	255	139	27	7,000	1,283	5,716
Oregon	30,169	19,111	17,960	14,012	3,751	197	969	181	11,059	5,995	5,063
Pennsylvania	16,577	4,839	603	497	0	107	3,812	424	11,738	2,135	9,603
Rhode Island	356	53	0	0	0	0	42	10	303	52	251
South Carolina	12,746	1,557	1,071	641	0	430	325	160	11,189	3,574	7,615
South Dakota	1,682	1,190	1,138	1,039	45	54	52	0	492	23	469
Tennessee	14,480	2,171	1,473	741	0	732	599	99	12,310	2,209	10,101
Texas	17,273	1,069	905	682	0	224	109	54	16,204	4,418	11,786
Utah	17,962	14,950	13,425	6,259	6,800	366	1,514	11	3,013	550	2,463
Vermont	4,618	754	369	337	0	32	313	72	3,864	755	3,109
Virginia	15,766	2,766	2,250	1,692	0	558	302	213	13,000	2,912	10,088
Washington	22,279	12,474	9,536	8,188	75	1,273	2,580	358	9,806	4,905	4,901
West Virginia	12,007	1,589	1,233	1,073	0	161	278	77	10,418	3,244	7,174
Wisconsin	16,275	5,157	1,576	1,407	0	169	1,075	2,506	11,117	1,443	9,674
Wyoming	11,445	9,503	9,084	6,028	1,290	1,766	419	0	1,942	0	1,942
United States	751,228	328,199	248,413	147,181	47,629	53,604	68,831	10,955	423,029	138,120	284,908

Source: USFS 2009.

Figure 3.1.-1 provides an illustration of the approximate percentage of cropland, permanent pasture and rangeland, forest land, and other land by state. The combination of this information provides an approximate percentage of land uses within the United States, with cropland accounting for approximately 18 percent of land area, permanent pasture and rangeland approximately 18 percent of land area, and forest land accounting for approximately 33 percent of land area. Other land uses include roads, urban area, farmsteads, water, and special land such as tundra.

As mentioned previously, forest lands account for more than 33 percent of the total land area in the U.S. (2.3 billon acres). Federal forest lands account for approximately 248.4 million acres (33.1 percent of total forest land) with 74.6 million acres (9.9 percent of total forest land) reserved (e.g., wilderness areas). The National Forest System provides 147.2 million acres of Federally owned forest and the BLM provides management on 47.6 million acres of forest land (78.4 percent of Federally owned forest lands). The Federal forest lands of the National Forest System and BLM are considered eligible for the Matching Payment Program, so long as ownership of the materials has been demonstrated to the FSA. Local government owned forests total approximately 11.0 million acres. Total private forest land within the United States accounts for approximately 56.3 percent of the total forest land (USFS 2009). With regards to forest land, approximately 284.9 million acres (37.9 percent) were considered private non-corporate forest land, approximately equivalent to NIPF within the U.S. (*Ibid*.), which could be utilized for dedicated energy crop production under the Establishment and Annual Payments Program.

Figure 3.1-1. Shares of Land in Major Uses for the 48 Contiguous United States



3.1.1.3 *Expiring CRP Acres*

From FY 2009 to FY 2012 there will be more than 18.2 million acres expiring from CRP contracts throughout the U.S. This averages approximately 4.6 million acres per year. Overall, Colorado (1.8 million acres), Kansas (2.0 million acres), Montana (1.7 million acres), North Dakota (1.7 million acres), and Texas (2.7 million acres) account for approximately 54.4 percent of the expiring acres between FY 2009 to FY 2012. Table 3.1-4 provides information on expiring CRP acres by FY and by state. Figure 3.1-2 illustrates the total expiring acres by county between FY 2009 to FY 2012.

Different study methodologies have been conducted with different year ranges of expiring CRP acres to determine the extent of CRP acres returning to active crop production. Hansen (2007) summarizes these studies as of three types: (1) prior land use; (2) CRP contract holder surveys of intended use if CRP were no longer an option; and (3) data from acres leaving CRP from 1992 to 1997. The estimated prior land use scenario indicates that approximately 93 percent of CRP lands would return to active crop and hay production (Hansen 2007). Survey data from CRP contract holders indicate that if CRP were no longer an option that 63 percent of acres would return to crop production, 23 percent would retain cover for hay and forage, and 10 percent would be kept in grass and tree cover for forest products and wildlife habitat (*Ibid*). The data from 1992 to 1997 indicated that approximately 58 percent of expired acres returned to crop production, at least in the short term (*Ibid*). Overall, the data seems to indicate that the majority of acres expiring from CRP would return to crop production, if they do not re-enroll those acres into CRP; however, this would be highly dependent on current and anticipated crop prices, land prices, age of the landowner, and other external factors that influence land use decisions.

Table 3.1-4. Expiring CRP Acres by Fiscal Year 2009-2012

State	2009	2010	2011	2012
Alabama	32,392	69,493	80,332	76,789
Alaska	871	7,137	64	990
Arkansas	6,679	25,031	12,568	33,052
California	2,322	11,323	17,896	24,352
Colorado	409,099	451,962	345,324	571,174
Connecticut	37	13	13	58
Delaware	591	354	100	300
Florida	3,475	11,136	9,623	11,869
Georgia	24,371	31,619	23,414	33,902
Idaho	46,395	156,493	117,428	166,092
Illinois	37,439	62,253	68,744	111,113
Indiana	10,864	17,445	22,112	36,821

Table 3.1-4. Expiring CRP Acres by Fiscal Year 2009-2012 (cont'd)

State	2009	2010	2011	2012
State	2009	2010	2011	2012
Iowa	99,843	117,196	72,222	232,455
Kansas	331,165	614,539	533,211	520,595
Kentucky	13,243	42,192	37,355	46,970
Louisiana	5,941	17,822	11,950	37,548
Maine	1,106	4,110	5,606	5,309
Maryland	5,560	3,377	3,219	8,631
Massachusetts	11	30	5	0
Michigan	11,961	14,341	11,087	19,234
Minnesota	57,216	69,344	127,985	293,283
Mississippi	31,396	99,464	102,468	166,271
Missouri	32,620	132,136	196,910	378,316
Montana	138,388	387,645	497,221	696,970
Nebraska	116,621	179,185	151,672	201,812
New Hampshire	0	6	45	0
New Jersey	30	209	330	179
New Mexico	29,264	103,191	164,751	116,923
New York	2,083	2,370	2,539	3,805
North Carolina	7,093	17,010	12,923	10,758
North Dakota	191,778	258,323	388,964	846,111
Ohio	10,574	14,195	13,663	26,959
Oklahoma	101,359	210,842	192,026	191,748
Oregon	14,696	73,661	104,995	90,097
Pennsylvania	4,588	1,771	21,455	27,376
South Carolina	17,482	29,333	20,682	35,427
South Dakota	183,719	148,188	125,429	227,529
Tennessee	8,920	38,503	34,177	29,124
Texas	561,102	670,661	685,133	822,585
Utah	49,923	84,894	18,174	26,913
Vermont	30	0	58	27
Virginia	2,597	3,229	5,121	5,722
Washington	85,442	173,877	89,118	274,964
West Virginia	129	0	194	103
Wisconsin	31,550	51,738	44,377	70,200
Wyoming	62,618	74,948	49,724	60,318
Hawaii, Nevada, Rhode Island	0	146	0	0
United States	2,784,580	4,482,754	4,422,407	6,540,939

Source: FSA 2010

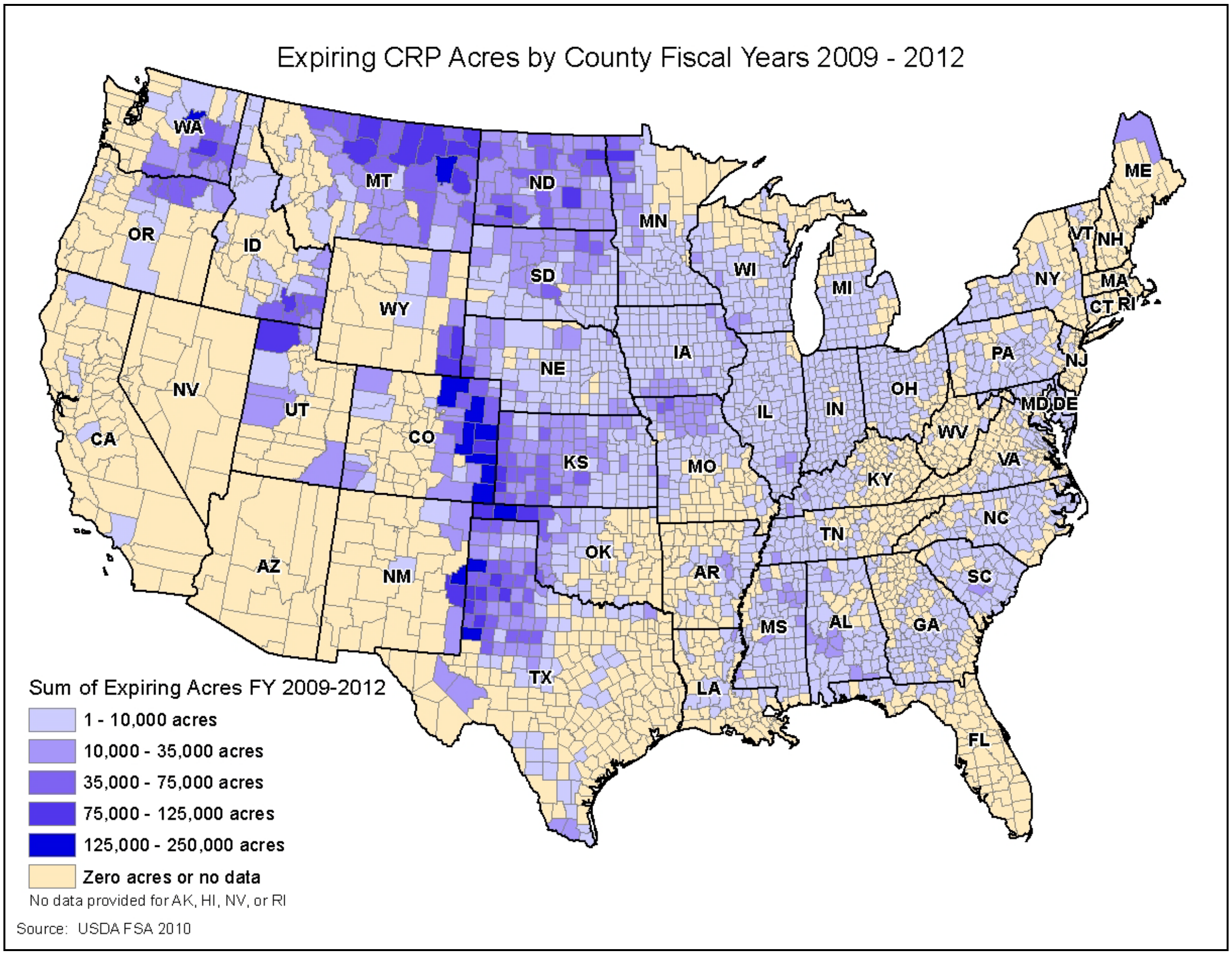


Figure 3.1-2. Total Expiring CRP Acres by County between FY 2009 to FY 2012 (FSA 2010)

3.1.2 Socioeconomics

3.1.2.1 Definition of the Resource

Socioeconomic analyses generally include detailed investigations of the prevailing population, income, employment, and housing conditions of a community or Region of Influence (ROI). The socioeconomic conditions of a ROI could be affected by changes in the rate of population growth, changes in the demographic characteristics of a ROI, or changes in employment within the ROI caused by the implementation of the proposed action.

Socioeconomic resources within this document include general agricultural characteristics associated with number of farms, acres of primary field crops, and revenues generated from primary field crops. Additionally, a brief analysis of rural population trends is discussed.

3.1.2.2 Net Farm Income

Net Farm Income is a measure of the overall economic performance of the agricultural sector. It is defined as the difference between total revenue and total expenses, including the gains or losses from the value of farm inventories. Computationally, a preferred variable is Realized Net Farm Income, which excludes the change in the value of farm inventories. For the purposes of this analysis Realized Net Farm Income would be used to measure the economic performance of the agricultural sector at the national level.

At the regional and farm levels all the elements of the Realized Net Farm Income variable are not readily available which is why at levels of aggregation lower than the national level, the best available variable to use to measure the performance of the agricultural activity would be Net Returns. Net Returns measure the difference between total revenues from agricultural activity and the total cash cost of production.

3.1.2.3 Farm Prices

Farm price is defined as the season average price received by farmers as they sell their production into the market. The farm price is usually determined by an aggregate market, usually national or global, with local differences created as a result of specific marketing conditions, such as distance to collection or consumption centers, storage availability, transportation, etc. All these local differences can be captured through an index, which allows for the translation of the average seasonal farm price at the national level, to more local geographic levels, i.e., state or county, prices. Hay price typically reflects local conditions and the hay market is defined in this analysis as a local market.

3.1.2.4 Agricultural Government Payments

Government payments are defined as any direct revenues received from the federal treasury as a result of performing agriculture related activities. There are two general types of payments – those linked to the change in prices and or production, and those that are fixed regardless of prices and/or production levels. The BCAP program could directly or indirectly impact payments linked to price and/or production levels. These payments include counter cyclical payments, loan deficiency payments, and Average Crop Revenue Election (ACRE) payments.

3.1.3 General Agricultural Characteristics

3.1.3.1 Number of Farms & Land in Farms

From 1997 to 2007, the number of farms in the United States declined 0.5 percent (USDA 2009b). Most farm categories declined from 1997 to 2007, with the number of acres in farms declining 3.4 percent, the average size of farms declining by 3.0 percent, the amount of cropland declining by 8.7 percent, and the amount of harvested cropland acreage declining by 2.9 percent (*Ibid*). The average market value of land and buildings increased approximately 90.2 percent for the average farm and approximately 95.7 for the average acre (*Ibid*). Farm production expenses also showed an increase of approximately 52.8 percent over the decade. When compared by type of farm, the largest number of farms (36 percent) fall within the small family farm – residential or lifestyle farm (Table 3.1-5). Farms with an average size of over 1,000 acres account for approximately 18 percent of the number of farms in the United States.

Table 3.1-5. Number of Farms, Land in Farms, and Average Size of Farms by Farm Typology, 2007

Item	Total	Small Family Farms					Large family	Very large family	Non-family
		Limited resource	Retirement	Residential/ lifestyle	Farming occupation/ lower sales	Farming occupation/ higher sales			
Farms (number)	2,204,792	308,837	456,093	801,844	258,899	100,126	86,551	101,265	91,177
Farms (percent)	100	14	21	36	12	5	4	5	4
Average size of farm (acres)	418	137	196	151	337	1,040	1,421	2,086	1,573

Source: USDA 2009b

3.1.3.2 Rural Population Trends

The USDA Economic Research Service (ERS) found that by 2006 non-metro counties in the United States accounted for a population of approximately 50.2 million persons, which is approximately 16.8 percent of the total United States population (ERS 2008; U.S. Census Bureau [USCB] 2008). The general trend in these counties was a decline in the population with over 51 percent of the non-metro counties experiencing population declines of approximately 0.5 percent per year from 2000 to 2006.

3.1.3.3 Primary Field Crops

The 2003 National Resources Inventory indicates that approximately 368 million acres within the United States is cultivated cropland and 58 million acres is uncultivated cropland. In 1992, those figures were 334 million acres of cultivated cropland and 47 million acres of uncultivated cropland. Table 3.1-6 illustrates the amount of acreage planted to select primary field crops between 2004 to 2009 with projections to 2018, along with harvested acres of those crops, and total production of the crops (USDA 2008a; USDA 2009c). As shown in the table, the amount of acreage planted in the specific crops generally increased from 2004 to 2008, with most commodity crops declining in 2009 from 2008 levels. Table 3.1-7 identifies the approximate year-to-year percent change during the period, as well as an average annual percent change.

Table 3.1-6. Planted Acres, Harvested Acres, and Production of Select Field Crops 2004-2009, with Projections for 2018

Crop Type	2009	2008	2007	2006	2005	2004	Percent Change 2004-2009	USDA 2018 Projection	Percent Change 2009-2018
	Planted Acres								
	(1,000 acres)								
Corn (Grain)	86,482	87,327	93,600	78,327	81,779	80,929	6.86%	90,500	4.65%
Sorghum (Grain)	6,633	9,420	7,486	6,454	6,522	7,712	-13.99%	7,300	10.06%
Oats	3,404	4,597	4,085	4,246	4,166	3,763	-9.54%	3,400	-0.12%
Barley, All	3,567	5,348	4,527	3,875	3,452	4,018	-11.22%	4,000	12.14%
Wheat, All	59,133	63,457	60,433	57,344	57,229	59,674	-0.91%	59,500	0.62%
Soybeans	77,451	74,533	63,631	75,522	72,032	75,208	2.98%	71,000	-8.33%
	Harvested Acres								
Crop Type	2009	2008	2007	2006	2005	2004	Percent Change 2004-2009	USDA 2018 Projection	Percent Change 2009-2018
	(1,000 acres)								
Corn (Grain)	79,630	78,940	86,542	70,648	75,117	73,631	8.15%	83,300	4.61%
Sorghum (Grain)	5,520	7,798	6,517	5,736	4,937	6,792	-18.73%	6,300	14.13%
Oats	1,379	2,220	1,787	1,823	1,564	1,504	-8.31%	1,500	8.77%
Barley, All	3,113	4,727	4,021	3,269	2,951	3,502	-11.11%	3,500	12.43%
Wheat, All	49,868	56,586	51,011	46,810	50,119	49,999	-0.26%	50,600	1.47%
Soybeans	76,407	72,121	62,820	74,602	71,251	73,958	3.31%	70,100	-8.25%
	Production								
Crop Type	2009	2008	2007	2006	2005	2004	Percent Change 2004-2009	USDA 2018 Projection	Percent Change 2009-2018
	(1,000 bushels)								
Corn (Grain)	13,151,062	10,087,292	13,073,893	10,534,868	11,114,082	11,807,086	11.38%	14,580,000	10.87%
Sorghum (Grain)	382,983	411,219	453,606	392,739	276,824	497,445	-23.01%	405,000	5.75%
Oats	93,081	144,383	115,695	114,859	93,522	90,430	2.93%	100,000	7.43%
Barley, All	227,323	278,283	279,743	211,896	180,165	210,110	8.19%	250,000	9.98%
Wheat, All	2,216,171	2,344,415	2,066,722	1,812,036	2,104,690	2,158,245	2.68%	2,310,000	4.23%
Soybeans	3,361,028	2,453,845	2,585,207	3,188,247	3,063,237	3,123,686	7.60%	3,260,000	-3.01%

Source: USDA 2009c

Table 3.1-7. Annual Percent Change for Planted Acres, Harvested Acres, and Production of Select Storable Field Crops, 2003-2008

Crop Type	2008-2007	2007-2006	2006-2005	2005-2004	2004-2003	Average Percent Change
	Percent Change in Planted Acres					
Corn (Grain)	-6.7%	19.5%	-4.2%	1.1%	3.0%	2.5%
Sorghum (Grain)	25.8%	16.0%	-1.0%	-15.4%	-6.9%	3.7%
Oats	12.5%	-3.8%	1.9%	10.7%	17.0%	7.7%
Barley, All	18.1%	16.8%	12.3%	-14.1%	-5.1%	5.6%
Wheat, All	5.0%	5.4%	0.2%	-4.1%	-4.0%	0.5%
Soybeans	17.1%	-15.7%	4.8%	-4.2%	2.5%	0.9%
Crop Type	**Percent Change in Harvested Acres**					
Corn (Grain)	-8.8%	22.5%	-5.9%	2.0%	3.8%	2.7%
Sorghum (Grain)	19.7%	13.6%	16.2%	-27.3%	-6.6%	3.1%
Oats	24.2%	-2.0%	16.6%	4.0%	7.8%	10.1%
Barley, All	17.6%	23.0%	10.8%	-15.7%	-7.0%	5.7%
Wheat, All	10.9%	9.0%	-6.6%	0.2%	-5.8%	1.6%
Soybeans	14.8%	-15.8%	4.7%	-3.7%	2.0%	0.4%
Crop Type	**Percent Change in Production**					
Corn (Grain)	-22.8%	24.1%	-5.2%	-5.9%	17.0%	1.4%
Sorghum (Grain)	-9.3%	15.5%	41.9%	-44.4%	5.3%	1.8%
Oats	24.8%	0.7%	22.8%	3.4%	2.0%	10.8%
Barley, All	-0.5%	32.0%	17.6%	-14.3%	-12.3%	4.5%
Wheat, All	13.4%	14.1%	-13.9%	-2.5%	-8.0%	0.6%
Soybeans	-5.1%	-18.9%	4.1%	-1.9%	27.3%	1.1%

Source: NASS 2009

3.1.3.4 Farm Income and Costs

The ERS (Strickland 2009) indicated that net farm income in 2009 was projected to be below 2008 levels, but would still be one of the top ten years for income earned by farming in the United States (*Ibid*). Net farm income was estimated to be approximately $57 billion with net cash income of $69.8 billion. Total expenses in the agricultural sector was anticipated to decline for the first time since 2002, though still anticipated to be approximately 4 percent higher than 2007 (Strickland 2009). Crop receipts were estimated to be $163.6 billion, lower than 2008, but the second highest on records.

At the household level, the average family farm household income for 2009 was estimated to be $76,065, a decline of less than four percent from 2008, but still above the national average household income (Ahern *et al.* 2009). The ERS anticipates that approximately 8.7 percent of average family farm household income was generated from on-farm sources with an average of approximately $69,440 of household income generated from off-farm sources (*Ibid*).

3.1.4 Forest and Paper Industry

The American Forest and Paper Association (AFPA) indicates that the overall contribution of the forestry and paper industry is approximately six percent of the U.S. Gross Domestic Product (GDP). The combined industries employ over a million persons and are estimated to provide over $7.0 billion in Federal, State, and local taxes. Table 3.1-8 illustrates the employment by industry and estimated annual payroll by state. Table 3.1-9 illustrates the number of manufacturing facilities by state and Table 3.1-10 illustrates the value of shipments and estimated state and local taxes paid by state.

Table 3.1-8. Forest and Paper Industries Employment and Annual Payroll

	Employment (number)				Annual Payroll Income ($millions)			
Location	Forestry & Logging	Wood Products	Pulp & Paper	Total	Forestry & Logging	Wood Products	Pulp & Paper	Total
Alabama	8,279	21,532	13,680	43,491	$358	$901	$1,482	$2,741
Alaska	553	909	4	1,466	$34	$24	$48	$106
Arizona	649	8,534	2,885	12,068	$7	$325	$213	$545
Arkansas	5,506	13,223	10,881	29,610	$194	$528	$758	$1,480
California	4,940	36,864	26,240	68,044	$244	$1,768	$2,119	$4,131
Colorado	1,297	6,347	1,903	9,547	$15	$260	$123	$398
Connecticut	449	2,159	4,696	7,304	$10	$108	$563	$681
Delaware	29	456	923	1,408	$2	$18	$80	$100
Florida	3,416	18,832	9,891	32,139	$122	$787	$844	$1,753
Georgia	8,151	24,867	20,861	53,879	$327	$1,023	$1,756	$3,106
Hawaii	19	1,067	196	1,282	$0	$36	$96	$132
Idaho	3,273	8,500	1,661	13,434	$135	$410	$187	$732
Illinois	836	10,165	23,588	34,589	$22	$429	$1,720	$2,171
Indiana	1,356	19,630	11,019	32,005	$39	$786	$873	$1,698
Iowa	575	12,684	4,116	17,375	$9	$600	$334	$943
Kansas	79	2,811	2,389	5,279	$1	$94	$152	$247
Kentucky	2,686	14,079	10,096	26,861	$53	$522	$691	$1,266
Louisiana	4,915	9,222	8,353	22,490	$217	$436	$736	$1,389

Table 3.1-8. Forest and Paper Industries Employment and Annual Payroll (cont'd)

Location	Employment (number)				Annual Payroll Income ($millions)			
	Forestry & Logging	Wood Products	Pulp & Paper	Total	Forestry & Logging	Wood Products	Pulp & Paper	Total
Maine	6,046	6,856	8,287	21,189	$195	$275	$878	$1,348
Maryland	816	3,714	4,670	9,200	$22	$184	$300	$506
Massachusetts	1,013	3,888	11,900	16,801	$36	$170	$920	$1,126
Michigan	4,631	12,333	13,507	30,471	$126	$550	$1,055	$1,731
Minnesota	2,804	16,531	11,349	30,684	$79	$953	$894	$1,926
Mississippi	6,732	14,768	4,835	26,335	$246	$620	$429	$1,295
Missouri	2,092	11,270	8,377	21,739	$57	$354	$517	$928
Montana	2,234	5,131	397	7,762	$80	$233	$41	$354
Nebraska	71	2,362	1,643	4,076	$2	$80	$159	$241
Nevada	42	1,954	668	2,664	$1	$83	$96	$180
New Hampshire	1,766	2,951	1,887	6,604	$85	$128	$163	$376
New Jersey	218	4,624	13,426	18,268	$4	$221	$1,229	$1,454
New Mexico	301	2,041	778	3,120	$4	$56	$44	$104
New York	4,168	11,795	19,062	35,025	$109	$483	$1,725	$2,317
North Carolina	6,125	27,098	18,326	51,549	$218	$1,116	$1,362	$2,696
North Dakota	9	2,006	114	2,129	$0	$77	$69	$146
Ohio	2,494	18,808	23,321	44,623	$92	$708	$1,589	$2,389
Oklahoma	814	4,190	2,853	7,857	$26	$172	$201	$399
Oregon	11,271	31,569	6,012	48,852	$812	$1,603	$606	$3,021
Pennsylvania	4,491	32,363	25,870	62,724	$141	$1,264	$1,957	$3,362
Rhode Island	9	752	1,306	2,067	$1	$35	$115	$151
South Carolina	4,946	10,701	13,263	28,910	$187	$470	$1,191	$1,848
South Dakota	327	2,493	728	3,548	$10	$103	$104	$217
Tennessee	3,801	17,958	16,868	38,627	$188	$706	$1,448	$2,342
Texas	4,486	30,226	19,617	54,329	$187	$1,339	$1,882	$3,408
Utah	221	4,997	2,733	7,951	$5	$163	$156	$324
Vermont	1,812	2,839	1,168	5,819	$37	$107	$149	$293
Virginia	4,642	19,695	10,677	35,014	$170	$789	$861	$1,820
Washington	8,386	20,965	10,911	40,262	$434	$1,077	$1,176	$2,687
West Virginia	2,814	8,411	647	11,872	$94	$327	$103	$524
Wisconsin	5,186	26,808	34,587	66,581	$114	$1,019	$2,615	$3,748
Wyoming	443	982	44	1,469	$6	$32	$75	$113
United States	142,219	574,960	443,213	1,160,392	5,558	24,552	36,884	66,994

Source: AFPA 2010

Table 3.1-9. Forestry and Paper Industries Manufacturing Facilities

Location	Manufacturing Facilities (number)					
	Sawmills, Millwork, Treating	Engineered Wood and Panel Products	Other Wood Products	Pulp, Paper, & Paperboard Mills	Converted Paper Products	Total
Alabama	56	10	9	20	65	160
Alaska	2	0	0	0	0	2
Arizona	5	1	5	4	39	54
Arkansas	37	10	2	6	69	124
California	54	11	13	19	526	623
Colorado	10	0	2	0	43	55
Connecticut	2	1	3	6	72	84
Delaware	0	0	0	1	8	9
Florida	34	4	9	12	147	206
Georgia	52	17	2	22	160	253
Hawaii	2	0	0	0	6	8
Idaho	26	9	4	2	7	48
Illinois	5	0	8	9	326	348
Indiana	6	1	1	4	154	166
Iowa	0	0	1	2	42	45
Kansas	0	0	1	2	32	35
Kentucky	2	2	1	6	92	103
Louisiana	18	13	0	12	47	90
Maine	25	2	0	14	21	62
Maryland	6	0	1	3	39	49
Massachusetts	7	0	3	17	180	207
Michigan	17	4	5	22	171	219
Minnesota	14	8	10	11	116	159
Mississippi	37	11	2	10	48	108
Missouri	8	0	3	4	128	143
Montana	22	5	5	1	0	33
Nebraska	0	0	0	0	16	16
Nevada	0	0	1	1	18	20
New Hampshire	15	0	0	4	27	46
New Jersey	3	0	3	5	226	237
New Mexico	3	0	0	1	9	13
New York	13	4	4	31	301	353
North Carolina	59	7	7	10	184	267
North Dakota	1	1	0	0	3	5
Ohio	7	1	6	18	335	367
Oklahoma	6	2	4	7	35	54
Oregon	91	56	13	11	42	213
Pennsylvania	14	2	5	20	271	312
Rhode Island	1	0	1	0	35	37

Table 3.1-9. Forestry and Paper Industries Manufacturing Facilities (cont'd)

Location	Manufacturing Facilities (number)					
	Sawmills, Millwork, Treating	Engineered Wood and Panel Products	Other Wood Products	Pulp, Paper, & Paperboard Mills	Converted Paper Products	Total
South Carolina	31	9	1	10	88	139
South Dakota	8	1	0	0	9	18
Tennessee	3	1	4	11	142	161
Texas	38	9	9	7	251	314
Utah	5	0	1	0	32	38
Vermont	5	0	3	4	9	21
Virginia	40	7	2	13	94	156
Washington	73	15	24	14	79	205
West Virginia	5	3	2	2	9	21
Wisconsin	17	7	10	40	201	275
Wyoming	7	0	0	0	0	7
United States	892	234	190	418	4,954	6,688

Source: AFPA 2010

Table 3.1-10. Value of Forest and Paper Industry Shipments and Estimated State and Local Tax Payments

Location	Value of Industry Shipments ($millions)			Estimated State & Local Tax Payments ($millions)
	Wood Manufacturing	Paper Manufacturing	Total	
Alabama	$4,839	$7,595	$12,434	$99
Alaska	n/a	n/a	$0	n/a
Arizona	$1,696	$992	$2,688	$48
Arkansas	$3,142	$4,519	$7,661	$83
California	$7,532	$9,248	$16,780	$353
Colorado	$745	$497	$1,241	$27
Connecticut	$251	$1,700	$1,951	$51
Delaware	n/a	$549	$549	n/a
Florida	$3,701	$3,979	$7,681	$140
Georgia	$5,398	$10,084	$15,482	$184
Hawaii	$0	$0	$0	n/a
Idaho	$2,215	$812	$3,027	$39
Illinois	$1,515	$6,069	$7,584	$158
Indiana	$3,434	$3,424	$6,859	$99
Iowa	$1,979	$1,522	$3,502	$48
Kansas	$369	$757	$1,126	$28

Table 3.1-10. Value of Forest and Paper Industry Shipments and Estimated State and Local Tax Payments (cont'd)

Location	Value of Industry Shipments ($millions)			Estimated State & Local Tax Payments ($millions)
	Wood Manufacturing	Paper Manufacturing	Total	
Kentucky	$2,155	$4,816	$6,971	$74
Louisiana	$2,214	$4,907	$7,121	$110
Maine	$1,150	$3,476	$4,626	$119
Maryland	$1,166	$1,328	$2,495	$30
Massachusetts	$768	$3,267	$4,035	$89
Michigan	$2,534	$4,965	$7,499	$119
Minnesota	$3,643	$5,428	$9,071	$106
Mississippi	$2,919	$2,451	$5,370	$77
Missouri	$1,238	$4,579	$5,816	$63
Montana	$956	n/a	$956	$26
Nebraska	$452	$483	$936	$16
Nevada	$338	n/a	$338	$9
New Hampshire	$599	$415	$1,014	$25
New Jersey	$810	$3,241	$4,051	$130
New Mexico	$230	n/a	$230	$8
New York	$1,717	$5,059	$6,776	$160
North Carolina	$5,969	$5,711	$11,680	$146
North Dakota	$357	n/a	$357	n/a
Ohio	$2,784	$7,422	$10,205	$173
Oklahoma	$452	$2,269	$2,721	$26
Oregon	$8,991	$3,306	$12,297	$173
Pennsylvania	$5,401	$10,935	$16,336	$185
Rhode Island	n/a	$257	$257	$10
South Carolina	$2,496	$6,341	$8,837	$122
South Dakota	$295	n/a	$295	$10
Tennessee	$2,900	$5,002	$7,902	$123
Texas	$5,557	$6,389	$11,947	$200
Utah	$496	$1,028	$1,524	$21
Vermont	$416	$302	$719	$15
Virginia	$4,189	$4,311	$8,500	$102
Washington	$4,900	$5,617	$10,517	$242
West Virginia	$1,887	n/a	$1,887	$19
Wisconsin	$5,167	$13,802	$18,969	$235
Wyoming	n/a	n/a	$0	n/a
United States	$111,963	$168,856	$280,819	$4,320

Source: AFPA 2010

3.2 BIOLOGICAL RESOURCES:

Biological resources include plant and animal species and the habitats in which they occur. For this analysis, biological resources are divided into the following categories: vegetation wildlife, and protected species. Vegetation and wildlife refer to the plant and animal species, both native and introduced, which characterize a region. Protected species are those federally designated as threatened or endangered under the Endangered Species Act (ESA) or species that are considered candidates for being listed as threatened or endangered. This section, due to the broad scope, contains sub-section information on the analysis scale by Land Resource Regions (LRR) and to the State level using State Wildlife Action Plans (SWAP), common vegetation, common wildlife, and a broad overview of protected species.

3.2.1 Scale of Analysis

The geographic scale of the lands potentially affected by the implementation of the project area establishment component of BCAP encompasses the entire U.S. and its territories; hence, a great variety of terrestrial and aquatic plant and animal species may be affected by the Proposed Action. Given the national scale of the BCAP and the programmatic level of this analysis, it is not feasible to list all of the species that may be present on lands eligible for enrollment, but broad generalizations based upon the organizing principle of LRR within the U.S. can be made. The USDA NRCS published a handbook titled “Land Resource Regions and Major Land Resource Areas of the United States, the Caribbean, and the Pacific Basin” (Agriculture Handbook 296) (NRCS 2006a). The Agriculture Handbook 296 describes 28 LRR and the physiography, geology, climate, water resources, soils, biological resources, and kinds of land use in 278 Major Land Resource Areas in the United States, the Caribbean, and the Pacific Basin (Figure 3.2-1). The name of each LRR reflects the type of agricultural activities that affect the economy and ecology of that region. Descriptions of the Land Resource Regions and their associated vegetation and wildlife are located in Appendix I.

Individual State wildlife action plans (SWAP) were also used to assist in the analysis and evaluation of wildlife resources for each of the LRR. Each state identified habitats and species in need of conservation efforts to facilitate funding, research, and management decisions. A representative state was chosen from each LRR. In each case, the state chosen comprises the largest proportion (i.e., acreage) of the particular LRR (Table 3.2-1). Wildlife descriptions for this PEIS mention game species, common species, and species of concern. Given the broad scale of species present in the United States, these are only examples of common species and not a definitive list by LRR or state.

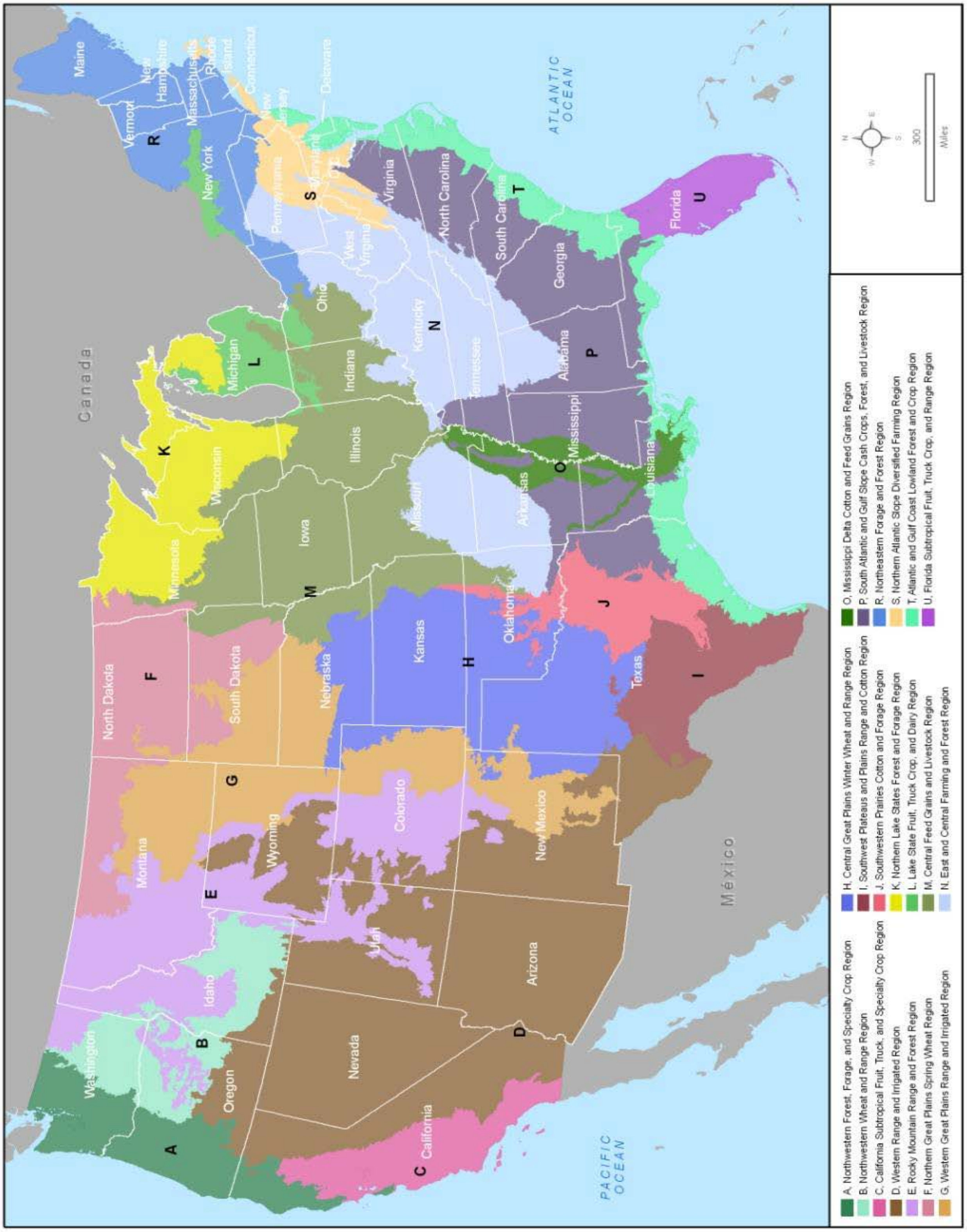


Figure 3.2-1. NRCS Land Resource Regions (NRCS 2006a)

Table 3.2-1. Selected States to Represent Land Resource Regions

Region Code	Land Resource Region Descriptive	State
A	Northwestern forest, forage, and specialty crop region	Oregon
B	Northwestern wheat and range region	Idaho
C	California subtropical fruit, truck, and specialty crop region	California
D	Western range and irrigated region	Arizona
E	Rocky Mountain range and forest region	Montana
F	Northern Great Plains spring wheat region	North Dakota
G	Western Great Plains range and irrigated region	New Mexico
H	Central Great Plains winter wheat and range region	Kansas
I	Southwest plateaus and plains regions	Texas
J	Southwestern prairies cotton and forage region	Texas
K	Northern lakes states forest and forage region	Wisconsin
L	Lake states fruit, truck crop, and dairy region	Michigan
M	Central feed grains and livestock region	Iowa
N	East and Central farming and forest region	Kentucky
O	Mississippi Delta cotton and feed grains region	Arkansas
P	South Atlantic and Gulf slope cash crops, forest, and livestock region	Georgia
R	Northeastern forage and forest region	New York
S	Northern Atlantic slope diversified farming region	Pennsylvania
T	Atlantic and Gulf coast lowland forest and crop region	Louisiana
U	Florida subtropical fruit, truck crop, and range region	Florida

It is understood that habitats are interdependent and each will affect and be affected by others, especially those geographically adjacent to each other (SWAP summary). Most wildlife species obtain life needs from varying resources and therefore move freely across habitats. The SWAP have been developed and based on major land resource areas within LRR. By managing the health and integrity of the habitats within a region, these wildlife action plans will conserve and maintain the broad array of wildlife that lives within each State.

Developed under the 2001 Commerce, Justice, State and Related Agencies Appropriations Act (PL 106-553, USC 16(2000) 669[c]), the SWAPs address eight key elements:

- Information on the distribution and abundance of wildlife, including low and declining populations, that describes the diversity and health of the state's wildlife.
- Descriptions of locations and relative conditions of habitats essential to species in need of conservation.

- Descriptions of problems that may adversely affect species or their habitats, and priority research and survey efforts.
- Descriptions of conservation actions proposed to conserve the identified species and habitats.
- Plans for monitoring species and habitats, and plans for monitoring the effectiveness of the conservation actions and for adapting these conservation actions to respond to new information.
- Descriptions of procedures to review the plan at intervals not to exceed 10 years.
- Coordination with federal, state, and local agencies and Indian tribes in developing and implementing the wildlife action plan.
- Broad public participation in developing and implementing the wildlife action plan.

Hence, the SWAPs will provide a valuable foundation for analyses of the project area establishment component of BCAP on wildlife resources within a given LRR.

3.2.2 Vegetation

Vegetation refers to the plants, both native and introduced, of a specific region. This analysis focuses on vegetation including major agricultural crops, genetically engineered crops and invasive and noxious species that may be found on lands eligible for the project area component of BCAP. At the scale used for this analysis, LRR vegetation was summarized by general community types with examples of common and unique species for the region. Descriptions of the LRR and their associated vegetation are located in Appendix I. Additionally, GIS was used to summarize the amount of Level I land cover types for each LRR (Table 3.2-2).

3.2.2.1 Current Crop Trends

Agricultural production in the U.S. is distributed throughout five regions: the Corn Belt, the Great Plains, the West Coast, Delta, and Sugarcane. Corn and soybeans are primarily farmed in the Corn Belt. Wheat is the dominant crop in the Great Plains and West Coast regions with corn and sorghum serving as alternative crops. Rice is a major crop in the Mississippi Delta; about half of rice production in the region occurs in Arkansas and a large proportion takes place in southwest Louisiana. Sugarcane bagasse is important in southern Louisiana and southern Florida (Gallagher *et al*. 2003).

Vegetation and wildlife diversity can be described in the five agricultural regions by comparison with the LRRs defined in the Agriculture Handbook 296. The Corn Belt is located within LRR M, N, and P. Wheat crops are primarily grown in the Great Plains and West Coast agricultural regions which fall within F and G. Rice crops are dominant in the Southern agricultural region, which covers LRR O, P and T. The majority of rice is found in LRR O and P.

Table 3.2-2. Amount of Level 1 Land Cover Types by Land Resource Region

Level I Land Cover Type	Acres by Regions						
	A	B	C	D	E	F	G
Transitional	1,625,924	7,057	3,677	53,286	2,104,389	4,062	21,923
Deciduous forest	3,649,095	221,555	1,250,996	1,119,476	6,950,156	1,160,624	812,048
Evergreen forest	35,799,208	2,851,824	4,011,746	45,173,774	69,785,374	86,803	5,090,717
Mixed forest	4,854,050	65,967	1,645,257	1,203,443	1,415,805	2,184	52,574
Shrubland	2,553,182	26,267,127	7,205,119	229,339,250	25,174,891	2,571,389	13,743,261
Orchards and vineyards	215,595	198,604	2,580,196	112,453	8,085	0	10
Grasslands/herbaceous	3,331,080	6,871,092	11,443,570	38,522,853	32,952,900	27,459,450	95,192,693
Pasture/hay	2,499,847	3,530,425	2,819,552	5,472,594	2,968,309	7,523,272	3,323,953
Row crops	267,674	1,981,894	2,969,713	2,006,298	420,751	23,440,043	3,652,060
Small grains	251,010	5,608,047	1,732,921	1,132,524	2,664,024	16,700,945	6,211,755
Fallow	12,869	3,368,422	12,563	44,716	1,123,737	7,529,312	4,092,856
Total	55,059,534	50,972,014	35,675,310	324,180,667	145,568,421	86,478,084	132,193,850
	H	I	J	K	L	M	N
Transitional	11,051	326	51,615	386,740	13,304	42,196	710,270
Deciduous forest	1,910,955	1,424,563	6,920,582	21,753,836	5,959,362	20,598,450	77,260,846
Evergreen forest	824,344	4,967,639	1,633,910	4,888,733	718,276	475,974	9,821,817
Mixed forest	143,479	59,879	440,164	5,346,145	857,555	784,886	16,905,025
Shrubland	11,886,492	25,944,190	3,122,819	261,793	6,128	131,579	113,095
Orchards and vineyards	1,641	14,727	395	20	395	1,641	0
Grasslands/herbaceous	61,265,199	8,139,029	7,281,376	727,034	349,713	7,167,955	819,757
Pasture/hay	8,422,934	2,421,870	11,491,914	8,461,324	5,280,722	41,779,594	29,304,299
Row crops	27,820,748	2,538,385	2,864,199	10,471,576	11,472,294	95,256,041	8,579,668
Small grains	24,531,893	360,369	925,093	422,303	8,708	1,774,879	115,171
Fallow	1,464,920	12,088	830	0	0	1,453	0
Total	138,283,656	45,883,065	34,732,897	52,719,504	24,666,457	168,014,648	143,629,948
	O	P	R	S	T	U	
Transitional	35,969	4,693,649	605,250	101,916	1,426,055	366,467	
Deciduous forest	759,569	37,007,040	28,066,687	9,859,960	3,441,832	7,868	
Evergreen forest	477,050	35,232,497	10,077,403	1,035,727	11,697,100	3,182,629	
Mixed forest	432,492	27,316,475	16,762,761	2,309,961	3,654,867	1,058	
Shrubland	0	32,509	118,136	1,453	910,603	220,962	
Orchards and vineyards	0	16,655	9,983	10	9,519	1,043,062	
Grasslands/herbaceous	13,413	444,602	633	0	1,162,720	3,084,389	
Pasture/hay	1,746,198	21,623,641	7,264,869	7,104,577	4,519,370	1,141,973	
Row crops	13,042,625	21,739,899	4,134,311	1,516,002	6,536,205	2,012,713	
Small grains	1,303,159	406,034	227	0	1,640,177	0	
Fallow	0	0	0	0	0	0	
Total	17,810,475	148,513,001	67,040,260	21,929,606	34,998,448	11,061,121	

Sources: Major Land Resource Area, NRCS 2006a
Land Use Land Cover Data, National Center for Earth Resources Observation and Science of USGS 2005

3.2.2.2 Invasive and Noxious Plant Species

Current agricultural and conservation practices include the planting of native and introduced species and control or eradication of invasive or noxious species. A large number of invasive plant species have been introduced to and established within the U.S. (Table 3.2-3). These introductions range from accidental, such as contamination of seed commodities, to deliberate, such as planting for erosion control or as ornamental plantings. Each State in the U.S. has its own noxious weed laws and most undesirable plants list. Control of invasive and noxious species is important to maintaining native vegetation communities.

The EO 13112 protects the U.S. from invasive species, unless benefits clearly outweigh potential harms. In addition, the PPA, which became law in June 2000 as part of the Agricultural Risk Protection Act, consolidated all or part of 10 existing laws, applicable to USDA activities, into one comprehensive law, including the authority to regulate plants, plant products, certain biological control organisms, noxious weeds, and plant pests (APHIS 2002). EO 13112 defines native species as a species that, with respect to a particular ecosystem, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem. An alien or non-native species is any species, with respect to a particular ecosystem, including its seeds, eggs, spores, or other biological material capable of propagating that species, that is not native to that ecosystem; an invasive species is a nonnative "species whose introduction does or is likely to cause economic or environmental harm or harm to human health" (EO 13112). The PPA defines a noxious weed as any plant or plant product that can directly or indirectly bring harm to agriculture, the public health, navigation, irrigation, natural resources, or the environment; this Act expands the definition of noxious weed from the definition in the 1974 Federal Noxious Weed Act, which included only weeds that were of foreign origin, new to, or not widely prevalent in the U.S. (APHIS 2002). Noxious weeds are identified and listed on State and Federal lists.

Non-native, exotic, or invasive species are often introduced from other regions or countries accidentally, intentionally, or through habitat change induced by humans or nature. Often these non-native species have no natural controls in the area where they are released, allowing their populations to increase rapidly. A non-native species becomes invasive when it out-competes native species and replaces native species in natural plant communities. Some non-native species can damage U.S. agriculture by reducing crop and livestock production or threatening export potential, with impacts on U.S. prices, consumers, and trade. Some species have a particularly high potential for damage because, once introduced in the U.S., they lack natural enemies and their populations can increase and spread to levels that are difficult and costly to eradicate (Invasive Species Advisory Committee [ISAC] 2006).

Table 3.2-3. List of Major Economically and Ecologically Important Invasive Weed Species in the U.S.

Habitat	Scientific name	Common name	Plant Type	Distribution
Riparian	*Ailanthus altissima*	tree-of-heaven	Tree	Widespread throughout U.S.
	Albizia julibrissin	mimosa	Shrub/Small Tree	Expanding range in tropical regions, southeastern U.S.
	Arundo donax	giant reed	Grass	Expanding range in Pacific Coast states, Arizona
	Casuarina equisetifolia	Australian pine	Tree	Expanding range in Hawaii and Florida
	Delairea odorata	Cape ivy	Vine	Expanding range in California
	Elaeagnus angustifolia	Russian olive	Shrub/Small Tree	Sporadic infestations throughout most of U.S.
	Lepidium latifolium	perennial pepperweed	Forb	Rapidly expanding range in West
	Phragmites communis	common reed	Grass	Widespread in eastern U.S.
	Sapiem sebiferum	Chinese tallow	Tree	Carolinas to Florida
	Tamarix spp.	tamarisk	Shrub/Small Tree	Rapidly expanding range in West
Aquatic or Wetlands	*Alternanthera philoxeroides*	alligatorweed	Forb	Widespread in southeastern U.S., some infestations in California
	Egeria densa	Brazilian elodea	Forb	West of the Mississippi River; some in California and southeastern U.S.
	Eichhornia crassipes	water hyacinth	Forb	Widespread throughout southeastern U.S. and California
	Hydrilla verticillata	hydrilla	Forb	Widespread in Southeast and mid-Atlantic coast to Connecticut, threatens western states
	Lythrum salicaria	purple loosestrife	Forb	Widespread in northern and central states, expanding range in West
	Melaleuca quinquenervia	melaleuca	Tree	Widespread in Florida
	Myriophyllum aquaticum	parrotfeather	Forb	Widespread throughout U.S.
	Myriophyllum spicatum	Eurasian watermilfoil	Forb	Widespread throughout U.S.
	Salvinia molesta	giant salvinia	Forb	Well established in Texas, new infestations in California and other western and southeastern states
	Spartina alterniflora	smooth cordgrass	Grass	Native in estuaries of eastern U.S., spreading along coast of Pacific Northwest
	Trapa natans	water chestnut	Forb	Expanding range in northeastern U.S.

Table 3.2-3. List of Major Economically and Ecologically Important Invasive Weed Species in the U.S.(cont'd)

Habitat	Scientific name	Common Name	Plant Type	Distribution
Rangeland and Wildland	*Acacia auriculiformis*	earleaf acacia	Shrub/Small Tree	Expanding range in Southeast
	Acroptilon repens	Russian knapweed	Forb	Widespread throughout U.S., particularly western states
	Aegilops spp.	goatgrasses	Grass	Widespread in western U.S.
	Ammophila arenaria	European beachgrass	Grass	Isolated infestations along sand dunes of California
	Andropogon virginianum	broomsedge	Grass	Hawaii (native to southeastern U.S.)
	Bromus madritensis ssp. rubens	red brome	Grass	Widespread in western states, especially Mojave and Sonoran deserts
	Bromus tectorum	downy brome	Grass	Widespread throughout U.S., particularly western states
	Cardaria draba	hoary cress	Forb	Widespread in western U.S.
	Carduus nutans	musk thistle	Forb	Widespread throughout U.S.
	Carpobrotus edulis	iceplant, sea fig	Shrub	Spreading in coastal areas of West
	Centaurea calcitrapa	purple starthistle	Forb	Expanding range in California
	Centaurea diffusa	diffuse knapweed	Forb	Widespread in western U.S.
	Centaurea maculosa	spotted knapweed	Forb	Widespread throughout U.S., particularly western states
	Centaurea solstitialis	yellow starthistle	Forb	Western states, particularly California, Idaho, Oregon
	Centaurea squarrosa	squarrose knapweed	Forb	Expanding range in western U.S.
	Chondrilla juncea	rush skeletonweed	Forb	Expanding range in western U.S.
	Cirsium arvense	Canada thistle	Forb	Widespread throughout U.S.
	Cirsium vulgare	bull thistle	Forb	Widespread throughout U.S.
	Conium maculatum	poison hemlock	Forb	Widespread throughout U.S.
Rangeland and Wildland	*Convolvulus arvensis*	field bindweed	Vine	Widespread throughout U.S.
	Cortaderia jubata	jubatagrass	Grass	Widespread along California and Oregon coast
	Cortaderia selloana	pampasgrass	Grass	Widespread along California and Oregon coast
	Crupina vulgaris	common crupina	Forb	Expanding range in California and northwestern states
	Cynara cardunculus	artichoke thistle	Forb	Expanding range in California
	Cynoglossum officinale	houndstongue	Forb	Expanding range in many regions of U.S.
	Cytisus scoparius	Scotch broom	Shrub	Widespread throughout Pacific Coast states

Table 3.2-3. List of Major Economically and Ecologically Important Invasive Weed Species in the U.S.(cont'd)

Habitat	Scientific name	Common name	Plant Type	Distribution
Rangeland and Wildland	*Ehrharta spp.*	Veldtgrass	Grass	Expanding range in coastal areas of California
	Euphorbia esula	leafy spurge	Forb	Widespread in northern states, particularly western U.S.
	Foeniculum vulgare	fennel	Forb	Widespread throughout Pacific Coast states, especially southern California
	Genista monspessulana	French broom	Shrub	Widespread in western U.S.
	Hedychium gardnerianum	Kahili ginger	Forb	Hawaii
	Hieracium aurantiacum	orange hawkweed	Forb	Expanding range in Northwest
	Hieracium pratense	meadow hawkweed	Forb	Expanding range in Northwest
	Hypericum perforatum	St. Johnswort	Forb	Widespread in western U.S.
	Imperata cylindrica	cogon grass	Grass	Expanding range in tropical and sub-tropical areas of U.S., southeastern U.S. to Texas and southern California
	Isatis tinctoria	Dyer's woad	Forb	Spreading in Utah, California, and other western states
	Lantana camara	lantana	Shrub	Expanding range in Florida and Hawaii
	Lepidium latifolium	perennial pepperweed	Forb	Rapidly expanding range in West
	Leucanthemum vulgare	oxeye daisy	Forb	Widespread throughout U.S.
	Linaria dalmatica	Dalmatian toadflax	Forb	Expanding range in West
	Linaria vulgaris	yellow toadflax	Forb	Expanding range in West
	Lonicera japonica	Japanese honeysuckle	Vine	Eastern and central U.S. and Hawaii
	Melia azedarach	Chinaberry tree	Shrub/Small Tree	Spreading in Southeast
	Miconia calvescens	Miconia	Shrub/ Small Tree	Hawaii
	Myrica faya	firebush	Shrub/Small Tree	Hawaii
	Onopordum acanthium	Scotch thistle	Forb	Widespread throughout West
	Passiflora	mollissima banana poka	Vine	Hawaii
	Polygonum perfoliatum	mile-a-minute	Forb	Expanding range in East
	Potentilla recta	sulfur cinquefoil	Forb	Widespread in northern states

Table 3.2-3. List of Major Economically and Ecologically Important Invasive Weed Species in the U.S.(cont'd)

Habitat	Scientific name	Common name	Plant Type	Distribution
Rangeland and Wildland	*Psidium callleianum*	strawberry guava	Tree	Hawaii
	Pueraria lobata	kudzu	Vine	Widespread in Southeast to Pennsylvania and Illinois
	Rubus argotus	Florida prickly blackberry	Shrub	Hawaii (native to southeastern U.S.)
	Salsola tragus	Russian thistle (tumbleweed)	Forb	Widespread in West
	Salvia aethiopis	Mediterranean sage	Forb	Expanding range in western U.S.
	Schinus terebinthifolius	Brazilian pepper	Shrub/Small Tree	Expanding range in southwestern U.S.
	Potentilla recta	sulfur cinquefoil	Forb	Widespread in northern states
	Senecio jacobaea	tansy ragwort	Forb	Widespread in Pacific Northwest
	Solanum viarum	tropical soda apple	Shrub	Spreading in southeastern U.S.
	Spartium junceum	Spanish broom	Shrub	Spreading in western states
	Taeniatherum caput-medusae	medusahead	Grass	Widespread in west
	Ulex europaeus	gorse	Shrub	Isolated infestations on Pacific Coast
Cropland	*Abutilon theophrasti*	velvetleaf	Forb	Widespread throughout much of U.S.
	Amaranthus retroflexus	redroot pigweed	Forb	Widespread throughout U.S.
	Aegilops cylindrica	jointed goatgrass	Grass	Widespread throughout U.S.
	Chenopodium album	common lambsquarters	Forb	Widespread throughout U.S.
	Cirsium arvense	Canada thistle	Forb	Widespread throughout U.S.
	Convolvulus arvensis	field bindweed	Vine	Widespread throughout U.S.
	Cyperus esculentus	yellow nutsedge	Grass	Widespread throughout U.S.
	Cyperus rotundus	purple nutsedge	Grass	Widespread throughout U.S.
	Echinochloa crus-galli	barnyardgrass	Grass	Widespread throughout U.S.
	Elytrigia repens	quackgrass	Grass	Widespread throughout U.S.
	Kochia scoparia	kochia	Forb	Primarily invasive in western U.S.
	Setaria spp.	foxtails	Grass	Widespread throughout U.S.
	Sorghum halepense	Johnsongrass	Grass	Widespread throughout U.S.
	Striga asiatica	witchweed	Forb	Eradicated or close to eradication in North and South Carolina

Source: Mullin *et al.* 2000

Invasive species are spread in many ways: by wind, fire, or water; on shoes or vehicle tires; on farm machinery; and in fur or the digestive tract of livestock and wildlife. Agricultural crops can carry seeds from invasive plants. For example, contaminated seed bags of alfalfa are thought to be the source of the invasive plant, camelthorn (*Alhagi maurorum*). In addition, the movement of agricultural equipment or associated plants and planting material within or from infested areas increases the risk of a spread. Plant traits that enable a given plant to be invasive under conducive biogeographical contexts include perennial roots or rhizomes, prolific seed production, adaptability to severe conditions such as highly saline, dry or wet soils, resistance to herbicides, resistance to pests and disease, or ability to suppress the growth of adjacent plants (i.e., allelopathic).

Plants that are non-native to the United States are not necessarily categorized as invasive or having an invasive impact. The terms invasive and noxious may be applied to plant species native to the United States as well as those that are non-native to the United States (USFWS 2009a; National Invasive Species Council [NISC] 2008). The majority of non-native plant species do not exhibit invasive tendencies (NISC 2008) and many, such as wheat and corn (which are Title I commodities not eligible under the Establishment and Annual Payments Program of BCAP, although the crop residues of these species are eligible under the Matching Payments Program of BCAP), have become indispensible to our economy and way of life (USFWS 2009a; NISC 2008). Less than nine percent of non-native plant species introduced into the U.S. may be invasive (USFWS 2009a). Miscanthus (*Miscanthus* spp.) a native to Africa and Asia, is considered an eligible material under the Matching Payment Program of BCAP; however, some States may consider or determine that Miscanthus could be a noxious weed, thereby, making Miscanthus ineligible as a crop under the Establishment and Annual Payments Program of BCAP in those States.

Conversely, many native species exhibit aggressive growth habits and are noxious weeds outside their native range. For example, Virginia copperleaf (*Acalypha virginica*), a native herb, is variously ranked as state endangered, state threatened, and species of concern in several states; however it is also included on the list of noxious and invasive weeds of the northeast (NRCS 2009a). A bio-geographical context must therefore be included when assessing whether a non-native species should be considered an invasive species (NISC 2008).

Many purportedly beneficial introduced species have had long-term economic and environmental costs owing to their invasiveness (Raghu *et al.* 2006). Kudzu (*Pueraria montana*), Johnsongrass (*Sorghum halepense*), multiflora rose (*Rosa multiflora*), and Japanese honeysuckle (*Lonicera japonica*) are examples of non-native, invasive species that were at one time promoted and distributed by the U.S. government for such uses as erosion control, livestock living fences, forage, wildlife habitat, and highway medians. These species were later recognized as invasive and causing harm, invading and impacting natural systems across the United States; and have since caused unforeseen ecological damage; incurring long-term economic and environmental costs that are ongoing still (Swearingen *et al.* 2002).

Invasive plant species can have significant negative impacts on biological resources including decreases in native wildlife and plant species populations, alterations to rare plant communities, or changing ecological processes that native plant species and other desirable plants and wildlife depend on for survival (including impacts upon native pollinators) (NISC 2008). Invasive plant species could potentially cause or vector decimating plant diseases, prevent native and agricultural species from reproducing, suppress the growth of neighboring plants, out-compete desirable species for nutrients, light, moisture or other vital resources; and adversely impact erosion rates, hydrologic regimes and soil chemistry such as pH and nutrient availability. Natural wildfire cycles could also be altered; invasions by fire-promoting grasses could alter entire plant communities, eliminating or sharply reducing populations of many native plant species (*Ibid*).

Eradication or control of invasive and noxious species can be an arduous task often including multiple methods of treatment to be effective. The application of herbicide, grazing, burning, mechanical or manual control (cutting, excavating), and mowing are all methods that can be used to control and eradicate invasive species. While it may not be possible to fully eradicate an invasive plant species, management activities can control further spread or takeover. Some species of invasive plants require timed treatment for eradication or control such as when the plant is dormant, young, or prior to flowering/seeding. Additionally, vegetation may become accustomed to certain methods of control and other methods may be required to aid in management (NRCS Practice Standard 595, Pest Management).

3.2.2.3 Genetically Engineered Crops

Genetically engineered (GE) organisms are those whose genetic material has been inserted with the genetic material from one or more organism(s); the receiving organism has new traits or characteristics (APHIS 2006). This technology has been used extensively in creating improved agricultural crops; the most widely adopted bioengineered crops have been those with herbicide-tolerant traits and/or insect resistant traits such as in bioengineered soybeans and corn (Fernandez-Cornejo and McBride 2002). Table 3.2-4 lists those genetically engineered crops and the associated traits that are currently available or still in development in the United States. These modified, traditional agricultural crops have been grown with extensive oversight, regulation and review by USDA, Food and Drug Administration (FDA), and EPA. APHIS' Biotechnology Regulatory Services (BRS) regulates the introduction of GE organisms in the United States. The BRS refers to these organisms as "regulated articles", which are organisms that have been altered by or produced through GE and have the potential to be plant pests. Introduction includes any movement into or through the United States, or release into the environment that is outside an area of physical confinement (APHIS 2006). USDA biotechnology regulations require any GE organism, with potential to be a plant pest, be regulated until it has undergone extensive review to demonstrate that it does not pose a risk.

Table 3.2-4. GE Crops Currently Available and in Development in the U.S.

Crop	Herbicide Tolerance	Insect Resistance:	Viral/Fungal Resistance	Agronomic Properties
Corn	C	C	D	D
Soybeans	C	D		D
Cotton	C	C6		D
Potatoes		W	D	D
Wheat	C		D	
Other field crops[1]	C[2] D[3]	D	D	D
Tomato, squash, melon			D	D
Other vegetables	D			
Papaya			C	
Fruit trees			D	
Other trees				D[4]

C = Currently available; D = In various stages of development and testing; W = Withdrawn from the market.
[1]Includes barley, canola, peanuts, tobacco, rice, alfalfa, etc.
[2]Canola.
[3]Barley, rice, sugar beets.
[4]Modified lignin content (for example, to reduce cost of paper making from trees).
Source: (USDA 2006)

When compared to conventional counterparts, Goklnay (2001) found GE oilseed rape, potato, corn, and sugar beets no more invasive or persistent than non GE crops. Many of these crops have been deregulated by APHIS and have also completed the required reviews from the EPA and the FDA, depending on the nature of the GE trait (APHIS 2006). The effects of genetic engineering technology can be highly variable, and risks and benefits must be considered on a case-by-case basis (Chapman and Burke 2006).

GE development has been characterized based on trait comparison. Trait "Stacking" has become an increasingly important factor. Stacking refers to modifying more than one trait in a crop variety; i.e., a variety with insect-resistance and herbicide-tolerance. Fernandez-Cornejo and Caswell (2006) describe three generations of GE crops. First generation plants have enhanced input traits such as herbicide tolerance, insect/disease/fungus-resistance, or tolerance to environmental stress. Second generation plants have improved output such as delayed ripening; enhanced color or flavor; or increased protein, carbohydrate, fatty acid, micronutrient, oil, and modified starch content. Third generation crops are crops having products other than traditional food and fiber such as pharmaceutical production or improved bio-based fuel processing (USDA 2006).

Commercially available GE crop varieties were introduced in 1996. Improved technology and gene analysis allows geneticists to achieve desirable plant characteristics much faster than conventional breeding methods (Heaton *et al.* 2008) and many farmers have adopted this technology's progeny. In 2006, the USDA anticipated 85 percent of the corn, 91 percent of the soybeans, and 81 percent of the cotton grown in the U.S. would be GE by 2009 (USDA 2006)

According to James (2008), it is estimated that 12.2 million hectares (19.5 percent) of the 62.5 million hectares of biotech crops produced in the U.S. were used for biofuel production in 2008. These were primarily Title I crops, corn (71 percent), soybeans (29 percent) and canola (less than 1 percent) (James 2008) which are not BCAP eligible crops.

3.2.3 Wildlife

Wildlife refers to the animal species (mammals, birds, amphibians, reptiles, invertebrates, and fish/shellfish), both native and introduced, which characterize a region. Over the past four decades, populations of wildlife species have declined throughout the country. These declines have been attributed to loss of habitat associated with intensive farming, forest management, reforestation, advanced natural succession, fire exclusion, invasion of exotic plants, and urbanization (NRCS 2009b). Losses of native grasslands to agriculture and other land uses have exceeded 56 million acres (62 percent) of the original 90 million acres of native grassland (Ducks Unlimited 2009). Agriculture dominates human uses of land (Robertson and Swinton 2005). In the U.S., non-Federal, rural land uses comprise 71 percent of the contiguous 48 States (approximately 1.4 billion acres) (NRCS 2007a). In 2007, 920.1 million acres (47 percent) of the contiguous 48 States were devoted to crop, conservation reserve, pasture, or rangeland uses (USDA 2009b). How these lands are maintained influences the function and integrity of ecosystems and the wildlife populations that they support.

3.2.3.1 Biodiversity and Habitat

Biological diversity refers to the variety and variability among living organisms and the ecological complexes in which they occur. Diversity can be defined as the number of different items and their relative frequency. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the chemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, genes, and their relative abundance; it also encompasses behavior patterns and interactions. Major contributors to declining biodiversity include urbanization, agricultural expansion, land degradation, deforestation, land and water pollution, invasive species and, increasingly, climate change (Keeney and Nanninga 2008). The most widespread problems to biodiversity from agricultural activities are the expansion of cropping and grazing into wildlife habitats, overgrazing riparian areas, and agricultural activities that contaminate aquatic habitats (Office of Technology Assessment 1993).

In general, greater diversity leads to greater plant productivity, more nutrient retention, and more stable ecosystems (Keeney and Nanninga 2008). Environmental homogeneity tends to reduce biodiversity on farms as well as on other lands. For example, research in many areas has demonstrated that sites with high crop diversity tend to have larger number numbers of birds, butterflies, beetles, and spiders that sites of the same size where there was only one kind of crop being grown. The various birds and beneficial insects, in turn, provide ecosystem services including the mitigation of crop pests (Dale *et al.* 2010).

Despite these biodiversity benefits, homogeneity tends to be more efficient and less expensive for farmers, so crops such as corn are grown almost exclusively as monocultures in the U.S. Planting decisions also rely on the expected financial return of the crop, and so are heavily dependent on market expectations. A decision to change from diverse crops to a single crop not only reduces the biodiversity of the areas that are planted on a farm but also contributes to the homogenization of the surrounding landscape, potentially further reducing biodiversity. Extensive landscapes with single cropping can also increase the "environmental footprint" of a farm, because the lack of diversity or repetitious use of land for a single species will tend to require more chemical inputs to control pests and more fertilizer to maintain yields (Dale *et al.* 2010).

To mitigate the environmental impacts caused by agriculture, the U.S. Federal government has developed and implemented various land conservation programs, the most prominent of which is the CRP. The CRP is a voluntary program that pays rent annually to landowners who enroll their highly erodible cropland or other environmentally sensitive acreage and convert it to vegetative cover such as native grasses or trees. Regionally, specific land-management practices used on CRP lands are designed to reduce soil erosion and sedimentation in streams and lakes, improve water quality, establish wildlife habitat and enhance forest and wetland resources close to farms (ESA Dale *et al.* 2010). These practices help to enhance biodiversity by subsidizing habitat creation in areas that would otherwise be planted to row crops (*Ibid*).

The size of habitat patch plays a role in preserving and maintaining wildlife habitat. As the area of habitat decreases, the number of different species it can support decreases. While some species have small breeding and foraging territories, others, such as northern harrier, require expansive acreage for support. Patch size has been shown to influence the density or occurrence of several species in a number of studies (Johnson 2001). Effects of small patch size are likely to be more pronounced in landscapes where similar habitat is scarce (*Ibid.*). For example, Andrén (1994) suggested that "the decline in population size of a species living in the original habitat seems to be linearly related to the proportion of original habitat lost, at the initial stages of habitat fragmentation. At some threshold, area and isolation of patches of original habitat will also begin to influence the population size in the original habitat patches." Andrén also found that the presence of a given species in a patch may be a function not only of patch size and isolation, but also the kind of the neighboring habitat and of the species composition in the patch. Habitat generalists may survive in very small habitat patches because they may be able to utilize resources in surrounding areas. For example, the habitat requirements for chipmunks are usually met on a small woodlot while a white-tail deer may utilize several habitat patches in one-half to three square miles depending on the quality of the habitat. Furthermore, habitat fragmentation worsens the problem of habitat loss for grassland and wetland birds as areas of grasslands and wetlands may be too small, too isolated, and too influenced by edge effects to maintain viable populations of some species (Johnson 2001).

A dynamic mosaic environment is most beneficial in providing for diverse wildlife. Within agricultural areas, beneficial wildlife areas are not evenly distributed, and the potential for sustainable wildlife habitat at a given location is dependent on the landscape context. Specifically, population response is scale-dependent because the population capacity of a landscape is a function of the percentage of the usable landscape (Guthery 1997). Populations show greater response when the necessary habitat size is created within a given geographic area, that is, a given intensity of habitat management will produce a greater response if conducted over a larger geographic region.

3.2.4 Protected Species

3.2.4.1 Definition of the Resource

Protected species are those federally designated as threatened or endangered under the ESA or species that are considered candidates for being listed as threatened or endangered. Critical habitat is defined as: (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation (USFWS 2008a).

3.2.4.2 Existing Conditions

In 1973, Congress passed the ESA. The ultimate goal of the ESA is to conserve threatened and endangered plant and animal species by listing species in this condition and then improving their status until they can be removed from this list. A threatened species is one likely to become endangered while an endangered species is one in danger of becoming extinct.

The USFWS is the lead Federal agency governing terrestrial and freshwater threatened and endangered species and the National Oceanic and Atmospheric Administration National Marine Fisheries Service (NOAA) regulates marine threatened and endangered. Federal agencies proposing activities that could potentially affect a protected species must consult with the USFWS and/or NOAA. Protected species often have very specific living conditions based on their reproductive requirements. A total of 1,321 protected species have been determined to be threatened and endangered within the U.S. and its territories (USFWS 2008b; Table 3.2-5). Of these, 545 listed species have designated critical habitat (*Ibid*). The distribution of protected species varies greatly between states (Table 3.2-6).

Table 3.2-5. Protected Species within the U.S.

Species Group[1]	Number of Threatened or Endangered Species[2]	Number of Species with Designated Critical Habitat
Birds	90	25
Mammals	85	30
Amphibians	25	10
Reptiles	37	14
Fishes	139	64
Insects/Arachnids	69	35
Clams/Snails/Crustaceans/Corals	129	40
Plants	747	327
TOTAL	**1,321**	**545**

[1] Includes terrestrial and marine species

[2] 12 species (5 fish, 3 mammals. 2birds, 1 amphibian, and 1 reptile) are counted more than once in the above table, primarily because these animals have distinct population segments (each with its own individual listing status)

Source: USFWS 2009b, USFWS 2009c

Table 3.2-6. Federal and State-Listed Species and Populations of Special Concern within the Representative State for Each Land Resource Area

LRR Code	State	Listed Plants	Listed Animals[1]	Animal species of concern[2]
A	Oregon	15	42	226
B	Idaho	4	18	229
C	California	179	129	807
D	Arizona	17	37	183
E	Montana	3	11	60
F	North Dakota	1	9	100
G	New Mexico	13	32	452
H	Kansas	3	13	316
I	Texas	28	65	669
J	Texas	28	65	669
K	Wisconsin	7	12	655
L	Michigan	9	16	404
M	Iowa	5	15	297
N	Kentucky	8	34	251
O	Arkansas	6	24	369
P	Georgia	22	49	619
R	New York	10	23	537
S	Pennsylvania	6	18	572
T	Louisiana	4	26	240
U	Florida	55	59	974

[1] Includes terrestrial and marine species (based on published population data)

[2] *Each state is using its own criteria for this category. May include regularly occurring and migratory/wintering birds, mammals, fish, reptiles, amphibians, mussels, snails, insects and other invertebrates.*

Source: USFWS 2009b, USFWS 2009c, state SWAP summary

Habitat destruction is probably the single most important factor leading to the endangerment of species. It plays a role in the decline of approximately 95 percent of federally listed threatened and endangered species. Habitat destruction has impacted nearly every type of habitat and all ecosystems (Library Index 2009). As noted, leading causes of habitat destruction include urbanization and agriculture (Keeney and Nanninga 2008). Besides causing the direct replacement of natural habitat with fields, agricultural activity also results in soil erosion, pollution from pesticides and fertilizers, and runoff into aquatic habitats. Agriculture has impacted forest, prairie, and wetland habitats in particular. Wetland conversion for agriculture is the primary factor in the loss of wetlands. Approximately 80 percent of wetland losses have resulted from drainage and land clearing for agriculture (American Forestry Association 1990). However, in the most recent examination of wetland trends in the U.S., the USFWS found that from 1998 to 2004 the decline in wetlands was reversed with a net gain of 32,000 acres (Dahl 2006). Further it was indicated that agricultural lands provided for the overall creation of over 70,000 acres of wetland and associated other lands including upland areas adjacent to wetlands created over 349,000 acres of wetlands (*Ibid*). The loss in wetlands from deepwater habitat losses, urban and rural developments, and silviculture accounted for approximately 228,500 acres (*Ibid*).

3.3 AIR QUALITY

3.3.1 Definition of the Resource

The Clean Air Act (CAA) requires the maintenance of National Ambient Air Quality Standards (NAAQS). NAAQS, developed by the EPA to protect public health, establish limits for six criteria pollutants: (ozone) O_3, nitrogen dioxide (NO_2), carbon monoxide (CO), sulfur dioxide (SO_2), lead (Pb), and inhalable particulates (course particulate matter (PM) greater than 2.5 micrometers and less than ten micrometers in diameter [PM_{10}] and fine particles less than 2.5 micrometers in diameter [$PM_{2.5}$]). The CAA requires states to achieve and maintain the NAAQS within their borders. Each State may adopt requirements stricter than those of the National standard. Each State is required by EPA to develop a State Implementation Plan (SIP) that contains strategies to achieve and maintain the National standard of air quality within the State. Areas that violate air quality standards are designated as non-attainment areas for the relevant pollutants.

Air quality in the broadest sense is the atmosphere's capability to sustain healthy life directly through respiration of living organisms and indirectly by buffering the earth from extreme temperature variations. As scientists and the public became more concerned with climate change and the impact that human derived air pollutants were having on global temperature, the EPA identified carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O) as the key greenhouse gases (GHG) affecting warming temperatures. While each of these gases occurs naturally in the atmosphere, human activity has significantly increased the concentration of these gases since the beginning of the industrial revolution. The level of human produced gases accelerated even more so after the end of the Second World War, when industrial and consumer consumption flourished. With the advent of the industrial age, there has been a 36 percent increase in the concentration of CO_2, 148 percent in CH_4, and 18 percent in N_2O (EPA 2008a).

Since CO_2 and CH_4 are two of the key gases most responsible for the "Greenhouse Effect," scientists and policy makers are interested in carbon gases and how they may be removed from the atmosphere and stored. The process of carbon moving from atmosphere to the earth and back is referred to as the carbon cycle. Simplified components of the carbon cycle are: (1) conversion of atmospheric carbon to carbohydrates through the process of photosynthesis; (2) the consumption of carbohydrates and respiration of CO_2; (3) the oxidation of organic carbon creating CO_2; and (4) the return of CO_2 to the atmosphere. Carbon can be stored in four main pools other than the atmosphere: (1) the earth's crust, (locked up in fossil fuels and sedimentary rock deposits); (2) the oceans where CO_2 is dissolved and marine life creates calcium carbonate shells; (3) in soil organic matter (SOM); and (4) within all living and dead organisms that have not been converted to SOM. These pools can store or sink carbon for long periods, as in the case of carbon stored in sedimentary rock and in the oceans. Conversely, carbon may be held for as short a period as the life span of an individual organism. Humans can affect the carbon cycle through activities such as the burning of fossil fuels, deforestation, or releasing soil organic carbon (SOC) through land disturbing activities.

The process of storing carbon in the ecosystem is called carbon sequestration. Carbon sequestration includes storing carbon in trees, plants and grasses (biomass) in both the above ground and the below ground plant tissues, and in the soil. Soil carbon can be found in the bodies of microorganisms (fungi, bacteria, etc), in non-living organic matter, and attached to inorganic minerals in the soil. Figure 3.3-1 graphically presents a simplified global carbon cycle.

3.3.2 Existing Conditions (GHG)

Observed increases in atmospheric GHG concentrations are primarily a result of fossil fuel combustion for power generation, transportation, and construction. In 2007, agricultural GHG sources accounted for approximately 7 percent of total U.S. GHG emissions (Figure 3.3-2) (EPA 2009a). Agriculture activities serve as both sources and sinks for GHG (Figure 3.3-3). Agriculture sinks of GHG are reservoirs of carbon that have been removed from the atmosphere through the process of biological carbon sequestration (Schahczenski and Hill 2009). Agriculture and forestry activities have affected GHG levels in the atmosphere through cultivation and fertilization of soils, production of ruminant livestock, management of livestock manure, land use conversions, and fuel consumption. The primary GHG sources for agriculture are N_2O and CH_4 (USDA 2008b). Agriculture contributed 36 percent of U.S. CH_4 emissions in 2007, and 73 percent of N_2O emissions (Figure 3.3-4) (*Ibid*). Although CO_2 is the most prevalent GHG in the atmosphere, N_2O and CH_4 have longer durations in the atmosphere and absorb more long-wave radiation.

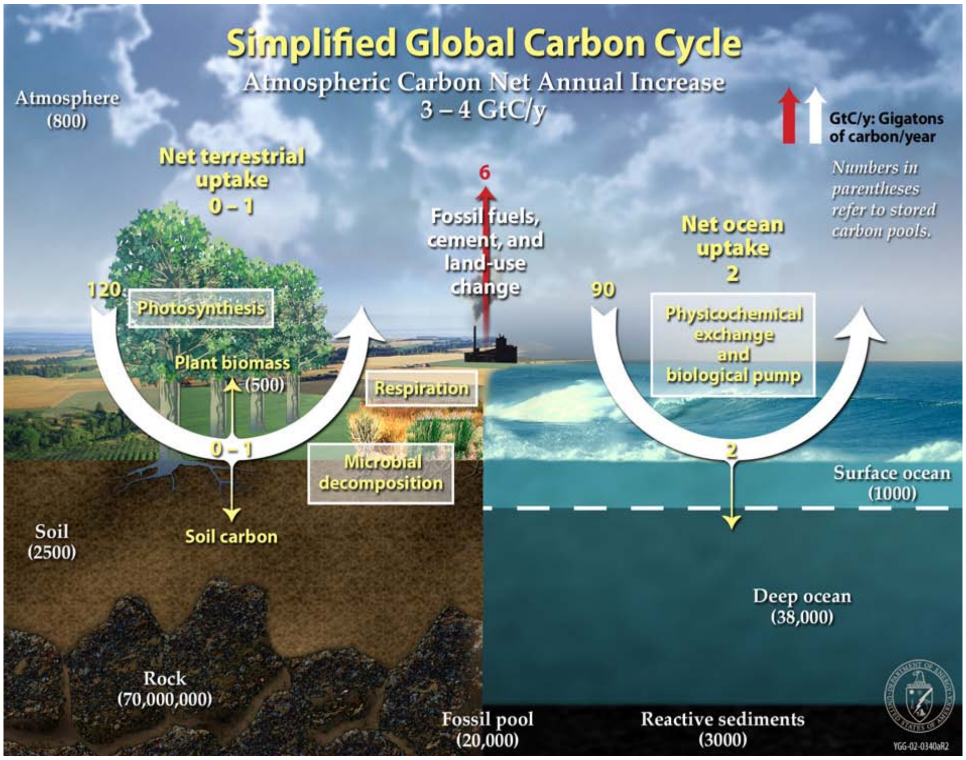


Figure 3.3-1. Simplified Global Carbon Cycle (DOE 2009d)

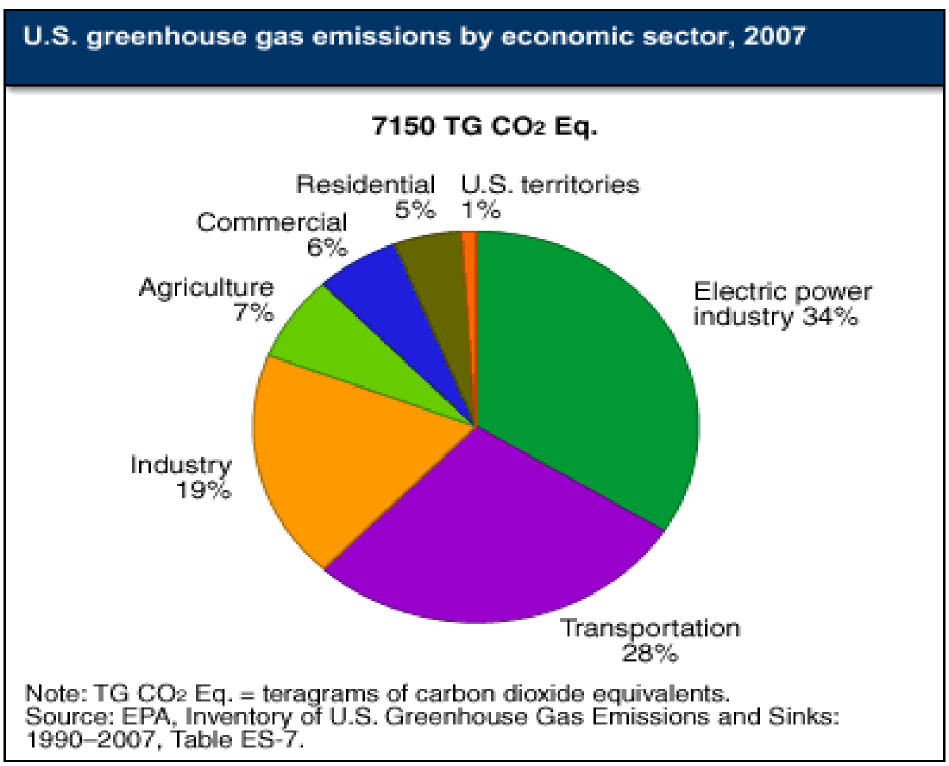


Figure 3.3-2. U.S. GHG Emissions by Economic Sector (EPA 2009a)

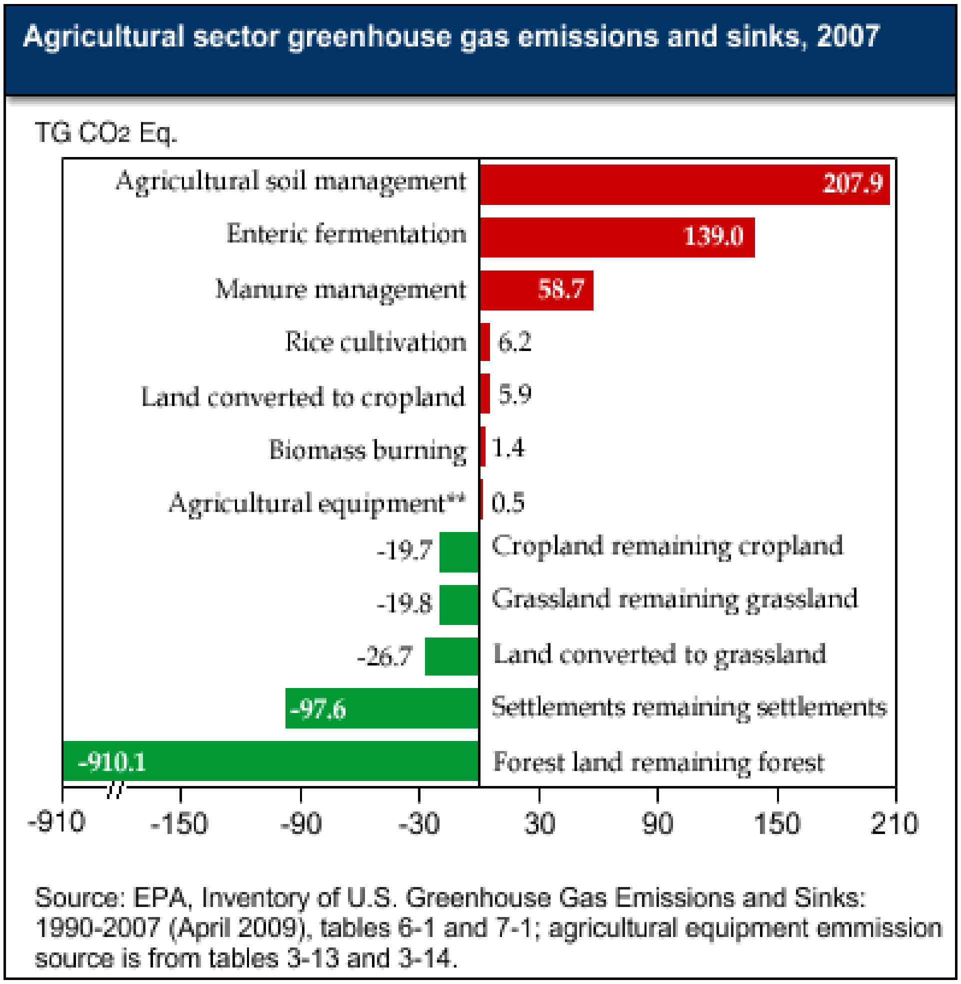


Figure 3.3-3. Agricultural Sector GHG Emissions and Sinks (EPA 2009a)

Therefore, small quantities of N_2O and CH_4 can have significant effects on climate change (Schahczenski and Hill 2009). Methane emissions are outside the scope of this analysis since this document focuses solely on crop production.

According to a 2008 USDA study, crop production contributed a little more than one-third (35 percent) of total agriculture GHG emissions in 2005. Most of the emissions from crop production were from non-rice soils, with residue burning and rice cropping accounting for about two percent of overall agricultural emissions. Livestock production is responsible for most of the remaining agricultural emissions, with about 22 percent from enteric fermentation (a normal digestive process in animals that produces methane), 10 percent from managed waste, and 18 percent from grazed lands. The remaining 13 percent of total emissions result from agriculturally related energy usage, (USDA 2008b).

While carbon in biomass is considered to have net zero CO2 emissions, numerous other emissions occur from the production of biomass and the management of land. Carbon dioxide emissions occur from fossil-fuel combustion, soil carbon emissions, and from indirect land-use change. Nitrous oxide emissions occur following the application of nitrogen fertilizers. Whether these emissions increase or decrease depend on land management changes in response to the production of bioenergy crops.

3.3.2.1 Carbon Sequestration

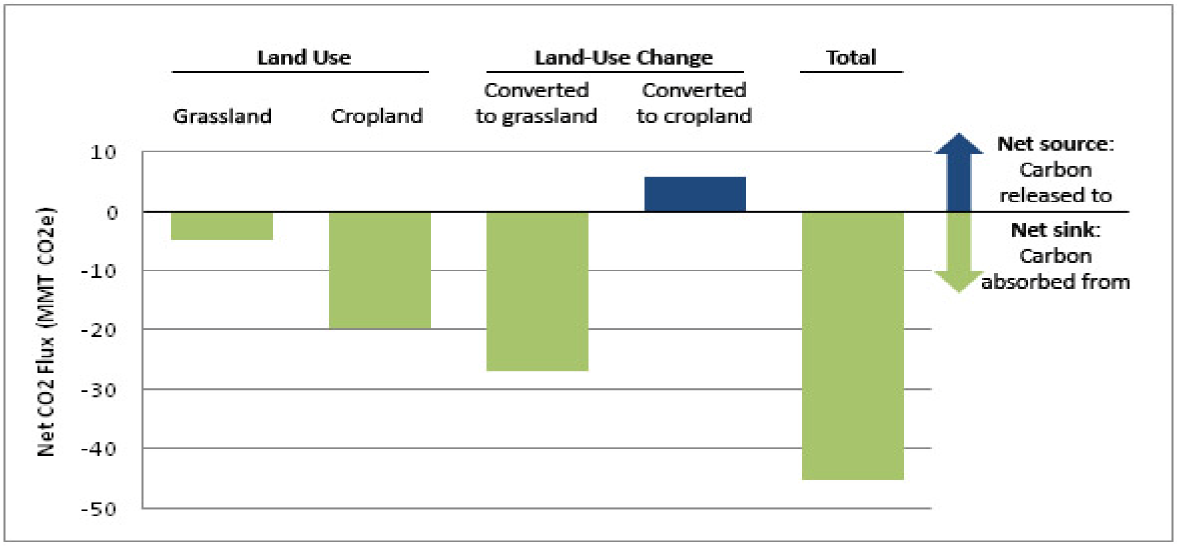
Implementation of BCAP, and the subsequent planting of bioenergy crops or removal of biomass for bioenergy use, can alter the uptake and release of CO_2. Crops that generate more biomass take up more CO_2. However, carbon in crops is emitted back to the atmosphere as CO_2 following the decomposition, burning, or processing of crop biomass. Carbon in crops cycles through the atmosphere (see Figure 3.3-1) over a one to three year time period, thereby being considered to have net zero CO_2 emissions (West and Marland 2002). Forest products used for bioenergy purposes are considered to have a similar cycle, except that carbon in standing trees will be sequestered from the atmosphere for a longer time period.

Agricultural crop production can affect carbon sequestration in two ways:

- **Land use conversion** - Converting land from one land use to another can result in significant changes to the amount of stored carbon; forests and wetlands generally store more carbon than grasslands, which in turn tend to store more carbon than croplands.
- **Land management practices** - A variety of land management practices can help maintain and increase the amount of stored carbon on agricultural lands. These practices include agroforestry, improved cropping systems, improved nutrient and water management, conservation tillage, water management, and maintenance of perennial crops.

The EPA (2009a) has estimated the annual carbon flux associated with land use, land-use change, and forestry for the contiguous 48 states. Land-use practices and land-use change can result in either a net release of carbon stored in the plants and soil (making the system a carbon source) or a net uptake of carbon by the plants and soil (making the system a carbon sink) (Pew 2009).

For agricultural lands, specifically croplands and grasslands, the annual carbon flux values include changes to the amount of carbon stored in soils due to land management and changes in land use, as well as the CO_2 emissions resulting from the application of lime and urea fertilizer. Collectively, agricultural lands in the United States act as a small carbon sink, storing more carbon than they release (Figure 3.3-4). For comparison, forests act as a much larger carbon sink in the United States, storing about 20 times more carbon than the total carbon sink provided by all agricultural lands (Pew 2009).



Source: EPA 2009a

Figure 3.3-4. Changes in Carbon Storage of Agricultural Land in 2007

3.3.2.2 Nitrous Oxide Emissions

Nitrous oxide emissions from agricultural soils are the largest source in the U.S. (Figure 3.3-5) This is primarily due to the fact that N_2O is a potent GHG and the large amounts of nitrogen (N) fertilizer added to crops that stimulate N_2O production (USDA 2008b).

Nitrous oxide emissions were largest in areas where a large portion of land is used for intensive agriculture. For example, 90 percent or more of the land in many counties in the Corn Belt is intensively cropped. Corn is the leading crop for N_2O emissions followed by soybean and wheat. Emissions from corn cropping are high because large amounts of N fertilizer are routinely applied and the land area used for corn production is the most extensive. In general, N_2O emissions are highly correlated with crop areas and N inputs. Synthetic fertilizer makes up about half of total N additions, followed by fixation and manure (USDA 2008b).

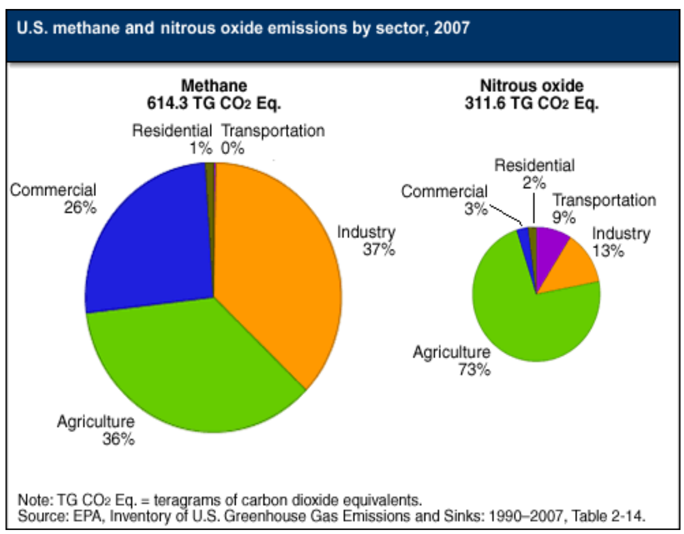


Figure 3.3-5. U.S. Methane and Nitrous Oxide Emissions (Horowitz and Gottlieb, 2009)

3.3.2.3 Agriculture and Energy Use

Energy use in the agricultural sector can also result in emissions, both by direct use in agricultural production, such as the electricity used to power irrigation pumps and the liquid fuels for vehicles or farm equipment used in the fields, and indirect use, which includes the emissions associated with the production of commercial fertilizers and other energy-intensive farm inputs. Energy use accounts for 14 percent of total agricultural emissions (Figure 3.3-6) (Pew Center for Global Climate Change 2009).

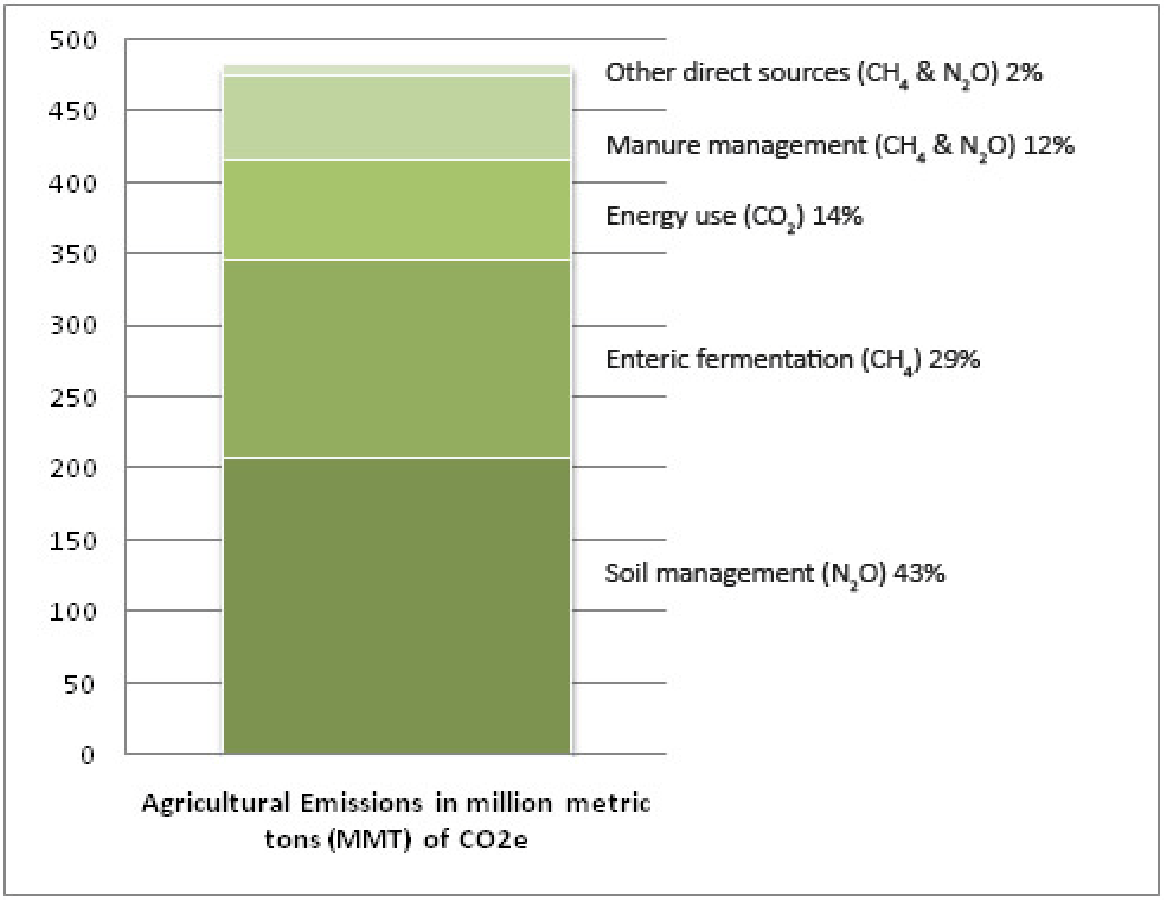


Figure 3.3-6. Emissions from Agriculture by Source in Million Metric Tons (USDA 2008b)

Likewise, forestry practices' energy use has been documented in Sweden over various studies with a compilation of operations undertaken by Eriksson *et al* 2007 (Table 3.3-1). They found that based on average estimates from Sweden for Norway spruce (*Picea abies*), that transportation and removal of remainders accounted for greater energy use per dry tonne of biomass than establishment and forest health activities and harvest.

Table 3.3-1. Energy Used in Forestry and Transport Operations, Sweden

Forest or Transport Operation	End-Use Energy (MJ/t)	
	Petroleum	Electricity
Seed Production and seedlings[a]	15.0	3.8
Soil Scarification and clearing[a]	10.0	
Regeneration[a]	2.1	
Precommercial thinning[a]	1.8	
Cutting during thinning[b]	120.0	
Forwarding during thinning[b]	81.0	
Cutting during final felling[b]	76.0	
Forwarding during final felling[b]	61.0	
Secondary haulage of roundwood[b]	233.0	14.0
Transport of sawmill residues[c]	166.0	
Removal and transport of slash[c]	765.0	
Removal and transport of stumps[c]	1,380.0[d]	
Recovery and transport of demolition wood[c]	186.0	
Not allocated[a]	13.0	

[a] Megajoules end-use energy per dry tonne of roundwood per rotation
[b] Megajoules end-use energy per dry tonne of roundwood transported
[c] Megajoules end-use energy per dry tonne of biofuel
[d] Based on the assumption that removing stumps requires twice as much energy as removing slash, and the energy needed to transport stumps and slash is the same

Source: Eriksson *et al.* 2007

3.4 SOIL RESOURCES

3.4.1 Definition of the Resource

Soils are a natural body made up of weathered minerals, organic matter, air and water. Soils are formed mainly by the weathering of rocks, the decaying of plant matter, and the deposition of materials such as chemical and biological fertilizers that are derived from other origins. Soils are differentiated based on characteristics such as particle size, texture and color, and classified taxonomically into soil orders based on observable properties such as organic matter content and degree of soil profile development (Brady and Weil 1996). Soil taxonomy was established to classify soils according to the relationship between soils and the factors responsible for their character (NRCS 1999a). Soil taxonomy has organized soils into four levels of classification, the highest being the soil order. For the purposes of this analysis, soil resources include all soil orders within the United States. At this broad level of classification, there are 12 soil orders: Alfisols, Andisols, Aridisols, Entisols, Gelisols, Histosols, Inceptisols, Mollisols, Oxisols, Spodosols, Ultisols, and Vertisols.

Given the broad scope of the BCAP, this PEIS employs the NRCS LRR and MLRA Handbook to describe the existing soil environment as related to resource area (NRCS 2006a). Maps and general description of each of the LRRs and MLRAs are presented in Section 3.2, Biological Resources.

3.4.2 Existing Conditions

A summary of the associated soil order for each LRR in the continental U.S. is provided below. Table 3.4-1 provides a general overview of the soil orders found within regions most likely to have economically feasible energy crop production in relation to the Establishment and Annual Payment Program of BCAP within the United States. Additionally, a discussion of soil carbon sequestration is included.

Table 3.4-1. Soil Order Descriptions

Soil Order	Description	LRR
Alfisols	A dark surface horizon mineral soil, similar to mollisols however, lacking the same level of fertility and more acidic.	M, N, P, H, A
Andisols	Soils of recent volcanic origin having cinders and volcanic glass. Typically found in the northwest and in Alaska.	A
Aridisols	These soils are found in the arid regions of the US. Typically high in calcium, Magnesium, potassium and sodium. The soils have an alkaline pH.	B
Entisols	This soil order is relatively un-weathered. These soils have no diagnostic horizon development. Often found on floodplains, glacial outwash areas and other areas receiving alluvial materials.	M, G, N, H, A, P
Inceptisols	Soils of the humid and sub humid region. Weathering has created minimal diagnostic differentiation in the soil column.	N, M, H, A, P
Mollisols	Dark colored mineral soils developed under grassland conditions. Rich in nutrients, very fertile. Associated with America's corn belt.	M, F, G, H, B
Spodosols	These soils have undergone significant weathering. Organic carbon, aluminum and often iron has been translocated to a lower horizon referred to a spodic horizon. These soils are acidic and may have deleterious levels of aluminum in the subsoil.	A
Ultisols	Highly weathered soils found in hot, moist regions. Typically acidic and low in available nutrients.	A, N, P
Vertisols	Soils having significant amounts of expanding clay content. Soils typically crack when dry and swell when wet.	P

Source: Adapted from Brady 1990

3.4.2.1 Herbaceous Species Regions

Region M is comprised of parts of Iowa, Illinois, Missouri, Minnesota, Indiana, Kansas, Nebraska, Ohio, Wisconsin, South Dakota, Oklahoma, and Michigan. Also, very small parts of North Dakota and Kentucky are located in this region. The region makes up 282,450 square miles, which is dominated by the soil orders of Alfisols, Entisols, Inceptisols, and Mollisols (Table 3.4-1) (NRCS 2006a). The major soil resource concerns are water erosion, wetness, maintenance of the content of organic matter, and productivity of soils. Based on the soils and climate of Region M, agriculture is the favored industry. This region produces most of the United States' corn, soybeans, and feed grain. Generally, this is viewed as one of the most productive areas of the country.

Region F is made up of parts of North Dakota, Montana, South Dakota, and Minnesota. The total square miles of this region are 143,225 (NRCS 2006a). The topography has been impacted and smoothed by continental glaciations. There are several deposits and sediment that are evidence of ancient glacial lakes present in this region. The geology of the area consists of sediment that has been weathered from sedimentary rocks. Most of the soils are Mollisols with dominant suborders of Ustolls and Aguolls. Wind and water erosion can be a major threat to this region. The soils are fertile and relatively flat but are limited in agricultural use due to low rainfall and short growing seasons. The main crop is spring wheat, which is grown by dry farming methods (*Ibid*). Also, potatoes, sugar beets, soybeans, and corn are important crops in the Red River Valley.

Region G is located in parts of Montana, New Mexico, South Dakota, Colorado, Nebraska, Wyoming, North Dakota, and Texas, with very small portions in Oklahoma and Kansas. This region makes up 213,945 square miles (NRCS 2006a). This region formed along the foothills of the Rocky Mountains, on the edge of the Great Plains. The topography is generally sloping with common flat-topped, steep-sided buttes rising out of the landscape. The soils in this region are dominated by Entisols and Mollisols. Wind erosion and some water erosion are the main resource concerns of this region. The dominant land use in this region is grazing by cattle and sheep. Some winter wheat and small grains are grown for cash or feed crops. Rain is low and irrigation is necessary for crops such as corn. Other crops include alfalfa, forage crops, and sugar beets (*Ibid*). Some dryland farming is done with winter wheat and other small grains.

Region H consists of parts of Texas, Kansas, Oklahoma, Nebraska, New Mexico, and Colorado and a very small part of Wyoming. This region accounts for approximately 219,740 square miles (NRCS 2006a). This area is generally level to gently sloping and most of the soils are Mollisols but significant acreages of Alfisols, Entisols and Inceptisols are also present. Overgrazing and wind and water erosion are the major resource concerns in this area. The production of beef cattle is the primary agricultural enterprise for this region but Region H also has almost as much cropland as it has grassland. Some winter wheat and small grains are grown for cash or feed crops and irrigation crops are grown along the streams. These crops include corn alfalfa, forage crops, and sugar beets.

3.4.2.2 Woody Species Regions

Region A consists of parts of Oregon, Washington, and California and accounts for approximately 90,165 square miles (NRCS 2006a). The topography of this region is defined by steep mountains and sloping valleys with two mountain ranges, The Coast Range and The Cascade Mountains. About 44 percent of this region is Federal land in national forests. This region is heavily forested, allowing timber production to be the major industry (*Ibid*). Also, in valleys that receive rainfall, the dairy farming industry is very prevalent.

Region B is located in Idaho, Washington, and Oregon, with a very small part in Utah, accounting for approximately 81,255 square miles (NRCS 2006a). This region is located on the lee side of the Cascade Mountain and extends into the Snake River Plains. This region is a mixture of cropland and grazing land. The major crop of this region is wheat but oats, barley, lentils and pears are also important crops (*Ibid*). The major crop in the western part of this region is apples. Grazing mainly occurs in the drier parts of the region.

The dominant soil orders in Region A are Alfisols, Andisols, Entisols, Inceptisols, Spodosols, and Ultisols. These soil orders vary greatly depending location in the region, parent material, and moisture and temperature regime they formed under. Region B differs in that it is mostly Mollisols and Aridisols formed from a mixture of loess and ash deposits.

Region N consist of parts of Kentucky, Missouri, Tennessee, Arkansas, West Virginia, Pennsylvania, Alabama, Ohio, Oklahoma, North Carolina, Virginia, Indiana, Georgia, and Illinois, and in very small areas of Kansas, Maryland, New York, and South Carolina, accounting for 236,415 square miles (NRCS 2006a). The region consists of a wide range of topography and climate that has led to many diverse natural ecosystems and agriculture production. The soils of this region are dominantly Alfisols, Entisols, Inceptisols, or Ultisols. Many of these soils were formed from limestone, shale or sandstone. Soil depth varies from very shallow to very deep. The inherent fertility is greatly determined by the parent material with the limestone soils generally being much more fertile than those from sandstone or shale. Forestry is a very important industry due to the native deciduous forests. The dominant trees harvested are oak, yellow-poplar, and pine. The crops grown in this region are varied and can include cotton, soybeans, corn and wheat (*Ibid*).

Region P includes parts of Georgia, Mississippi, Alabama, North Carolina, Texas, Louisiana, South Carolina, Virginia, Arkansas, Florida, Tennessee, Kentucky, and Oklahoma and very small portions of Illinois and Missouri, accounting for 26,095 square miles (NRCS 2006a). The soils of this region are quite variable in nature and productivity. They are generally Alfisols, Entisols, Inceptisols, Ultisols or Vertisols. Some are formed in windblown loess, others are formed from alluvial clays deposits and some are derived from granite. They vary greatly in productivity but, because of slope and parent material, most soils tend to be highly erodible. The loess soils have some of the highest soil erosion rates from water erosion in the country. The high moisture and long growing season increase agricultural production. The diverse array of crops grown in this region includes cotton, soybeans, peanuts, corn, rice, sugarcane, and wheat (NRCS 2006a).

Region O includes parts of Arkansas, Louisiana, Mississippi, Missouri, and Tennessee, accounting for approximately 38,865 square miles along the floodplains and terraces of the Mississippi River (NRCS 2006a). This is a region of fertile soils, though drainage is often required to lower the inherent water table associated with this Delta region. The dominant soils are Alfisols, Vertisols, Inceptisols, or Entisols. The crop types currently grown are diverse and include cotton, soybeans, milo, corn, rice, sugarcane, and wheat (*Ibid*).

3.4.2.3 Soil Erosion

Soil erosion is a naturally occurring event and the erosion rates are relatively slow; however, human activity can greatly accelerate the rate of erosion. Poor farming practices, loss of vegetation through deforestation, overgrazing and the maintenance of agricultural land are some of the factors that make soils more susceptible to erosion. “Erosion removes the topsoil first, which is the layer with the highest organic matter content and where the most biological activity occurs. Once this nutrient rich layer of soil is gone, plant growth decreases and erosion increases significantly” (FSA 2003).

Soils susceptible to erosion are identified using the Erodibility Index (EI). The EI provides a numerical expression of the potential for a soil to erode based on factors such as topography and climate. The index value is derived from the Revised Universal Soil Loss Equation (RUSLE) for water erosion, and the Wind Erosion Equation for wind erosion. Highly erodible lands (HEL) are those with an index value of eight or higher (FSA 2003; NRCS 2008).

Figure 3.4-1 presents a USDA map depicting HEL with an EI greater than or equal to eight on cropland in the U.S. The most highly erodible soils are primarily in the Midwest and Northern Plain States, in areas that lie within the Mississippi and Missouri rivers watershed. A list of soils considered highly erodible are developed and maintained on a county level by NRCS.

One aspect of soil quality is reduced erosion and better surface aggregation, the enhanced stability of the soil surface and its ability to allow water to infiltrate into the soil as compared to running off. This runoff water can carry sediment and accompanying nutrients and pesticides into surface water, resulting in impaired water quality.

Many of the streams in all of the LRRs have impaired stream systems from sediment, nutrients, etc. (EPA 1998). Any change in sediment loss in land conversion from one crop management system to another could have potential environmental effects. The change in amounts of pesticides or nutrients used in biomass cropping and forest residue systems when compared to the existing land use could also have effects on water quality.

3.4.2.4 Soil Carbon Sequestration

Carbon is an extremely important component of most soils and has a strong influence on their functional properties. It increases the soil water and nutrient supplying capacity to crops. Most of the carbon in soils is in the SOM. SOM, partially decomposed plant and animal remains; serve as a food source for soil bacteria and other soil organisms such as earthworms. Organic matter also improves the ability of the soil to resist movement from wind and water erosion and improves the rate at which water can move into the soil instead of running off the soil surface.

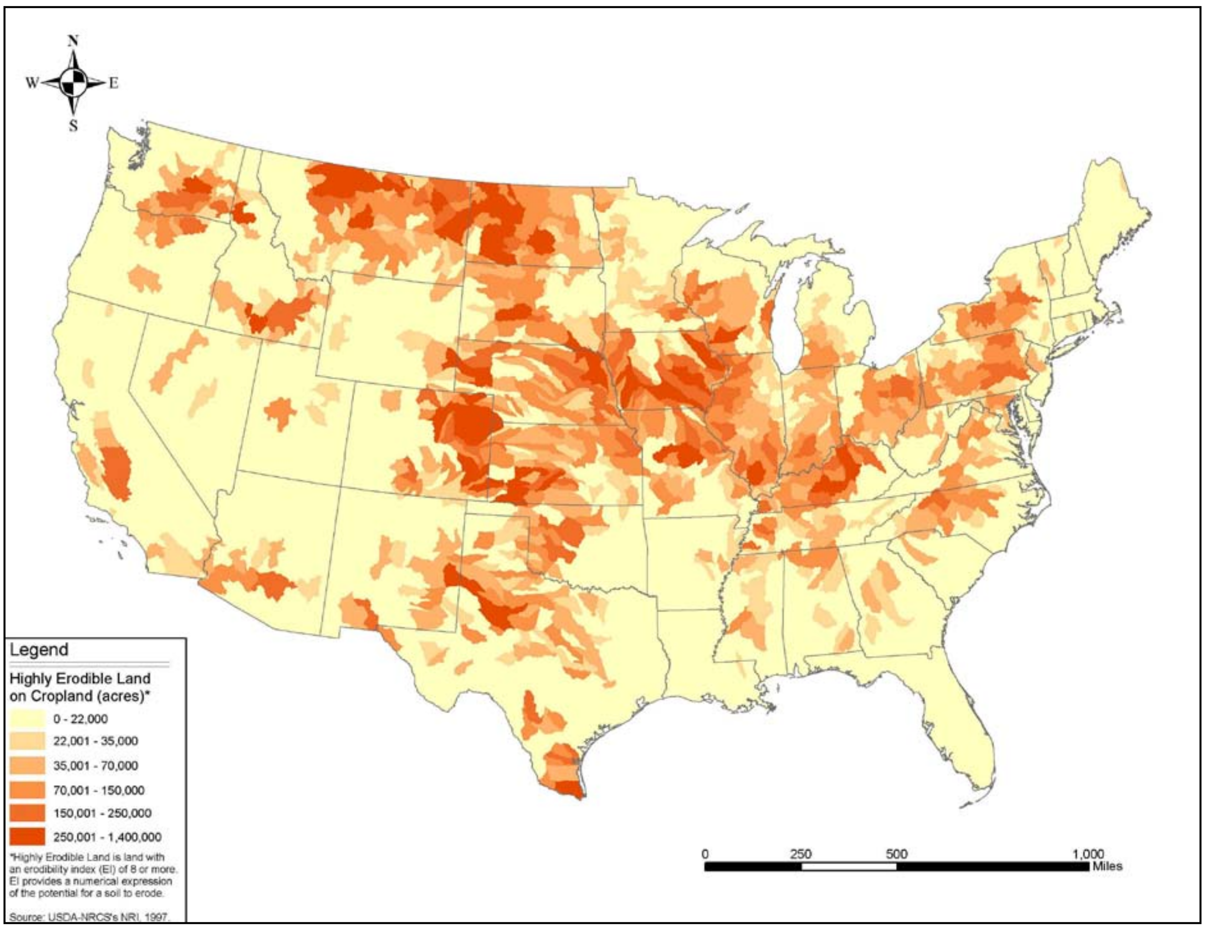


Figure 3.4-1. Highly Erodible Land on Cropland in the U.S. by Watershed (FSA 2003)

The KSU Soil Carbon Center (n.d.) describes soil carbon and soil carbon storage as, “Carbon also exists in the Earth’s crust as soil organic matter. Microorganisms in the soil convert decaying plant and animal tissue into soil organic matter. Soil organic carbon often is divided into three pools: active, intermediate or slow, and recalcitrant. The active pool typically stores carbon anywhere from a few months to a few years. This pool typically accounts for less than 5 percent of the total soil carbon. The recalcitrant pool is extremely stable, and stores carbon for hundreds or thousands of years before decomposing. About 60 to 70 percent of total soil carbon is in the recalcitrant pool."

Rice (2004) indicates that past studies have found that carbon stored in soils (1,100 to 1,600 petagrams [Pg]) accounts for more than twice the carbon stored in living vegetation (560 Pg) or in the atmosphere (750 Pg). Table 3.4-2 indicates the million of grams of soil carbon per hectare in different land cover types by different studies. Past agricultural land uses over a period of 50 to 100 years can reduce soil carbon by approximately 50 percent, indicating high fluctuation of soil carbon from this land use, but also a high potential to store carbon though modified agricultural practices (i.e., no-till cropping) (Rice 2004).

Table 3.4-2. Estimated Soil C for Various Land Cover Types

Land Cover Type	Soil C (Mg C/ha)	Reference Literature
Wet Tropical Forest (≥40 cm)	115	Brown and Lugo 1982
Moist Tropical Forest (≥40 cm)	85	Brown and Lugo 1982
Dry Tropical Forest (≥40 cm)	71	Brown and Lugo 1982
Guatemalan Tropical Forest (≥40 cm)	85	Brown and Lugo 1982
Temperate Forest (≥40 cm)	80	Schleshinger 1997
Eastern Kansas Prairie (=40cm)	78	Brennan and Rice 2001
Eastern Kansas Prairie (=15 cm)	53	Rice, et al. 2000
North Central Oklahoma (=15cm)	24	Rice, et al. 1999
Western Kansas (=15cm)	39	Rice, et al. 1999

Source: Rice 2004

Carbon sequestration or storage of carbon in cropping systems involves storage in non-removed crop residues and below ground root systems, as well as carbon stored in the soil as organic matter in varying stages of decomposition. Some of this SOM goes into more decomposition resistant fractions, which results in increases in soil carbon storage depending on the tillage system, crop grown, etc. A transition from a tilled row crop to a no-tilled row crop can enhance the amount of carbon stored since crop residues on the soil surface after harvest remain on the surface and decompose more slowly than if mixed in the soil with tillage (Table 3.4-3). This surface cover also results in less soil erosion (Shelton *et al.* 1983). These same scenarios could be enhanced with perennial crops, where not only would surface residue increase, but below ground root biomass would not decompose from one year to the next as is common with annual row crops such as corn. This increased carbon storage above and below ground potentially results in overall improvements in the productive quality of the soil.

Table 3.4-3. Agricultural Practice Soil C Sequestration Potential

Agricultural Practice	Carbon Sequestered (tons/acre/year)
Conservation Tillage	0.12-0.20
Summer Fallow Elimination	0.05-0.15
Rotation with Winter Cover Crops	0.05-0.15
Fertilizer Management	0.025-0.075
CRP Practices	0.15-0.35

Source: Kansas State University 2006

3.5 WATER QUALITY AND QUANTITY

3.5.1 Definition of the Resource

Freshwater is necessary for the survival of most terrestrial organisms, and is required by humans for drinking and agriculture, among other uses; however, less than one percent of Earth's water is in the form of freshwater that is not bound in ice caps or glaciers. The Water Pollution Control Act of 1972, or CWA, Safe Drinking Water Act, and the Water Quality Act are the primary Federal laws that protect the nation's waters. The principal law governing pollution of the nation's surface water resources is the CWA. The Act utilizes water quality standards, permitting requirements, and monitoring to protect water quality. The EPA sets the standards for water pollution abatement for all waters of the U.S. under the programs contained in the CWA but, in most cases, gives qualified States the authority to issue and enforce permits. For this analysis, water resources include surface water quality (including lakes, rivers and associated tributaries, and estuaries), groundwater quality, and water use/quantity of both surface and groundwater.

Surface water, as defined by the EPA, are waters of the United States, such as rivers, streams, creeks, lakes, and reservoirs, supporting everyday life through uses such as drinking water and other public uses, irrigation, and industrial uses. Of all the water used in the United States in 2000 (about 408 billion gallons per day), about 74 percent came from fresh surface water sources (USGS 2008a). Surface runoff from rain, snow melt, or irrigation water, can affect surface water quality by depositing sediment, minerals, or contaminants into surface water bodies. Surface runoff is influenced by meteorological factors such as rainfall intensity and duration, and physical factors such as vegetation, soil type, and topography.

Groundwater is the water that flows underground and is stored in natural geologic formations called aquifers. It is ecologically important because it sustains ecosystems by releasing a constant supply of water into wetlands and contributes a sizeable amount of flow to permanent streams and rivers (FSA 2003).

Water use/quantity is the specific amount of water used for a given task, such as the production of dedicated bioenergy crops. Three types are distinguished: *withdrawal*, where water is taken from a river, or surface or underground reservoir, and after use returned to a natural water body; *consumptive*, which starts with withdrawal but without any return (e.g. irrigation) and is no longer available directly for subsequent uses; *non-*

withdrawal, the *in situ* use of a water body for, e.g. navigation, fishing, recreation, effluent disposal and power generation. (FAO 2005)

3.5.2 Existing Conditions

3.5.2.1 Surface Water Quality

Surface water quality is determined by the natural, physical, and chemical properties of the land that surrounds the water body. The topography, soil type, vegetative cover, minerals, and climate all influence water quality. When land use affects one or more of these natural physical characteristics of the land, water quality is almost always impacted. These impacts may be positive or negative, depending on the type and extent of the change in land use. Agricultural practices have the potential to substantively affect water quality due to the vast amount of acreage devoted to farming nationwide and the great physical and chemical demands that agricultural use has on the land. The most common types of agricultural pollutants include excess sediment, fertilizers, animal manure, pesticides and herbicides.

Fertilizers and pesticides have been found to be in excess in many water bodies in the U.S. (EPA 2008b). EPA has documented over 3.0 million acres of water bodies and over 75,000 miles of rivers and streams and large areas of bays and wetlands with excess nitrogen and phosphorus pollution. These two nutrients, when in excess, create harmful blooms of algae and other water plants which deplete oxygen and can result in many detrimental effects including fish kills. A dramatic example of the effects of non-point pollution is demonstrated by hypoxic areas. When nutrient-laden runoff reaches the Gulf of Mexico, eruptive algal blooms occur and, upon decomposition and under the right conditions, severely deplete the oxygen levels in the water, resulting in fish kills and the loss of shellfish beds. Nitrogen has generally been viewed as the principal nutrient yielding excess algal growth in the Gulf hypoxic zone; however, recent analysis has brought attention to phosphorus as an important contributing agent (*Ibid*). The majority of Mississippi River nitrogen originates from agricultural land practices, while other sources include human sewage, nonagricultural fertilizer use, and precipitation. Hypoxia occurs from late February through early October, nearly continuously from mid-May through mid-September, and is most widespread, persistent, and severe in June, July, and August. Figure 3.5-1 presents the measured size of the Gulf of Mexico Hypoxic Zone from 1986 to 2009 (USGS 2008b and Louisiana Universities Marine Consortium 2009) and Figure 3.5-2 presents the areal extent of the Gulf of Mexico Hypoxic Zone in 2008 (EPA 2009b).

Standard intensive forestry practices associated with clear cut harvesting and fertilization of stands without the use of BMPs could negatively impact water quality associated with water temperature, dissolved oxygen, suspended sediments, and nutrient leaching through stormwater flows (Binkley and Brown 1993). The use of BMPs, including riparian buffers, has been shown to reduce the water quality effects from intensive forestry

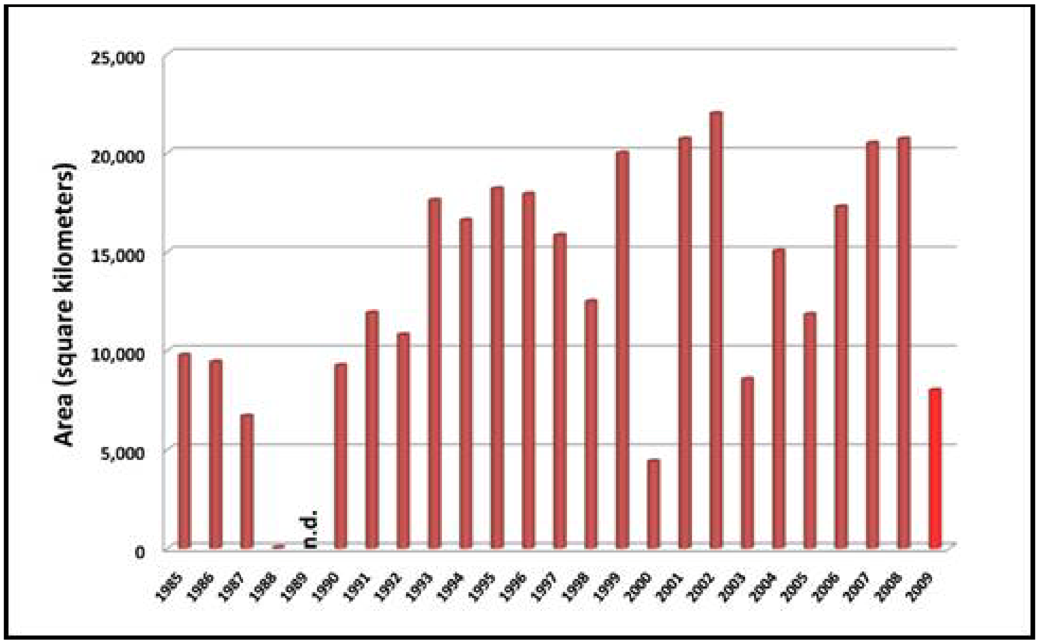


Figure 3.5-1. Size of the Gulf of Mexico Hypoxic Region

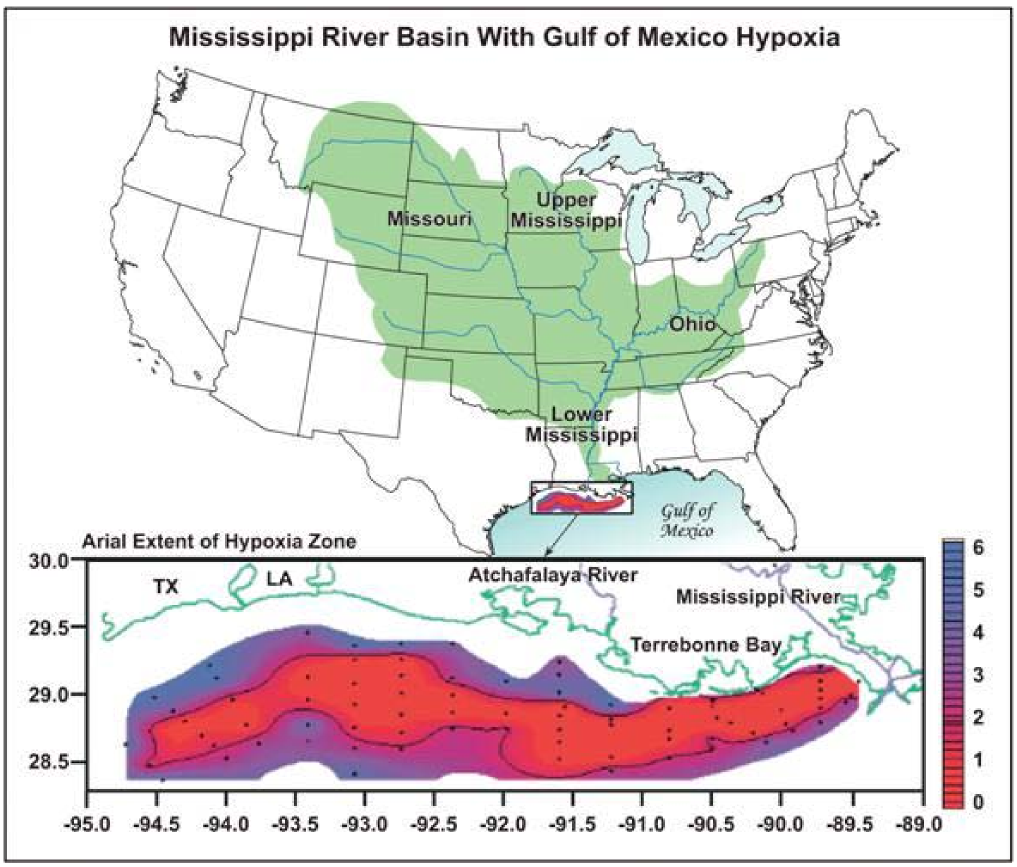


Figure 3.5-2. Arial Extent of Gulf of Mexico Hypoxic Region

activities (Binkley and Brown 1993; Arthur *et al*. 1998, Binkley *et al.* 1999; McBroom *et al.* 2008). Binkley *et al.* (1999) indicate that in general water quality draining forests is typically of better quality than other lands used in the U.S. Arthur *et al.* (1998) found that nutrient losses associated with clearcutting activities generally are ameliorated within three years as the biotic community reaches a more steady state of vegetation cover. More recently, McBroom et al. (2008) indicated that with the use of BMPs associated with forestry activities water quality draining those areas were below the threshold for impaired water quality standards for the State of Texas.

The use of biomass crops could have numerous implications for water quality including effects on fertilizer nutrient leaching and runoff, and soil erosion and sedimentation (National Academy of Sciences 2007). Nutrient leaching and runoff will be affected by biomass choice. The use of corn or wheat residue for biomass will probably have little impact on leaching of nutrients toward groundwater, but if soil cover is not adequate, runoff could increase resulting in greater losses of nitrogen and phosphorus to surface water, increasing the potential for excessive nutrient loading, and resulting oxygen depletion. The use of dedicated energy crops generally requires less nutrient applications than corn or wheat. Presently, recommendations for the potential biomass crop switchgrass are about one-third that for corn in the Southeast U.S. (Garland 2008). The amount of phosphorus is also generally lower than recommended for corn. Simpson *et al.* (2008) summarize the literature associated with potential water quality benefits from the use of switchgrass including reduced nutrient loss in runoff and drainage (approximately 50 percent to 90 percent lower) than corn-soybean rotations. This reduced nutrient use and lower runoff potential could have positive effects on water quality.

Normal, routine, and continuous agricultural activities such as plowing, cultivating, and harvesting crops, maintenance of drainage ditches, and construction and maintenance of irrigation ditches, farm or stock ponds, and farm roads in accordance with best management practices (BMPs) are exempt from CWA permitting requirements.

3.5.2.2 Groundwater Quality

Groundwater use has many societal benefits. It is the source of drinking water for about half the nation and nearly all of the rural population, and it provides over 50 billion gallons per day in support of the Nation's agricultural economy (USGS 2003). Groundwater contamination occurs when man-made products such as gasoline, oil, road salts and chemicals get into the groundwater and cause it to become unsafe and unfit for human use. Some of the major sources of these products, called contaminants, are storage tanks, septic systems, hazardous waste sites, landfills, and the widespread use of road salts, fertilizers, pesticides and other chemicals.

Groundwater has been seriously affected by various nutrient and pesticide pollutants as reported by the EPA's Report on the Environment for 2008 (EPA 2008b). The BCAP could mean a distinct land use change from traditional row crops such as corn or wheat. Land conversion to perennial crops such as switchgrass or SRWC could have major impacts. These might include reduced transport of nitrogen due to lower use than with corn (Garland 2008) and enhanced use efficiency due to a greater perennial deep root system compared to corn. Preliminary data is indicating this in comparisons of corn to switchgrass and Miscanthus (Czapar 2008). Nitrate leaching was reduced with switchgrass or Miscanthus compared to corn.

3.5.2.3 Water Use/Quantity

Water use changes with programs such as BCAP could be important. The estimated water usage for different purposes has been summarized by Kenny *et al*. (2009). Excluding irrigation, agriculture only directly uses about one percent of the water withdrawals. Thermoelectric power uses 48 percent and irrigation uses 34 percent. BCAP would greatly influence total use if it brought non-irrigated land into production in biomass cropping systems that would require irrigation. Increased acreages of corn or wheat grown for biomass removal and replacing other non-irrigated crops is not likely given the high costs associated with irrigation. Dedicated biomass energy crops such as switchgrass or Miscanthus could require irrigation if grown in semi-arid and arid areas of the U.S.

The U.S. Geological Survey (USGS) publishes estimated water use in the U.S. every five years, with data going back to 1950 (Kenny *et al*. 2009). The latest publication of *Estimated Use of Water in the United States* (2009) for data from 2005 indicated that approximately 410 billion gallons per day (Bgal/d) of water was used in the U.S. (Kenny *et al.* 2009). Of the total withdrawals, freshwater accounted for about 85 percent, while saline water accounted for the remaining 15 percent. More than one-quarter of the total water used in the United States in 2005 was drawn from California, Texas, Florida, and Idaho. California alone accounted for approximately 11 percent of all water use in 2005. Total surface-water withdrawals were 323 Bgal/d, while total groundwater withdrawals were 84.5 Bgal/d.

The total water withdrawals have increased from 180 Bgal/d in 1950 to 410 Bgal/day in 2005 (Figure 3.5-3 and Table 3.5-1). Groundwater (fresh) has increased from 34 Bgal/d to 79.6 Bgal/d from 1950 to 2005. Surface water (fresh) withdrawals increased from 140 Bgal/d to 270 Bgal/d from 1950 to 2005. Withdrawals for irrigation increased by more than 68 percent from 1950 to 1980 (from 89 Bgal/d to 150 Bgal/d) then from 1985 to 2000 withdrawals stabilized to 134 to 128 Bgal/d. This decrease can be attributed to climate, crop type, advances in irrigation efficiency, and higher energy costs.

Water use in the U.S. was determined from estimates of water withdrawals for eight categories: public supply, domestic, irrigation, livestock, aqua-culture, industrial, mining, and thermoelectric power (Kenny *et al.* 2009). For 2005, the largest water withdrawals were for thermoelectric power and irrigation. Irrigation was the second largest use of freshwater in the U.S. and totaled 128 Bgal/d for 2005 (37 percent of total freshwater withdrawals) (Table 3.5-2). Irrigation was the largest use of groundwater in the US, accounting for approximately 67 percent of all groundwater withdrawals in 2005. California, Nebraska, Texas, Arkansas, and Idaho accounted for 52 percent of total irrigated acreage. Estimates of total irrigation withdrawals for 2005 were about 8 percent less than during 2000. When 2005 irrigation was separated by source, surface water withdrawals decreased by nine percent when compared to 2000, while groundwater withdrawals declined by five percent. About 61.1 million acres were irrigated in 2005, with a decline of irrigated acres of four percent in the West and an increase of five percent in the East.

The 2007 Agricultural Census includes an irrigation survey taken by producers in 2008 for those producers indicating that they used irrigation on the 2007 survey forms. This survey found that from 2002 to 2007, the number of farms using irrigation increased slightly (0.5 percent) with the number of irrigated acres increasing approximately 2.3 percent during the period (USDA 2009a). This followed the 1997 to 2002 period where the number of farms using irrigation declined by approximately 3.0 percent, while the number of irrigated acres had declined by approximately 1.7 percent (*Ibid*). For non-horticultural irrigation, the number of farms using irrigation declined 1.6 percent from 2003 to 2008, while the number of irrigated acres increased 4.6 percent during the period (*Ibid*). For corn, the number of farms using irrigation increased by 4.2 percent and the number of irrigated acres increased 23.0 percent from 2003 to 2008. The Missouri River water resource region accounted for approximately 50.9 percent of the farms producing corn and 54.6 percent of the acres (*Ibid*). Corn yields on irrigated acres were on average 40.3 percent higher than on non-irrigated acres.

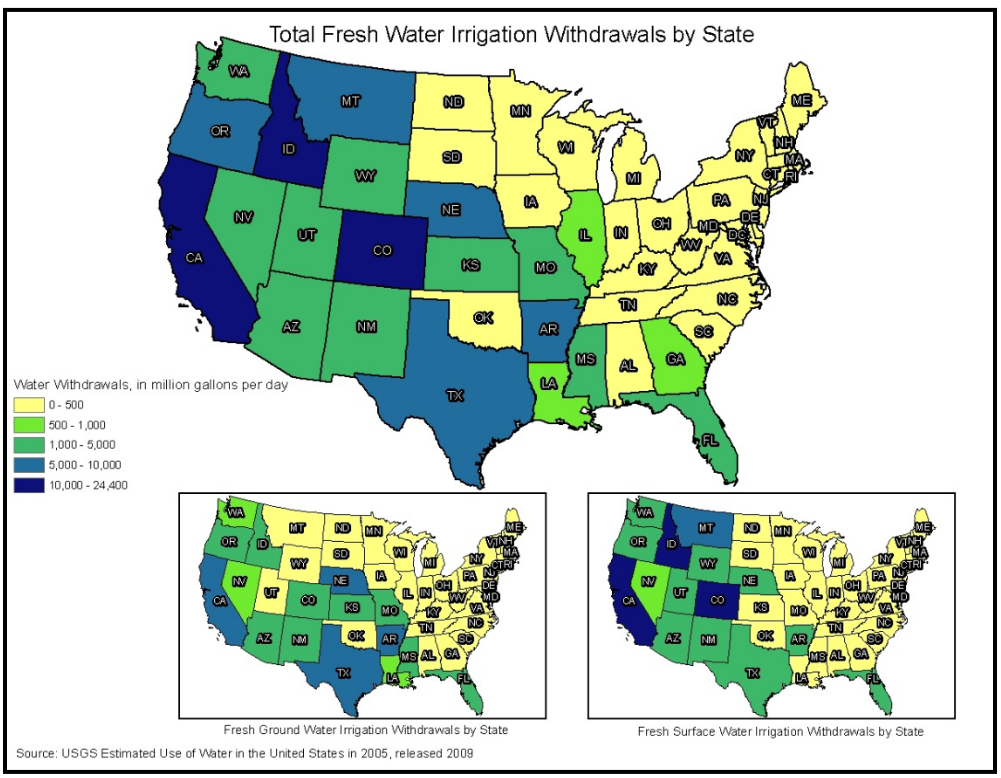


Figure 3.5-3 Water Withdrawals for Irrigation

Table 3.5-1. Water Withdrawals from 1950 to 2005

	Year												Percent Change
	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2000-2005
Population, in millions	150.7	164	179.3	193.8	205.9	216.4	229.6	242.4	252.3	267.1	285.3	300.7	5.4%
	Water Withdrawals (billions of gallons per day)												
Total withdrawals	180	240	270	310	370	420	[1]430	[1]397	[1]404	[1]399	[1]413	410	-0.7%
Public supply	14	17	21	24	27	29	[1]33	[1]36.4	[1]38.8	[1]40.2	43.2	44.2	2.3%
Rural domestic and livestock													
Self-supplied domestic	2.1	2.1	2.0	2.3	2.6	2.8	3.4	3.3	3.4	3.4	3.6	3.8	7.0%
Livestock	1.5	1.5	1.6	1.7	1.9	2.1	2.2	2.2	2.3	2.3	[2]2.4	2.1	-10.1%
Irrigation	89	110	110	120	130	140	150	[1]135	[1]134	[1]130	[1]139	128	-7.9%
Thermoelectric power	40	72	100	130	170	200	210	187	[1]194	190	195	201	3.1%
Other													
Self-supplied industrial	37	39	38	46	47	45	45	[1]25.9	22.6	22.4	19.7	18.2	-7.6%
Mining	(3)	(3)	(3)	(3)	(3)	(3)	(3)	3.4	4.9	3.7	[2]4.5	4.0	-10.7%
Commercial	(3)	(3)	(3)	(3)	(3)	(3)	(3)	1.2	2.4	2.9	(4)	(4)	
Aquaculture	(3)	(3)	(3)	(3)	(3)	(3)	(3)	2.2	[5]2.3	[5]3.2	[2]5.8	8.8	52.2%
Source of water													
Ground													
Fresh	34	47	50	60	68	82	83	[1]73.4	[1]79.6	76.4	[1]84.3	79.6	-5.6%
Saline	(4)	0.6	0.4	0.5	1.0	1.0	0.9	[1] 0.7	1.2	1.1	[1]2.7	3.0	13.1%
Surface													
Fresh	140	180	190	210	250	260	[1]280	[1]263	[1]255	[1]261	[1]265	270	1.9%
Saline	10	18	31	43	53	69	71	59.6	68.2	59.7	61	58	-4.9%

1 Revised data values.

2 Partial totals from 2000 have been expanded to include all States.

3 Included in self-supplied industrial.

4 Data not available.

5 In 1990 and 1995, some aquaculture use was included in the commercial category.

Source: Kenny *et al.* 2009

Table 3.5-2. Total Irrigation Water Withdrawals by State, 2005

State	Irrigated land (in thousand acres)				Withdrawals (in million gallons per day)			Withdrawals (in thousand acre-feet per year)			Application rate (in acre-feet per acre)
	By type of irrigation				By source			By source			
	Sprinkler	Micro-irrigation	Surface	Total	Ground-water	Surface water	Total	Ground-water	Surface water	Total	
Alabama	132	3.25	0.17	136	74.2	87	161	83.2	97.5	181	1.33
Alaska	2.4	0	0.07	2.47	1.03	0.02	1.05	1.15	0.02	1.18	0.48
Arizona	213	21	716	949	2,260	2,540	4,810	2,540	2,850	5,390	5.68
Arkansas	482	84.8	4,300	4,870	7,020	1,510	8,530	7,870	1,690	9,570	1.96
California	1,460	2,650	4,940	9,050	8,620	15,700	24,400	9,660	17,700	27,300	3.02
Colorado	1,150	3.16	1,880	3,030	2,320	10,000	12,300	2,600	11,200	13,800	4.56
Connecticut	24.2	1.82	0	26.1	0.74	21.8	22.5	0.83	24.4	25.2	0.97
Delaware	95.9	1.23	0	97.1	55.3	9.77	65.1	62	11	73	0.75
District of Columbia	0.32	0	0	0.32	0	0	0	0	0	0	0
Florida	447	668	752	1,870	1,450	1,620	3,070	1,620	1,820	3,440	1.84
Georgia	1,420	92.9	0	1,510	486	265	752	545	297	843	0.56
Hawaii	16.9	102	0	119	23.6	74.2	97.8	26.5	83.2	110	0.92
Idaho	2,310	4.57	1,220	3,530	3,870	12,700	16,600	4,340	14,200	18,600	5.26
Illinois	460	0	0	460	479	24.5	504	537	27.5	565	1.23
Indiana	313	0	0	313	97.4	54	151	109	60.5	170	0.54
Iowa	123	0	0	123	31.6	1.69	33.3	35.5	1.89	37.4	0.30
Kansas	2,780	13	330	3,120	2,620	114	2,740	2,940	128	3,070	0.98
Kentucky	34.5	2.18	1.44	38.1	0.93	18	18.9	1.04	20.1	21.2	0.56
Louisiana	99.3	0	956	1,060	684	308	992	767	345	1,110	1.05
Maine	29.9	0.03	0.91	30.9	1.15	2.77	3.92	1.29	3.11	4.39	0.14

Table 3.5-2 Total Irrigation Water Withdrawals by State, 2005 (cont'd)

State	Irrigated land (in thousand acres)				Withdrawals (in million gallons per day)			Withdrawals (in thousand acre-feet per year)			Application rate (in acre-feet per acre)
	By type of irrigation				By source			By source			
	Sprinkler	Micro-irrigation	Surface	Total	Ground-water	Surface water	Total	Ground-water	Surface water	Total	
Maryland	75.2	5.28	0	80.5	34.8	15	49.8	39	16.8	55.8	0.69
Massachusetts	21.7	1.89	0	23.6	47.1	98	145	52.8	110	163	6.9
Michigan	449	16.2	1.28	467	198	110	308	222	124	345	0.74
Minnesota	448	0	19.4	467	216	28.4	244	242	31.8	274	0.59
Mississippi	399	0	1,130	1,530	1,430	131	1,560	1,600	147	1,750	1.14
Missouri	514	1.15	762	1,280	1,340	38.9	1,370	1,500	43.6	1,540	1.21
Montana	919	0.64	1,350	2,270	140	9,530	9,670	157	10,700	10,800	4.77
Nebraska	5,870	0.76	2,480	8,350	7,310	1,150	8,460	8,190	1,290	9,480	1.14
Nevada	255	0.18	320	575	670	828	1,500	751	928	1,680	2.92
New Hampshire	5.49	0	0	5.49	0.45	4.07	4.52	0.5	4.56	5.07	0.92
New Jersey	109	13.7	2.71	125	43.2	51.9	95.1	48.4	58.2	107	0.85
New Mexico	408	19.1	441	868	1,270	1,550	2,810	1,420	1,730	3,160	3.64
New York	81.2	24.2	0	105	20.3	30.8	51.1	22.8	34.5	57.2	0.54
North Carolina	275	7.01	0	282	77.4	214	292	86.8	240	327	1.16
North Dakota	214	0	45.5	259	77.8	73	151	87.3	81.8	169	0.65
Ohio	70.4	0	0	70.4	17.7	24.9	42.6	19.8	27.9	47.7	0.68
Oklahoma	384	1.91	86.9	472	361	134	495	405	150	555	1.17
Oregon	1,010	7.85	949	1,970	1,930	3,780	5,710	2,170	4,230	6,400	3.25
Pennsylvania	67.1	16.9	0	84.1	8.29	16	24.3	9.29	18	27.3	0.32
Rhode Island	6.94	0	0.7	7.64	5.49	0	5.49	6.15	0	6.15	0.81

Table 3.5-2. Total Irrigation Water Withdrawals by State, 2005 (cont'd)

State	Irrigated land (in thousand acres)				Withdrawals (in million gallons per day)			Withdrawals (in thousand acre-feet per year)			Application rate (in acre-feet per acre)
	By type of irrigation				By source			By source			
	Sprinkler	Micro-irrigation	Surface	Total	Ground-water	Surface water	Total	Ground-water	Surface water	Total	
South Carolina	182	20.7	5.84	208	48.1	43.4	91.6	54	48.7	103	0.49
South Dakota	298	0	124	422	149	143	292	167	160	327	0.78
Tennessee	49.9	7.31	5.69	62.9	33.4	22	55.4	37.5	24.7	62.1	0.99
Texas	4,060	74.7	2,070	6,210	6,120	1,680	7,800	6,860	1,890	8,740	1.41
Utah	574	1.45	631	1,210	389	3,610	4,000	436	4,040	4,480	3.71
Vermont	4.56	0	0	4.56	0.3	2.83	3.13	0.34	3.17	3.51	0.77
Virginia	111	19.6	0	131	14.7	33.2	47.9	16.5	37.2	53.7	0.41
Washington	1,470	102	268	1,840	629	2,890	3,520	705	3,240	3,950	2.14
West Virginia	2.32	0	0.99	3.31	0.01	0.01	0.02	0.01	0.01	0.02	0.01
Wisconsin	373	0	12.8	386	387	15.2	402	433	17.1	450	1.17
Wyoming	180	4.03	818	1,000	422	3,570	3,990	474	4,000	4,470	4.47
Puerto Rico	0	54.5	0	54.5	30	15.2	45.2	33.6	17	50.6	0.93
U.S. Virgin Islands	0	0	0	0	0	0	0	0	0	0	0
TOTAL	30,500	4,050	26,600	61,100	53,500	74,900	128,000	60,000	84,000	144,000	2.35

Source: Kenny *et al.* 2009

3.6 RECREATION

3.6.1 Definition of the Resource

Recreational resources are those activities or settings either natural or manmade that are designated or available for recreational use by the public. In this analysis, recreational resources include lands and waters utilized by the public for hunting and viewing wildlife, fishing, hiking, birding, boating, and other water-related activities.

3.6.2 Existing Conditions

3.6.2.1 Outdoor Recreation Trends

Cordell *et al.* (2008) have indicated a growing trend in outdoor recreation activities from 1994 to 2008. Their analysis of the National Survey on Recreation and the Environment indicates that approximately 62.8 million participants were viewing wildlife during 1994/1995 and that during 2005/2008 that number had increased to 114.8 million participants (82.8 percent increase). The days spent on wildlife viewing activities increased from 2.3 billion days in 1994/1995 to 5.3 billion days by 2005/2008 (130.4 percent increase). With a general increasing trend for outdoor recreational activities, there could be sufficient opportunities for recreational activities to be conducted on private lands in rural areas, including those lands enrolled in CRP practices.

In 2008, the U.S. Fish and Wildlife Service published the 2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation (USFWS 2007). The surveys were conducted on state and national levels. The 2006 survey found that more than 87 million individuals greater than or equal to 16 years of age participated in fishing, hunting, and/or wildlife-watching activities within one year prior to the survey, nationally (Table 3.6-1).

Table 3.6-1. Total Wildlife-Associated Recreation Participants by Region

	Total		Sportspersons		Wildlife-Watching	
	Participants (1,000)					
Region Where Activity Occurred	Number	Percent	Number	Percent	Number	Percent
United States	87,465	100	33,916	39	71,132	81
Atlantic	32,077	100	11,046	34	26,325	82
Midwest	24,414	100	10,068	41	18,909	77
Plains	10,109	100	4,868	48	7,221	71
South	15,809	100	8,193	52	10,983	69
West	21,325	100	6,611	31	17,683	83

Source: USFWS 2007.

The largest percentage of hunting in the U.S. was for big game (85 percent), then small game (38 percent), migratory birds (18 percent), and other animals (9 percent). The data suggests that a portion of the hunting population participated in more than one class of game hunting during the year. Table 3.6-2 provides an illustration on the number of days hunting, while Table 3.6-3 provides the number of anglers and days fishing in freshwater (except Great Lakes).

The total amount spend on these activities, including trip-related, equipment and miscellaneous expenditures, was over $122 billion within that same time period. The average total expenditures in 2006 were $1,229 per angler with an average trip expenditure of $80 per day. The average total expenditures in the same year were $1,447 per hunter with an average per trip expenditure of $170 per day. The total of expenditures in 2006 per wildlife-watching participant averaged $216 per person. Table 3.6-4 illustrates the wildlife-recreation related expenditures by region.

Table 3.6-2. Total Days Hunting by Region

Regions	Days of hunting in state (1,000)			Days of hunting by state residents (1,000)		
	Total Days, Residents and nonresidents	Days by state residents	Days by nonresidents[1]	Total days, in states of residence and other states	Days in state of residence	Days in other states[1]
United States	219,925	203,319	18,023	219,925	203,319	18,023
Atlantic	64,537	59,393	4,815	65,837	59,393	6,090
Midwest	62,148	59,399	2,536	62,271	59,399	2,850
Plains	27,275	25,143	2,079	26,171	25,143	514
South	45,660	41,100	4,426	46,443	41,100	5,344
West	20,461	17,108	3,208	19,338	17,108	1,989

Source: USFWS 2007
[1] Numbers include estimates from small sample sizes; some states counted as zero because sample size was too small to report reliably.

Table 3.6-3. Total Anglers and Days Fishing (Freshwater except Great Lakes)

Region	Anglers (1,000)			Days of fishing by state residents (1,000)		
	Total anglers, residents and nonresidents	State Residents	Nonresidents[1]	Total days, of residence and other states	Days by state residents	Days by nonresidents[1]
United States	25,035	23,266	4,604	419,942	382,512	37,869
Atlantic	6,955	5,460	1,459	105,497	94,357	10,712
Midwest	7,776	6,439	1,337	119,465	109,462	10,004
Plains	3,314	2,901	395	48,714	45,578	3,088
South	5,480	4,454	1,028	90,453	83,986	6,470
West	4,944	3,892	1,051	54,277	47,672	6,603

Source: USFWS 2007
[1] Numbers include estimates from small sample sizes; some states counted as zero because sample size was too small to report reliably.

3.6.2.2 Rural Tourism

Reeder and Brown (2005) found that rural areas that focused on recreational development and rural tourism aspects experienced greater socioeconomic well-being than rural area that had not focused on these types of development. They found that these areas had generally higher employment growth rates and had a greater percentage of working age residents employed. Earnings and income levels were generally higher; however, cost of living also increased in these areas, resulting in higher housing prices. The cost of living increases were generally not enough to fully offset the income gains attributable to rural tourism and recreational development.

Brown and Reeder (2007) estimated that approximately 52,000 farms (2.5 percent of total farms) in the U.S. in 2004 had income derived from farm-based recreation activities, such as hunting, fishing, horseback riding, etc. Barry and Hellerstein (2004) indicated that on-farm recreational income provides farmers approximately $800 million per year with the highest annual per farm income being in the Fruitful Rim ($1,127) and the highest percentage of farms with recreational income being in the Heartland (7 percent).

Carpio *et al.* (2008) noted that approximately 62 million Americans visited farms at least one time in 2000 (approximately 30 percent of the population). They estimated that the average number of trips per year to farms was 10.3 with a generated consumer surplus of $174.82 per trip with $33.50 per trip being specifically generated by the rural landscape. The total consumer surplus due to the rural landscape was estimated to be $21.4 billon, which was approximately equal to half the U.S. net total farm income average. Carpio *et al.* (2008) surmise that there is a potential trend indicating an increasing regard to the visitors' economic valuation of farm amenities.

Table 3.6-4. Wildlife-Recreation Associated Expenditures by Region (thousands of dollars)

Region Where Spending Occurred	Total, wildlife-associated expenditures				Fishing and hunting expenditures				Wildlife-watching expenditures			
	Total	Trip-Related	Equipment	Other	Total	Trip-Related	Equipment	Other	Total	Trip-Related	Equipment	Other
United States	122,304,987	37,432,326	64,137,178	20,735,483	76,650,027	24,557,174	40,963,125	11,129,728	45,654,960	12,875,152	23,174,053	9,605,755
Atlantic	27,947,442	8,452,035	16,389,337	3,106,071	17,237,929	5,474,991	10,186,725	1,576,208	10,709,515	2,977,043	6,202,610	1,529,861
Midwest	25,514,143	6,966,786	13,504,334	5,043,023	18,005,482	5,264,752	9,267,235	3,473,495	7,508,659	1,702,034	4,237,098	1,569,528
Plains	12,889,842	4,287,517	6,659,068	1,943,256	9,117,852	3,518,052	4,438,731	1,161,069	3,771,990	769,466	2,220,337	782,187
South	21,489,749	6,921,046	11,373,992	3,194,713	14,696,808	5,293,625	7,268,557	2,134,625	6,792,942	1,627,421	4,105,433	1,060,087
West	24,215,665	9,574,054	12,302,347	2,339,264	13,270,763	4,473,423	7,625,829	1,171,511	10,944,901	5,100,628	4,676,515	1,167,754

Source: USFWS 2007

4.0 ENVIRONMENTAL CONSEQUENCES

4.1 ALTERNATIVES COMPARISON RECAP

4.1.1 No Action Alternative

The No Action Alternative is carried forward in this PEIS in accordance with 40 CFR 1502.14(d) to represent the environmental baseline against which to compare the other alternatives. The No Action Alternative assumes that no Federal program for the Establishments and Annual Payments Program component of BCAP would be implemented and assesses the potential impacts this could have on the natural and human environment. This alternative does not meet the purpose and need as described above, but is carried forward to provide a baseline against which the impacts of the Proposed Action can be assessed.

4.1.2 Alternative 1 – Targeted BCAP Implementation (Preferred Alternative; Environmentally Preferred Alternative)

Under Alternative 1, BCAP would be implemented on a more restrictive or targeted basis. BCAP project areas would be authorized for those projects that support only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres. No new non-agricultural lands shall be allowed to enroll in the program for BCAP crop production. This would mean that NIPF would need to be maintained in existing tree cover, established in SRWC, or left suitable for growing trees and not converted into cropland or the equivalent of cropland for an herbaceous dedicated energy crop. An additional limitation is imposed by the relatively small funding for implementation of a BCAP provided in the preliminary FY 2010 President's budget, which could limit the number of viable areas analyzed under this alternative. Similar to the CRP administered by FSA, the number of acres enrolled in BCAP project areas for crop production shall be limited to no more than 25 percent of the cropland in a given county. Payment rates would be limited to an amount sufficient to provide some risk mitigation. To participate in a BCAP project area, a BCF that produces advanced biofuels must ensure the fuel meets the greenhouse gas test included in the EISA of 2007, that is, a defined percent of the full life cycle reduction in greenhouse gas gained over the production and use of conventional fuels.

4.1.3 Alternative 2 – Broad BCAP Implementation

Alternative 2 would enable anyone who meets the basic eligibility requirements as outlined in the 2008 Farm Bill provisions governing BCAP to participate in a BCAP project area. In addition, existing BCFs and crops would be supported, including small and pilot BCFs, and all bio-based products derived from eligible materials would qualify under this alternative. New non-agricultural lands (e.g. NIPF) would be allowed to enroll in the program for BCAP crop production. As such, NIPF could be planted to herbaceous species, thereby utilizing standard agricultural practices, rather than forestry practices to produce a crop. This alternative would still exclude the conversion of native sod into BCAP acreage and any other land considered ineligible in accordance with the 2008

Farm Bill. Additionally, the number of cropland acres within a county allowed to enroll in the program would not be capped.

To maximize program participation, payments would be sufficient to completely replace the potential income from non-BCAP crop production. Advanced biofuels produced by a BCF participating in a BCAP project area need only meet the less restrictive definition provided in Title IX of the 2008 Farm Bill, which does not include the GHG test as specified in the EISA.

Table 4.1-1 illustrates the various components of each of the action alternatives.

Table 4.1-1. Action Alternatives Summary

Alternative 1: Targeted Implementation of BCAP	Alternative 2: Broad Implementation of BCAP
BCFs supported by BCAP project areas are limited to producing energy.	All bio-based products produced by a BCF in BCAP project areas can be supported.
No new non-agricultural lands allowed for BCAP project area crop production.	New non-agricultural lands allowed for BCAP project area crop production.
Cropland acres enrolled in the program would be capped at 25 percent of cropland acres within a given county.	Cropland acres enrolled in the program would not be capped.
Advanced biofuels produced by BCAP project area BCFs must meet the greenhouse gas test.	Advanced biofuels produced by BCAP project area BCFs do not need to meet the greenhouse gas test.
Only new BCFs are allowed to be part of BCAP project areas and only newly established crops on BCAP contract acres are eligible crops.	Existing BCFs that meet BCAP eligibility requirements are supported.
Only large commercial BCFs would be allowed in BCAP project areas.	Small and Pilot BCFs would qualify for BCAP project areas.
Payments would be limited to provide some risk mitigation.	Payments would completely replace lost potential income from non-BCAP crops.

4.2 SOCIOECONOMICS AND LAND USE

4.2.1 Significance Thresholds

Economics for this analysis will incorporate the impacts that are likely to occur if provisions of BCAP were implemented to both the agricultural sector and rural communities. Variables of significance will vary depending on the Alternative and will include:

- Net farm income;

- Farm prices (only in Alternative 1);
- Government Payment;
- Land use shifts; and
- Direct, indirect, and induced economic impacts as a result of changes in government payments, net farm income, commodity prices, and land uses.

Economic impacts would occur as a result of shifts in land uses, as a result of BCAP implementation, and as the result of increasing the intensity of production.

4.2.2 Methodology

The economy-wide impacts will be estimated using IMPLAN, while the economic impacts on the agricultural sector would be estimated using Policy Analysis System (POLYSYS). Economics of a region or sector are greatly influenced by profits, investments, prices, costs of production, and transactions between industries within the region. The current economic environment of agriculture can be displayed through net farm income at the national level. However, various agricultural sectors are at different levels of economic viability. Economic viability also varies by location. Agricultural producers are price takers both in their product and with their inputs. Comparison of the economic environment as it exists or is expected to exist with and without the BCAP provisions would determine whether the affected environment is improved within the agricultural sector. Changes in regional development are also expected to occur and would be measured by changes in economic activity within the region/regions under analysis. Under Alternative 2, it is expected that there would be farm price impacts. These impacts may affect financial viability and, potentially, consumer costs of food throughout the country.

4.2.2.1 Model Details

The changes to the region's economy can be measured using IMPLAN, a model which employs a regional social accounting system and used to generate a set of balanced economic/social accounts and multipliers (Minnesota IMPLAN Group 2004). The social accounting system is an extension of input-output analysis. The model uses regional purchase coefficients (RPC's) generated by econometric equations that predict local purchases based on a region's characteristics. Descriptive output variables created by IMPLAN include total industry output (TIO), employment, and value-added for 500 plus industries within the regional economy being evaluated. There are three types of impacts – direct, indirect, and induced.

This study uses Type I and Type Social Accounting Matrix (SAM) multipliers. Type I multipliers are calculated by dividing direct plus indirect impacts by the direct impacts. Type SAM multipliers are calculated by adding direct, indirect, and induced impacts and then dividing by the direct impacts. The Type SAM multipliers take into account the expenditures resulting from increased incomes of households as well as inter-institutional transfers resulting from the economic activity. Therefore, Type SAM multipliers assume that, as final demand changes, incomes increase (decrease) along with inter-institutional transfers. Increased (decreased) expenditures by people and institutions lead to increased (decreased) demands from local industries.

A variety of economic impacts would result with a land use shift towards the production of a new crop such as a dedicated energy crop. There are numerous annual impacts that occur to the agricultural sector as a result of projected changes in crop acreage, crop prices, and government payments by POLYSYS, transportation of the energy feedstock, and the actual production and harvesting of a dedicated energy crop. Knowledge of the available infrastructure and the methods (for example, truck, train, or barge) used to transport the commodities are needed before impacts to the economy as a result of energy transportation can be determined. While the operation of the BCF also has an annual impact on the economy, this is beyond the scope of this activity.

The POLYSYS model is a framework that was developed over the past three years to combine research on full carbon accounting (FCA) at Oak Ridge National Laboratory with the POLYSYS agricultural economics model developed at the University of Tennessee. This framework is capable of estimating changes in land management, crop production, farm income, and commodity prices, and of calculating the energy and carbon dynamics associated with these changes.

The POLYSYS model is a variant of an equilibrium displacement model that is capable of estimating annual changes in land use, environmental quality, prices, income, and government payments as a result of a policy scenario. The POLYSYS modeling framework was developed to simulate changes in economic policy, agricultural management, and natural resource conditions and to estimate the resulting impacts from these changes on the US agricultural sector (Ray *et al.* 1998; De La Torre Ugarte *et al.* 1998, 2003; De La Torre Ugarte and Ray 2000; De La Torre Ugarte *et al.* 2007). At its core, POLYSYS is a system of interdependent modules that simulate (a) crop supply for the continental U.S., (b) national crop demands and prices, (c) national livestock supply and demand, and (d) agricultural income. Variables that drive these modules include planted and harvested areas, production inputs, yields, exports, production costs, demand by use, farm prices, government program outlays, and net realized incomes. Among the issues analyzed with POLYSYS are the potential effects of farm bill changes, bioenergy supply, El Nino events, elimination of CRP, erosion benefits of alternative management plans, and free trade agreements.

The elimination of CRP and its effects on cropland practice included older models as described by Hansen (2007) and more recent efforts (De La Torre Ugarte and Hellwinckel 2006; Larson *et al.* 2009, draft), which tried to model how cropland practices and choices would change if the CRP program was eliminated. From model indications it would appear that between nine to 15 million expiring acres of CRP by 2025 could return to crop production, with an estimated one million acres potentially being planted in dedicated energy crops. This was based on the probable higher value of traditional row crops without the incentives provided by BCAP for dedicated energy crop production. The expiring CRP acres would be offset through re-enrollments into CRP and new acres being enrolled in CRP to reach the 32 million acre cap as defined by the 2008 Farm Bill. Figure 4.2-1 illustrates the total expiring CRP acres from FY 2009 to FY 2010 with the superimposed potential BCAP project areas as developed through the modeling mechanisms and detailed in the following sections.

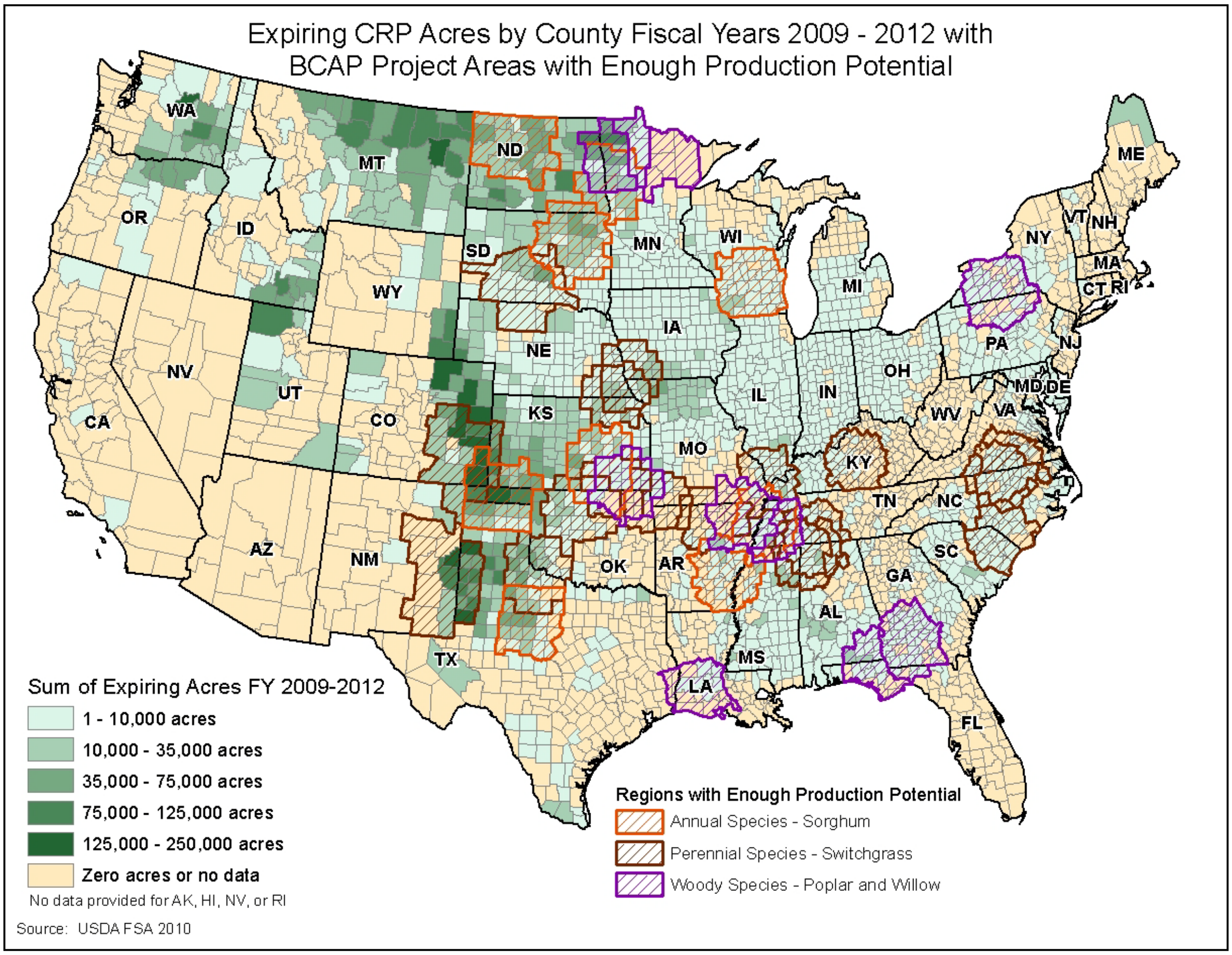


Figure 4.2-1. Expiring CRP Acres by County (FY 2009 – FY 2012) with Potential BCAP Project Area by Dedicated Energy Crop Type

4.2.2.2 Definition of Types of Impacts

Direct impacts measure the response of a given industry to a change in final demand for the industry. They include the backward linkages in the economy from the increase (decrease) in economic activities that occur from changes in inter-industry intermediate input demands within the region.

Indirect impacts represent the response by all industries in the economy to a change in final demand for a specific industry. As changes in economic activity occur, changes in final demand occur.

Induced impacts represent the response by all industries in the economy to increased expenditures of new household income and inter-institutional transfers generated from the direct and indirect impacts of the change in final demand for a specific industry.

Final demand is defined as employment compensation, proprietor income, returns to other property, and indirect business taxes

4.2.2.3 Model Variables

To estimate the likely location of BCAP potential project locations, first, the regional availability of feedstock and different price levels would be estimated. This was done using the county version of POLYSYS, which included switchgrass, SRWC, and forage sorghum as dedicated energy crops at the national level. It also included corn and wheat residues.

Next, with the help of a Geographical Information System (GIS) system, and land use maps at high levels of resolution, areas were identified that have the potential for a higher density of feedstock concentration. This allowed for the identification of broad areas where dedicated energy crops could be potentially located and their area of influence regarding the feedstock production.

For Alternative 1, all counties within a 50-mile radius of a proposed BCF based on feedstock availability were created in IMPLAN, generating proposed BCAP project areas for analysis within this document. Fifty miles is chosen as the average maximum radius for which feedstock can be economically provided to a BCF. The analysis incorporated projected land use and proprietor income changes, government payment changes, along with an increase in transportation and the development of a dedicated energy crop. The economic activity that results from these changes will be estimated for the region.

For Alternative 2, economic impacts resulting from national policy changes can be evaluated using state IMPLAN models. Numerous publications have taken results from a national model and used those results in IMPLAN to show what impacts would occur to a state or a region's economy. However, in this study, there is a need to take the impacts from an inter-regional multi-state model that is national in scope and project the potential impacts changes in policy on the nation's economy. The interface program, the POLYSYS/IMPLAN Integrator (PII 1), developed at The University of Tennessee, takes POLYSYS acreage, price, and changes in government programs and makes two major types of changes to IMPLAN databases. First, the program adds an energy crop sector to IMPLAN based on production and cost information supplied by the POLYSYS results for each of the 48 contiguous states. Next, agricultural impacts that occur as a result of projected changes in the agricultural sectors are placed in each state's IMPLAN model incorporating POLYSYS projected changes in crop production, prices, and income.

The integrator, PII 1, written in Visual Basic and taking advantage of IMPLAN's data structure, provides the user a means to solve IMPLAN at the state level and determine regional economic impacts as a result of changes in agricultural production practices, policies, prices, government payments, and/or technology adoption. The resulting reports generated from the analysis summarize, via graphs and maps, the economic impacts as measured by changes in total industry output, employment, and value added. In addition, tabular information is presented for use in the analysis. For the purposes of this report, three impacts are reported: (a) the impacts to the agricultural sector, (b) the impacts as a result of increased transportation requirements and (c) the impacts that occur as a result of interstate commerce. The impacts that occur from interstate commerce cannot be allocated to any particular state and, consequently, the maps do not incorporate these impacts. They occur as a result of input purchases across state lines, as well as the impacts that occur as a result of a flow of income from one state to another.

4.2.2.4 Assumptions and Data Limitations

The 2008 Farm Bill provides the guidelines for the feedstock eligible to participate in BCAP. In summary, crops known as Title I crops are not eligible to receive the benefits of BCAP for establishment and annual payments; this is the case of corn and soybeans, and even the use of grain sorghum and wheat for the production of biofuels. Dedicated energy crops that would not be considered noxious or invasive, like switchgrass, potentially Miscanthus, depending upon the State, and other grasses and crops would be eligible for establishment and annual payments, as well SRWC planted for energy purposes. The use of crop and forest residues could also be eligible to participate in BCAP as part of the Matching Payments Program. Dedicated energy crops and SRWC are eligible for establishment and feedstock producers' payments, in addition to matching payments. On the other hand, residues (agricultural and forest) are eligible for matching payments only.

The POLYSYS model currently incorporates switchgrass and residues (crop and forestry) as feedstock for BCF. However, it is important to note that switchgrass can be seen as a generic dedicated energy crop which would represent the land use requirements implicit in the use of other energy crops for which data is not readily available. The use of switchgrass as a model crop representing other dedicated energy crops, could underestimate the production potential of feedstock that has a yield that could be significantly larger than switchgrass, and consequently underestimate the potential of specific regions of the country as candidate locations for potential BCAP projects locations. In an effort to address those shortcomings, the POLYSYS model has been complemented with preliminary data in an effort to include poplars, willows, and forage sorghum as eligible crops. For Alternative 1, each of these dedicated energy crops were treated separately. Analysis was conducted separately for three types of perennials including a perennial herbaceous (e.g., switchgrass), two SRWC (hybrid poplar and willow), and forage sorghum as an annual herbaceous. Separate site selection was conducted for each of the species.

The economic analysis began with the identification of potential BCAP project areas. Due to the exponentially growing number of sites under Alternative 2, and the complexities it brings, no specific site selection analysis was done.

There were several criteria used to select the BCAP project areas:

1. The selection is driven by the availability of feedstock in the region;
2. To account for the larger number of projects the analysis assumes a plant size of 15 million gallons of ethanol production in a year. Ethanol facilities were chosen as the example BCF due to the amount of data available associated with these facilities. A plant size of 15 million gallons was determined to be a commercial-sized facility based on industry information associated with facilities currently under construction and in the planning stages. The commercial-sized facility was modeled specifically for the conditions of Alternative 1;
3. The projects were selected based on minimizing the cost for the BCAP. This included developing scenarios where the limited funding would create the highest overall return to the national economy; and
4. Competition for the same feedstock for closely located projects was avoided.

Given the limited BCAP funding that would be available for establishment of dedicated energy crops for Alternative 1 – enough for about two commercial-scale projects- the POLYSYS model was modified to perform a national level analysis of potential feedstock, but without generating a feedback impact in agricultural prices. The analysis included prices for switchgrass ranging from \$35 to \$80 per dry ton. The \$60 per dry ton analysis provided a good regional coverage of feedstock potential supply for herbaceous perennial and annual crops, and consequently was selected to perform the GIS analysis to locate the potential BCAP projects; while \$70 per ton was needed for poplars and \$90 per ton for willows.

For perennial herbaceous dedicated energy crops, the analysis examined two paths to select BCAP project locations. The first was to select the top five project locations based on the cost to the BCAP project. This would also identify locations in which the regional supply of feedstock is abundant and has a relatively lower price. The second was to select the potential BCAP top project in every state in which potential feedstock production was large enough to sustain a BCF, noting that even if a specific BCF is located in a particular state, its area of influence for gathering feedstock could go beyond the state borders. For both the SRWC and the annual herbaceous species site selection, a single criterion was used. Up to 10 different sites were selected based on a single criterion of sufficient biomass production to supply the 15 million gallon facility.

The starting place for the economic analysis in each scenario is the identification of the potential BCAP project locations. Since the No Action Alternative represents the absence of the BCAP, the site selection was only performed for Alternative 1.

Two selection paths were followed for Alternative 1. For perennial herbaceous crops, the top five sites based on the above-mentioned criteria specified were selected. For perennial herbaceous, SRWC, and annual herbaceous, to represent regional diversity a top site or two in every state was selected from the regions suitable for locating a potential BCAP project location, assuming dedicated energy crops were the source of cellulosic feedstock. It is noted that these top sites for perennial herbaceous were selected based upon minimizing costs to the BCAP, operating a plant of a specific size, and available feedstock appropriate for a plant of that size. This provides representative sites for economic/socioeconomic analysis. However, site selections for any new BCFs will be based upon many other factors, including availability of other feedstock, proximity to transportation and customers, regional and local economic development plans, financing availability, environmental constraints, and public acceptability. Any potential sites would have to undergo appropriate NEPA review, this PEIS being one step in that process. As such, the selection for economic/socioeconomic analysis of these sites in no way pre-judges the ultimate selection of sites for new BCFs created as a result of the implementation of the BCAP. Neither does the selection of these generic sites limit the analytical approach of other resource areas in this PEIS.

This process resulted first in the selection of the top five sites for potential perennial herbaceous BCAP project locations based on availability of feedstock to supply a potential BCF. For the top site in each state for any of the energy crops under analysis, regional competition for feedstock was not enforced, as one of the objectives was to emphasize multiple state projects. Moreover, it is important to have in mind that projects were selected independent of each other, and that feedstock demand would be at a very low national level. Therefore, in this alternative it was assumed that there were no price impacts associated with the implementation of the alternative.

For Alternative 2, the analysis was conducted at both a regional and national level. However, the objective of this alternative was to produce sufficient feedstock to meet the legislative requirements of EISA, both from corn (15 billion gallons) and from dedicated energy crops. The analysis focused on the impacts to net farm income; farm prices; government payments; land use shifts; and direct, indirect, and induced economic impacts as a result of changes in the aforementioned variables. The analysis assumed that farmers or land owners would receive $45 per ton in payment through BCAP plus a match from the plant demanding the cellulosic feedstock.

4.2.3 Alternative 1

4.2.3.1 Perennial Herbaceous Species

The selection process discussed above resulted in the selection of the top five sites presented in Figure 4.2-2 where the general locations and specific counties of influence are shown. The process also identified the top BCAP project site for each state with sufficient feedstock available, as shown in Figure 4.2-3. In the selection of the top BCAP project site for each state, the regional competition for feedstock was not enforced, as one of the objectives was to emphasize multiple state projects.

DIRECT IMPACTS

Realized Net Farm Income at the national level under Alternative 1 would be expected to remain unchanged from the baseline conditions due to the limited funding assumption under Alternative 1; therefore, there would not be expected national level effects. Net Returns at the farm level would be likely to improve for those producers selected as part of the project area for BCAP under this alternative. The production of a dedicated energy crop would be expected to create a higher valued opportunity for producers or those producers would not have selected to participate in BCAP. Depending on the overall acres in a county involved in the BCAP, the net returns for agriculture for that county or region could see significant gains under Alternative 1.

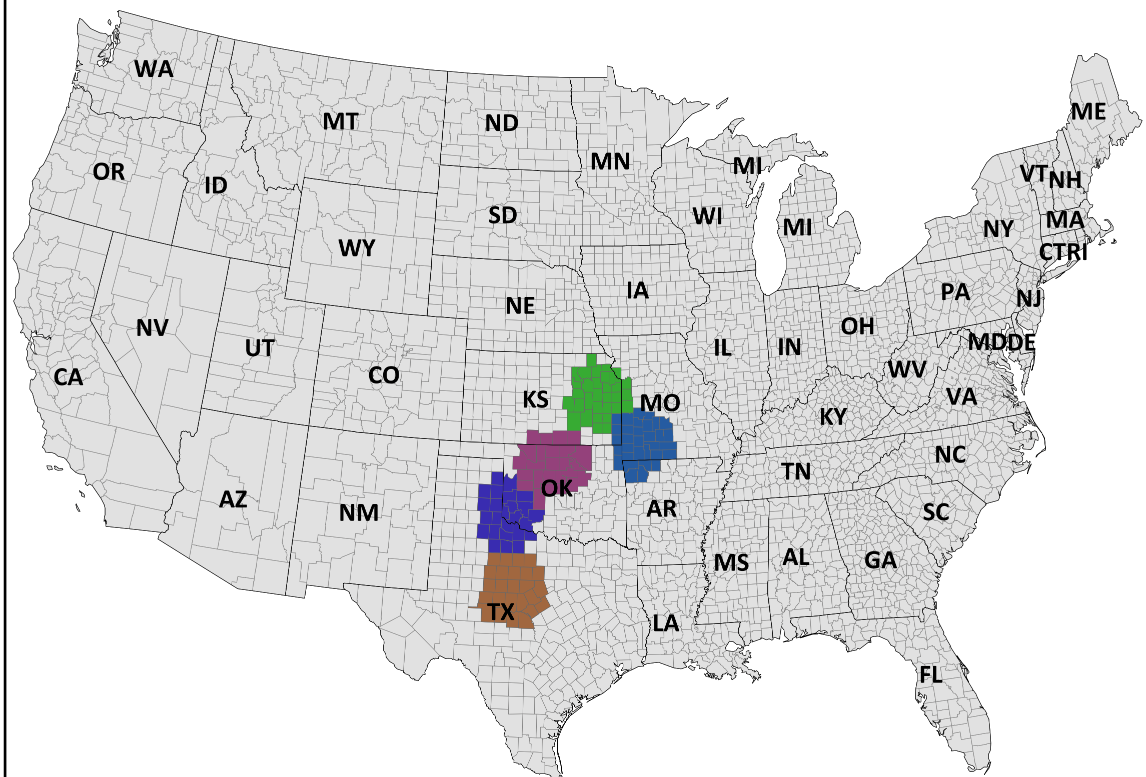


Figure 4.2-2. Location of the Top Five Switchgrass Potential BCAP Project Areas

The information in Table 4.2-1 indicates the impact on total net returns in the agricultural sector generated by the potential BCAP projects under this alternative. Table 4.2-1 shows which projects are the top five sites in the nation based on the model configuration, and which sites have been identified as the top in the state location. The county and state for each of the potential locations are provided.

The information in Table 4.2-1 is presented in three different areas, each representing the key stages of the BCAP project. The first column in each year is labeled *Total Crop Net Returns*, and it represents the loss of net revenues resulting from utilizing land previously planted in other crops and now dedicated to a BCAP project. The next columns show results by year. In *YEAR 1* the project receives the initial establishment

Table 4.2-1. Impact on Net Returns (constant U.S. Dollars) by Potential Switchgrass BCAP Project Areas

			YEAR 1					YEAR 2			YEAR 3		
Top 5	Top State	Location	Total Crop Net Returns	BCAP Establishment Payments	BCAP Farm Payments	Total BCAP Payments	Total Returns	Total Crop Net Returns	BCAP Farm Payments	Total Returns	Total Crop Net Returns	Plant Payments	Total Returns
	X	Mellette, SC	(1,641,690)	4,095,473	4,822,496	8,917,969	7,276,280	(276,532)	4,822,496	4,545,964	(276,532)	5,588,766	5,312,234
X		Osage, KS	(2,751,117)	2,224,754	4,048,212	6,272,966	3,521,849	(2,009,533)	4,048,212	2,038,679	(2,009,533)	4,861,579	2,852,047
	X	Fremont, IA	(5,939,410)	2,431,183	6,266,385	8,697,568	2,758,158	(5,129,015)	6,266,385	1,137,370	(5,129,015)	4,468,732	(660,283)
	X	Pawnee, NE	(3,758,923)	2,341,154	5,768,385	8,109,539	4,350,616	(2,978,538)	5,768,385	2,789,847	(2,978,538)	4,881,491	1,902,952
	X	Roosevelt, NM	(3,569,303)	4,194,605	3,857,666	8,052,270	4,482,967	(2,171,102)	3,857,666	1,686,564	(2,171,102)	3,914,484	1,743,382
	X	Bent, CO	(3,798,755)	3,869,690	3,773,441	7,643,131	3,844,376	(2,508,858)	3,773,441	1,264,583	(2,508,858)	4,413,223	1,904,365
	X	Chautauqua, KS	(2,712,654)	2,456,119	3,156,309	5,612,428	2,899,774	(1,893,948)	3,156,309	1,262,361	(1,893,948)	4,523,190	2,629,242
X	X	Garfield, OK	(2,422,113)	3,073,736	2,548,157	5,621,892	3,199,779	(1,397,534)	2,548,157	1,150,622	(1,397,534)	4,239,042	2,841,508
X		Callahan, TX	(2,709,821)	4,559,252	1,961,225	6,520,477	3,810,656	(1,190,070)	1,961,225	771,155	(1,190,070)	4,048,396	2,858,326
	X	Hardeman, TX	(3,246,201)	3,904,936	2,143,638	6,048,574	2,802,373	(1,944,555)	2,143,638	199,083	(1,944,555)	4,051,794	2,107,239
X		Harmon, OK	(2,571,417)	3,807,243	2,220,001	6,027,244	3,455,827	(1,302,336)	2,220,001	917,665	(1,302,336)	4,141,552	2,839,215
	X	Tishomingo, MS	(2,924,858)	3,831,209	4,821,566	8,652,774	5,727,917	(1,647,788)	4,821,566	3,173,778	(1,647,788)	3,978,784	2,330,996
	X	Izard, AR	(3,388,097)	3,573,778	5,109,304	8,683,082	5,294,985	(2,196,838)	5,109,304	2,912,466	(2,196,838)	3,955,101	1,758,264
	X	McDonald, MO	(2,931,264)	2,392,151	3,416,636	5,808,787	2,877,523	(2,133,881)	3,416,636	1,282,756	(2,133,881)	4,181,668	2,047,788
X		Lawrence, MO	(3,032,872)	2,333,143	3,669,147	6,002,290	2,969,419	(2,255,157)	3,669,147	1,413,990	(2,255,157)	3,935,684	1,680,527
	X	Alexander, IL	(2,141,995)	3,736,676	5,323,162	9,059,838	6,917,843	(896,436)	5,323,162	4,426,725	(896,436)	4,141,500	3,245,064
	X	Marion, KY	(3,635,624)	3,918,671	5,174,460	9,093,131	5,457,507	(2,329,400)	5,174,460	2,845,060	(2,329,400)	3,975,677	1,646,277
	X	Lawrence, TN	(2,820,556)	3,878,054	4,929,530	8,807,584	5,987,028	(1,527,871)	4,929,530	3,401,659	(1,527,871)	3,815,371	2,287,500
	X	Colbert, AL	(1,280,741)	3,828,920	4,770,575	8,599,495	7,318,754	(4,434)	4,770,575	4,766,141	(4,434)	3,936,001	3,931,567
	X	Dillon, SC	(3,933,044)	4,229,016	3,863,558	8,092,574	4,159,530	(2,523,372)	3,863,558	1,340,186	(2,523,372)	4,286,742	1,763,370
	X	Mecklenburg, VA	(4,186,338)	3,989,092	3,778,366	7,767,457	3,581,120	(2,856,640)	3,778,366	921,725	(2,856,640)	4,330,902	1,474,262
	X	Person, NC	(4,169,780)	4,013,331	3,550,328	7,563,660	3,393,879	(2,832,003)	3,550,328	718,325	(2,832,003)	4,411,100	1,579,097

payment and is subject to payments for 75 percent of the establishment cost and the farmer is eligible for a payment reflecting the opportunity cost of the land. If producers are under contract with the BCF and they could have received a payment from the BCF, this potential payment is not included in the calculations. The last column in each *YEAR* summarizes the overall impact in Total Net Returns to the Agricultural Sector. In *YEAR 2* there are not any establishment payments, and in *YEAR 3* there are no BCAP payments for the producers of the feedstock.

Figure 4.2-3. Top Switchgrass Potential BCAP Project Areas in States with Enough Feedstock Production Potential

Table 4.2-1 shows that in most potential project locations the impact on Total Net Returns are positive, and only in one they are marginally negative. The loss of Total Net Returns in Fremont, Iowa, is an indication that while it was the top location in a state, it would not have been considered one of the top locations for a BCAP project under the modeled scenarios.

The results in *YEAR 3* are of special importance, because they are an indication of the long term viability of the BCAP project in terms of supplying a BCF with the required feedstock. It is also important to remember that each BCAP project is of the same size, i.e., one that is large enough to supply feedstock to a conversion facility capable of producing 15 million gallons of ethanol a year. As mentioned previously, ethanol production was chosen for the model due to the amount of available data associated with this type of BCF.

Farm prices are mostly affected by changes in the supply and demand conditions of the market, and of markets of related goods. Given the limited size of BCAP under Alternative 1, the impacts would not be felt by national markets and farm prices would not be affected. However, as BCAP supports the existence of a BCF, it is possible that the creation of this market (closely linked to the farms that produce feedstock) could create an environment in which the farm prices received for the feedstock would increase locally, as the marketing and transactions costs are reduced.

To trigger any of the government payments linked to price and/or production, BCAP would have to affect the overall level of prices and or production for the major crops eligible for those payments. However, payments are only available if prices fall below some level of the loan rate, or if they are below the target prices, or the calculated state revenue. USDA's long term projections, the baseline for this analysis, describe a situation in which farm prices and state revenue are likely to be above the trigger levels, consequently the level of these government payments would be likely to be close to zero. It is not expected that either of the two BCAP scenarios would impact those types of payments.

The government commodity payments that could be affected are (a) the ones received from BCAP itself and (b) any payments that would result from driving acres enrolled in the CRP to exit the program before the contract expires.

As the BCAP projects are implemented the production of feedstock associated with the projects would induce a first level or direct shift as it displaces crops previously produced in those acres. If the displacements of acreage are large enough, market prices would be impacted and those changes in prices would induce a second level of land shifts in response to those new prices. Alternative 1 would introduce changes in land use at the very local level, i.e., at the county or multi-county region. Tables 4.2-2 and 4.2-3 indicate the land use in the areas of influence of each of the potential locations for BCAP projects. Table 4.2-4 summarizes the changes caused by implementing Alternative 1 from the No Action Alternative, and consequently indicates which crops, including lands producing hay, are giving up area for the planting of switchgrass in each of the potential locations. In addition, some acreage not currently cropped would be dedicated to switchgrass. These would vary by region and availability and are not expected to be significant, although for producers there would be a positive impact otherwise the land shift would not be made.

Table 4.2-2. Cropland Use (in acres) in the Selected Sites for Potential Switchgrass BCAP Project Areas under the No Action Alternative

Top 5	Top State	Location	Corn	Sorghum	Oats	Barley	Wheat	Soybeans	Cotton	Rice	Switchgrass	Hay	Cropland
	X	Mellette, SC	2,431,990	677,288	404,432	27,743	4,568,272	939,034	0	0	0	6,104,413	15,153,173
X		Osage, KS	3,760,735	1,220,849	0	0	2,968,153	5,991,283	0	0	0	5,474,073	19,415,091
	X	Fremont, IA	15,587,050	490,152	138,767	0	979,784	13,877,628	0	0	0	2,593,218	33,666,599
	X	Pawnee, NE	11,865,584	1,638,616	48,891	0	2,740,718	10,786,114	0	0	0	2,647,479	29,727,402
	X	Roosevelt, NM	1,122,062	1,904,271	67,447	0	5,399,690	75,552	4,349,833	0	0	1,277,229	14,196,083
	X	Bent, CO	1,864,526	1,607,163	0	2,889	7,166,664	13,437	0	0	0	1,133,963	11,788,642
	X	Chautauqua, KS	1,592,470	1,586,575	16,085	0	6,082,006	2,990,076	84,124	0	0	3,955,298	16,306,634
X	X	Garfield, OK	295,781	1,071,032	81,263	0	17,036,608	727,791	123,557	0	0	3,892,906	23,228,938
X		Callahan, TX	78,166	532,060	534,769	0	4,837,770	0	1,231,839	0	0	2,073,771	9,288,375
	X	Hardeman, TX	92,668	313,031	190,870	0	11,357,421	12,647	1,719,705	0	0	1,926,951	15,613,293
X		Harmon, OK	118,178	331,888	171,627	0	10,575,046	19,234	1,424,993	0	0	1,873,897	14,514,864
	X	Tishomingo, MS	824,125	49,278	0	0	231,679	1,597,926	811,356	0	0	1,883,976	5,398,339
	X	Izard, AR	479,407	115,647	0	0	607,765	3,972,979	575,449	2,574,182	0	2,888,300	11,213,728
	X	McDonald, MO	1,030,807	299,505	14,654	0	1,516,726	2,080,024	0	0	0	5,829,396	10,771,111
X		Lawrence, MO	1,063,085	210,995	0	0	1,215,803	1,957,836	0	0	0	6,785,648	11,233,366
	X	Alexander, IL	6,049,409	337,883	0	0	2,416,232	9,003,293	1,135,954	718,756	0	2,005,136	21,666,663
	X	Marion, KY	1,390,920	2,165	0	0	394,996	1,164,802	0	0	0	5,699,556	8,652,439
	X	Lawrence, TN	1,085,917	18,530	0	0	370,917	1,338,861	738,301	0	0	3,360,511	6,913,038
	X	Colbert, AL	896,415	18,134	0	0	272,015	1,550,236	773,860	0	0	2,572,521	6,083,181
	X	Dillon, SC	1,488,200	5,808	85,878	4,947	1,007,183	2,900,691	777,388	0	0	564,990	6,835,085
	X	Mecklenburg, VA	596,916	5,468	45,225	19,908	601,643	1,390,701	769,121	0	0	1,965,966	5,394,948
	X	Person, NC	464,235	4,963	67,093	24,902	600,011	1,318,574	531,512	0	0	2,047,205	5,058,495

Table 4.2-3. Cropland Use (acres) in the Selected Sites for Potential Switchgrass BCAP Project Areas under Alternative 1

Top 5	Top State	Location	Corn	Sorghum	Oats	Barley	Wheat	Soybeans	Cotton	Rice	Switchgrass	Hay	Cropland
	X	Mellette, SC	2,430,282	676,725	404,432	27,739	4,568,272	939,034	0	0	44,002	6,097,096	15,187,582
X		Osage, KS	3,754,775	1,217,675	0	0	2,962,105	5,991,283	0	0	23,366	5,471,024	19,420,228
	X	Fremont, IA	15,576,806	489,360	138,767	0	979,784	13,867,886	0	0	25,488	2,593,094	33,671,185
	X	Pawnee, NE	11,857,636	1,635,320	48,891	0	2,734,545	10,786,114	0	0	25,132	2,645,184	29,732,822
	X	Roosevelt, NM	1,121,799	1,903,051	67,447	0	5,378,726	75,541	4,345,190	0	33,529	1,277,035	14,202,319
	X	Bent, CO	1,862,893	1,601,509	0	2,889	7,137,179	13,437	0	0	38,331	1,132,404	11,788,642
	X	Chautauqua, KS	1,590,907	1,584,703	16,085	0	6,065,960	2,990,076	84,124	0	23,350	3,951,975	16,307,181
X	X	Garfield, OK	295,781	1,071,032	81,263	0	17,020,655	727,791	123,557	0	24,901	3,892,906	23,237,886
X		Callahan, TX	78,166	528,141	534,769	0	4,828,064	0	1,224,573	0	33,915	2,071,638	9,299,266
	X	Hardeman, TX	92,668	312,313	190,870	0	11,331,247	12,647	1,718,158	0	29,048	1,926,112	15,613,064
X		Harmon, OK	118,178	331,404	171,608	0	10,558,650	19,234	1,423,800	0	28,321	1,873,052	14,524,248
	X	Tishomingo, MS	819,811	48,422	0	0	230,358	1,597,926	808,072	0	23,290	1,868,573	5,396,451
	X	Izard, AR	478,869	112,937	0	0	599,522	3,972,979	569,674	2,573,282	24,302	2,882,163	11,213,727
	X	McDonald, MO	1,030,807	296,309	14,654	0	1,516,726	2,068,024	0	0	22,558	5,822,371	10,771,449
X		Lawrence, MO	1,063,085	208,294	0	0	1,215,803	1,945,936	0	0	22,498	6,777,689	11,233,304
	X	Alexander, IL	6,046,302	337,365	0	0	2,416,232	9,003,293	1,135,467	717,959	23,413	2,003,621	21,683,652
	X	Marion, KY	1,390,920	2,165	0	0	394,996	1,164,802	0	0	22,927	5,676,629	8,652,439
	X	Lawrence, TN	1,082,762	18,475	0	0	369,888	1,338,861	733,630	0	22,856	3,344,929	6,911,401
	X	Colbert, AL	896,415	18,088	0	0	272,015	1,550,236	773,860	0	23,190	2,567,014	6,100,818
	X	Dillon, SC	1,488,200	5,781	85,878	4,945	1,007,183	2,887,305	773,625	0	24,727	564,990	6,842,634
	X	Mecklenburg, VA	592,145	5,400	45,225	19,762	601,643	1,379,556	769,121	0	23,312	1,958,784	5,394,948
	X	Person, NC	460,188	4,963	67,093	24,818	600,011	1,308,934	527,596	0	23,453	2,041,439	5,058,495

Table 4.2-4. Change Under Alternative 1 from the No Action Alternative in Cropland Use in the Selected Sites for Potential Switchgrass BCAP Project Areas

Top 5	Top State	Location	Corn	Sorghum	Oats	Barley	Wheat	Soybeans	Cotton	Rice	Switchgrass	Hay
	X	Mellette, SC	(1,708)	(563)	0	(4)	0	0	0	0	44,002	(7,317)
X		Osage, KS	(5,960)	(3,173)	0	0	(6,048)	0	0	0	23,366	(3,048)
	X	Fremont, IA	(10,244)	(792)	0	0	0	(9,742)	0	0	25,488	(124)
	X	Pawnee, NE	(7,948)	(3,296)	0	0	(6,173)	0	0	0	25,132	(2,294)
	X	Roosevelt, NM	(263)	(1,219)	0	0	(20,963)	(11)	(4,643)	0	33,529	(193)
	X	Bent, CO	(1,633)	(5,653)	0	0	(29,485)	0	0	0	38,331	(1,559)
	X	Chautauqua, KS	(1,563)	(1,872)	0	0	(16,046)	0	0	0	23,350	(3,323)
X	X	Garfield, OK	0	0	0	0	(15,953)	0	0	0	24,901	0
X		Callahan, TX	0	(3,919)	0	0	(9,706)	0	(7,266)	0	33,915	(2,133)
	X	Hardeman, TX	0	(718)	0	0	(26,174)	0	(1,547)	0	29,048	(839)
X		Harmon, OK	0	(484)	(19)	0	(16,396)	0	(1,193)	0	28,321	(845)
	X	Tishomingo, MS	(4,314)	(856)	0	0	(1,320)	0	(3,285)	0	23,290	(15,403)
	X	Izard, AR	(538)	(2,710)	0	0	(8,243)	0	(5,775)	(900)	24,302	(6,137)
	X	McDonald, MO	0	(3,196)	0	0	0	(12,000)	0	0	22,558	(7,025)
X		Lawrence, MO	0	(2,701)	0	0	0	(11,900)	0	0	22,498	(7,958)
	X	Alexander, IL	(3,107)	(518)	0	0	0	0	(487)	(797)	23,413	(1,515)
	X	Marion, KY	0	0	0	0	0	0	0	0	22,927	(23,294)
	X	Lawrence, TN	(3,155)	(56)	0	0	(1,029)	0	(4,671)	0	22,856	(15,583)
	X	Colbert, AL	0	(46)	0	0	0	0	0	0	23,190	(5,507)
	X	Dillon, SC	0	(27)	0	(2)	0	(13,386)	(3,764)	0	24,727	0
	X	Mecklenburg, VA	(4,771)	(68)	0	(145)	0	(11,145)	0	0	23,312	(7,183)
	X	Person, NC	(4,047)	0	0	(84)	0	(9,640)	(3,916)	0	23,453	(5,766)

INDIRECT IMPACTS

Economic impacts vary by plant location. The impacts of growing a dedicated energy crop in a region would impact several sectors. The agricultural sector, defined in broad terms which would include input suppliers, would be impacted by the creation of a new market for the dedicated energy crop and would also be impacted by changes in land use. Additional local transportation would be required to move the biomass from the farm gate to the BCF. Finally, it is assumed that a $45 per ton payment would be made to farmers delivering biomass to the BCF to equal the matching payment of $45 per ton. Since the biomass price used in the analysis was $60, a $30 per ton impact is incorporated as an impact gain to farmer's (proprietor's) income. These impacts are estimated for the regions identified by POLYSYS.

Direct Payments

Under Alternative 1, it was assumed that approximately $10 million would be required for the establishment and CHST of enough switchgrass (166,667 tons X $60 per ton) to supply a BCF. As shown in Tables 4.2-3 and 4.2-4 impacts would result from changes in land use. These changes would lead to increased direct transportation costs (approximately $1.3 million) in each state (Table 4.2-5) and for the top five BCAP project locations (Table 4.2-6). The first impact estimated is that of producing the dedicated energy crop. It was estimated that producers of the dedicated energy crop would require $60/dry ton (approximately $10 million total investment) to establish the crop. This is not a windfall, however, because to receive the $10 million, producers must convert some of their land producing traditional crops into the dedicated energy crop. This would result in negative impacts within the community as inputs for those traditional crops are not purchased. These costs depend on the community and the changes in land use required to meet the demand for dedicated energy crops. The direct costs for this land use change ranged from a decline of $1.5 million for the Tennessee facility, to a decline of $5.0 million for the Iowa facility.

Transportation costs were estimated based on Brechbill and Tyner (2008). Their data indicate that transportation costs vary depending on distance from the plant. Their estimates ranged from $3.26 per dry ton if the haul was within five miles from the plant to almost $10 per dry ton when the switchgrass requires 50 miles of transportation. Other estimates included a cost of $22.00 per wet ton of switchgrass within a 50 mile region (Jackson 2009). Assuming the switchgrass was baled at 20 percent moisture, the cost to the plant would be estimated at $27.50 per dry ton. Kumar and Sokhansanj (2007) estimate the cost per dry ton to be $21.19 in 2007 dollars. If this is inflated to 2009 using a consumer price index, then the cost per dry ton would exceed $22.40. To estimate the impacts, the analysis uses Brechbill and Tyner (2008). Using the area of each of the 5-mile increments as weights, a weighted cost of $7.78 per dry ton is estimated. Multiplying this per ton cost by the number of tons required annually by the BCF, it was determined that transportation costs would approach $1.3 million for each BCF.

Table 4.2-5. Direct, Indirect, and Induced Economic Impacts by Initial State Year 3 (TIO and Jobs)

Dedicated Energy Crop				Land Use Change				Transportation			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Oklahoma:											
$10,000,020	$416,840	$8,237,354	$18,654,214	($2,431,365)	($600,194)	($1,179,135)	($4,210,694)	$1,297,086	$595,759	$738,955	$2,631,800
224	5	82	311	(55)	(6)	(12)	(73)	10	4	7	22
South Dakota:											
$10,000,020	$409,186	$7,086,434	$17,495,640	($4,196,516)	($1,099,749)	($1,941,598)	($7,237,863)	$1,297,086	$466,044	$525,114	$2,288,244
134	5	76	215	(55)	(10)	(21)	(86)	11	4	6	21
Tennessee:											
$10,000,020	$457,124	$9,595,158	$20,052,302	($1,519,291)	($447,074)	($689,770)	($2,656,135)	$1,297,086	$554,976	$785,128	$2,637,190
180	4	83	268	(34)	(5)	(6)	(45)	10	4	7	21
Texas:											
$10,000,020	$368,186	$5,200,350	$15,568,556	($2,346,468)	($440,322)	($658,702)	($3,445,492)	$1,297,086	$447,603	$412,737	$2,157,426
329	5	59	393	(90)	(4)	(22)	(108)	10	3	5	19
South Carolina:											
$10,000,020	$459,690	$7,347,561	$17,807,271	($3,541,669)	($477,934)	($1,459,151)	($5,478,754)	$1,297,086	$430,699	$511,230	$2,239,015
128	5	85	218	(46)	(5)	(17)	(68)	11	4	6	21
Iowa:											
$10,000,020	$541,067	$9,502,505	$20,043,592	($5,071,460)	($1,305,457)	($2,860,976)	($9,237,893)	$1,297,086	$526,118	$860,763	$2,683,967
148	6	96	250	(69)	(11)	(29)	(109)	11	5	9	24
Kentucky:											
$10,000,020	$682,325	$9,170,480	$19,852,825	($2,329,400)	($528,761)	($1,339,671)	($4,197,832)	$1,297,086	$466,306	$665,893	$2,429,285
562	8	94	664	(131)	(6)	(14)	(151)	10	4	7	21
Colorado:											
$10,000,020	$510,445	$6,808,577	$17,319,042	($3,428,649)	($785,326)	($1,270,663)	($5,484,638)	$1,297,086	$590,370	$625,733	$2,513,190
141	5	69	215	(49)	(7)	(13)	(68)	12	5	7	23

Table 4.2-5. Direct, Indirect, and Induced Economic Impacts by Initial State Year 3 (TIO and Jobs) (cont'd)

Dedicated Energy Crop				Land Use Change				Transportation			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Missouri:											
$10,000,020	$458,469	$7,817,574	$18,276,063	($2,259,658)	($507,921)	($1,090,376)	($3,857,955)	$1,297,086	$487,852	$760,241	$2,545,179
142	6	86	233	(34)	(5)	(12)	(51)	10	4	8	23
New Mexico:											
$10,000,020	$385,314	$6,323,308	$16,708,642	($3,746,230)	($1,253,428)	($1,395,489)	($6,395,147)	$1,297,086	$671,340	$554,692	$2,523,118
70	5	62	137	(37)	(14)	(14)	(65)	10	3	5	19
Kansas:											
$10,000,020	$364,657	$8,347,549	$18,712,226	($1,994,470)	($678,935)	($1,001,758)	($3,675,163)	$1,297,086	$802,016	$818,174	$2,917,276
195	4	77	275	(39)	(5)	(9)	(52)	11	4	8	23
Indiana:											
$10,000,020	$359,838	$5,998,776	$16,358,634	($1,974,802)	($375,430)	($606,917)	($2,957,149)	$1,297,086	$428,640	$509,089	$2,234,815
258	5	69	332	(45)	(5)	(7)	(57)	11	4	6	21
Mississippi:											
$10,000,020	$328,817	$6,140,522	$16,469,359	($2,845,438)	($651,393)	($853,779)	($4,350,610)	$1,297,086	$481,074	$493,507	$2,271,667
190	4	67	262	(113)	(10)	(10)	(132)	11	4	5	20
Alabama:											
$10,000,020	$352,869	$6,883,275	$17,236,164	($2,973,820)	($815,694)	($1,051,317)	($4,840,831)	$1,297,086	$473,965	$541,050	$2,312,101
168	5	70	242	(128)	(11)	(11)	(150)	10	4	6	20
Nebraska:											
$10,000,020	$452,677	$7,341,372	$17,794,069	($3,951,698)	($834,149)	($1,617,540)	($6,403,387)	$1,297,086	$408,857	$675,331	$2,381,274
149	6	84	239	(59)	(11)	(19)	(88)	9	3	8	21
Virginia:											
$10,000,020	$481,715	$10,069,458	$20,551,193	($2,793,087)	($957,975)	($1,675,053)	($5,426,115)	$1,297,086	$499,482	$825,602	$2,622,170
69	5	97	171	(32)	(10)	(16)	(58)	10	4	8	23

Table 4.2-5. Direct, Indirect, and Induced Economic Impacts by Initial State Year 3 (TIO and Jobs) (cont'd)

Dedicated Energy Crop				Land Use Change				Transportation			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Arkansas:											
$10,000,020	$343,838	$6,334,260	$16,678,118	($1,789,866)	($365,579)	($653,065)	($2,808,510)	$1,297,086	$444,149	$578,819	$2,320,054
164	6	75	244	(29)	(7)	(8)	(43)	11	4	7	22
North Carolina:											
$10,000,020	$459,434	$10,179,516	$20,638,970	($3,250,226)	($1,003,907)	($2,227,711)	($6,481,844)	$1,297,086	$505,843	$818,303	$2,621,231
166	5	98	269	(47)	(8)	(22)	(76)	10	4	8	23

TIO = total industry output

Table 4.2-6. Direct, Indirect, and Induced Economic Impacts by Five Top Potential Project Locations Year 3 (TIO and Jobs)

Dedicated Energy Crop				Land Use Change				Transportation			
Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Plant #1:											
$10,000,020	$416,840	$8,237,354	$18,654,214	($2,431,365)	($600,194)	($1,179,135)	($4,210,694)	$1,297,086	$595,759	$738,955	$2,631,800
224	5	82	311	(55)	(6)	(12)	(73)	10	4	7	22
Plant #2:											
$1 0,000,020	$454,205	$7,661,983	$18,116,208	($2,286,062)	($502,071)	($1,044,922)	($3,833,055)	$1,297,086	$497,308	$766,527	$2,560,920
170	5	84	259	(41)	(5)	(12)	(58)	10	4	8	23
Plant #3:											
$10,000,020	$392,189	$5,831,789	$16,223,998	($2,086,956)	($509,445)	($703,033)	($3,299,434)	$1,297,086	$414,962	$478,589	$2,190,637
536	5	60	601	(98)	(7)	(7)	(111)	10	3	5	18
Plant #4:											
$10,000,020	$372,145	$5,364,405	$15,736,570	($2,450,100)	($481,741)	($717,434)	($3,649,275)	$1,297,086	$461,692	$429,537	$2,188,315
294	5	60	359	(70)	(6)	(8)	(84)	10	3	5	18
Plant #5:											
$10,000,020	$489,055	$9,011,816	$19,500,891	($2,887,710)	($1,051,196)	($1,496,225)	($5,435,131)	$1,297,086	$757,168	$937,563	$2,991,817
222	5	84	311	(64)	(6)	(14)	(84)	10	5	9	23

TIO = total industry output

The final direct impact is a result of the $90 per dry ton payment to "producers" ($45 matching payment plus $45 from the BCF). Since the projected cost of the biomass was $60 per ton, the farmer would receive a $30 enticement fee. In reality, this fee could be split among several economic entities. In this analysis, it is assumed that proprietors in the community would receive this. The value of $5.0 million was used for each of the regions.

Total Economic Impacts

Total economic impact ranges from $28 million in Tennessee to $19 million in South Dakota and New Mexico (Figure 4.2-4). Each of the top five plants has a net positive impact to their regions, averaging between $21 million and $25 million. Land use changes would create negative impacts within a region. These negative impacts taken across all economic impacts (direct, indirect, and induced) range from nearly $10 million for the simulated plant located in Iowa to slightly more than $2.5 million for the plant located in southwest Tennessee (Figure 4.2-5). The largest positive impact within each of the study regions occurs in maintaining and harvesting the dedicated energy crop. The economic impact resulting from the $30 per ton paid to individuals (proprietor's income) within the region for growing, harvesting, and collecting the material ranges from $6.2 million (Plant #3) to nearly $7.9 million (Plant #5) (Figure 4.2-5).

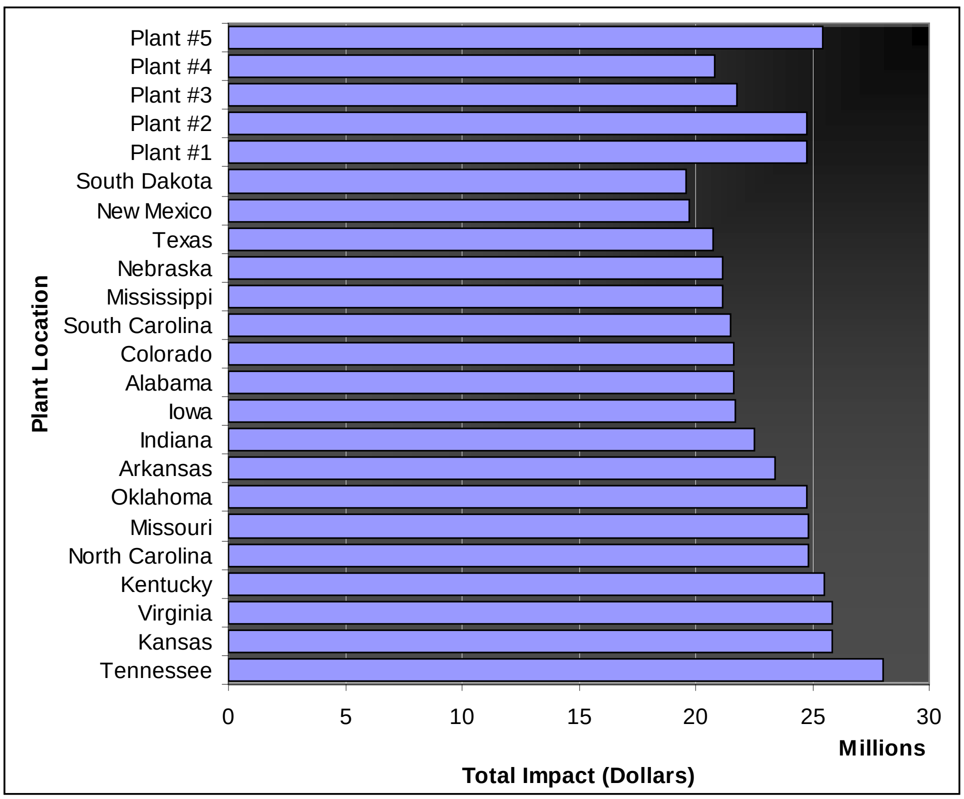


Figure 4.2-4. Direct, Indirect, and Induced Economic Impacts for Both the State and Top Five Potential Switchgrass BCAP Project Areas

Additionally, direct expenditures to producers would be anticipated to create approximately 70 to 250 jobs depending upon the location within the states, or approximately 170 to more than 500 jobs within the top five sites. In general, it appears from the model results that more jobs would be created from the production of a perennial herbaceous dedicated energy crop than lost from the land use shifts and associated input suppliers.

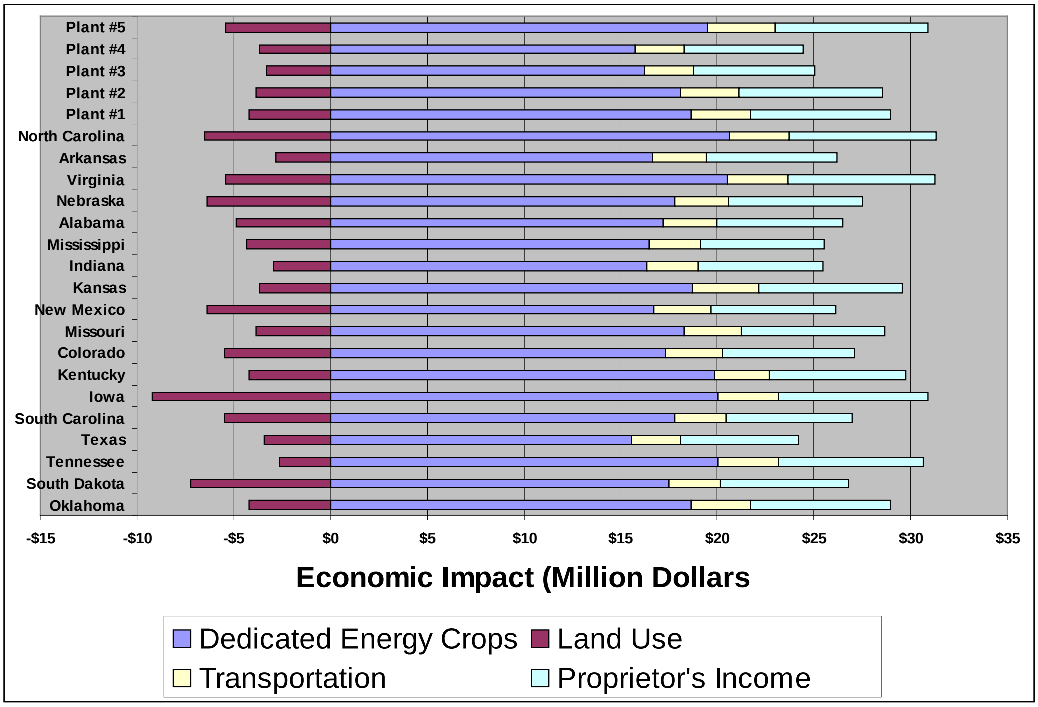


Figure 4.2-5. Economic Impacts for Each Type Estimated by Potential Switchgrass BCAP Project Areas

4.2.3.2 Short Rotation Woody Crops

The selection process discussed above resulted in the selection of the seven poplar and two willow sites presented in Figures 4.2-6 and 4.2-7, where the general locations and specific counties of influence are shown.

DIRECT IMPACTS

As with perennial herbaceous species, Realized Net Farm Income at the national level under Alternative 1 using SRWC dedicated energy crops would be expected to remain unchanged from the baseline conditions due to the limited funding assumption under Alternative 1; therefore, there would not be expected national level effects. It is expected that net returns at the farm level would likely improve for those producers selected as part of the project area for BCAP under this alternative. The production of a dedicated energy crop would be expected to create a higher valued opportunity for producers or those producers would not have selected to participate in BCAP. Depending on the overall acres in a county involved in the BCAP, the net returns for agriculture for that county or region could see significant gains under Alternative 1.

Figure 4.2-6. Potential Poplar BCAP Project Acres in States with Sufficient Feedstock Production Potential

The information in Table 4.2-7 indicates the impact on total net returns for SRWC adoption in the agricultural sector generated by the potential BCAP projects under this alternative. BCAP payments were assumed to continue for up to 15 years in the case of these SRWC. In the analysis, willow plantings are assumed to be planted once during this time period and harvested every fourth year. Since harvest would take place on the 4th, 8th, and 12th years, a contract of 12 years in length is assumed. For poplar it is assumed that a production period is eight years in length with a harvest on the eighth year. A second establishment period could occur during the 15-year contracted period; however, establishment payments would only occur once during the contract period. As such, the model used an eight year period to account for the combined effects of the

Establishment and Annual Payments Program of BCAP resulting from the complete life-cycle of poplar.

Figure 4.2-7. Potential Willow BCAP Project Areas in States with Sufficient Feedstock Production Potential

The information in Table 4.2-7 is presented for each of the three stages – Establishment, Maintenance, and Harvest. In the establishment year, the first row of data, change in crop net returns including dedicated energy crop establishment, contains the costs of planting sufficient acres in the specified crop within the region along with the reduction in net returns that occur because of the land use changes that occurred.

The second row includes the 75 percent BCAP establishment payment. The third row has the Farm payments that include the average per acre net returns plus average costs incurred in maintaining the woody crop (BCAP annual payments). The next two rows total the BCAP payments and the total estimated change in returns. During the

Table 4.2-7. Impact on Net Returns
(constant U.S. Dollars) by Potential SRWC BCAP Project Area and Source

Site Number	1	3	4	6	7	9	10	1	3
Dedicated SRWC	Poplar							Willow	
YEAR 1:									
Change in Crop Net Returns including Dedicated Energy Crop Establishment	(35,614)	(25,903)	(34,720)	(35,659)	(43,802)	(33,235)	(30,353)	(56,645)	(49,844)
BCAP Establishment Payments	21,335	8,506	14,479	15,810	23,897	14,396	18,479	37,553	37,383
BCAP Farm Payments	18,329	23,150	30,654	26,173	26,818	24,185	14,263	2,559	3,778
Total BCAP Payments	39,664	31,656	45,134	41,983	50,715	38,581	32,741	40,112	41,161
Total Change in Returns	4,050	5,753	10,413	6,324	6,913	5,347	2,388	(16,533)	(8,683)
Maintenance Years:									
Reduced Crop Net Returns	(18,329)	(23,150)	(30,654)	(26,173)	(26,818)	(24,185)	(14,263)	(2,559)	(3,778)
Total BCAP Payments	18,329	23,150	30,654	26,173	26,818	24,185	14,263	2,559	3,778
Total Change in Returns	0	0	0	0	0	0	0	0	0
Harvest Year:									
Reduced Crop Net Returns including Dedicated Energy Crop Harvest	(21,836)	(28,286)	(34,129)	(30,822)	(30,082)	(29,116)	(18,447)	(10,156)	(11,467)
BCAP Farm Payments	18,329	23,150	30,654	26,173	26,818	24,185	14,263	2,559	3,778
Total BCAP Payments	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500
Payment from Plant	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500	7,500
Total Change in Returns	11,493	9,865	11,525	10,351	11,736	10,069	10,816	7,404	7,311
Total change in Returns over the length of the contract									
	15,543	15,617	21,939	16,675	18,649	15,415	13,204	5,678	13,249

[a] Does not include an estimate of the time value of money.

maintenance years, the costs are estimated as returns foregone plus the average maintenance costs of the plantings. These are exactly equal to the BCAP annual payments made to the producer. In the Harvest year, the farmer receives the BCAP annual payment plus $90 per ton of which 50 percent is paid for by the BCAP Matching Payments Program. The bottom row in Table 4.2-7 contains the sum of returns for the 8-year poplar or 12-year willow contracts.

Table 4.2-7 shows that in most potential project locations the impact on Total Net Returns are positive, and only one is marginally negative. This occurs with willow in a region with smaller yields and higher total establishment costs and had the contract been extended to a 20 year period it would have been positive.

Again, as with the perennial herbaceous species, farm prices are mostly affected by changes in the supply and demand conditions of the market, and of markets of related goods. Given the limited size of BCAP under Alternative 1, the impacts would not be felt by national markets and farm prices would not be affected. However, as BCAP supports the existence of a BCF, it is possible that the creation of this market (closely linked to the farms that produce feedstock) could create an environment in which the farm prices received for the feedstock would increase locally, as the marketing and transactions costs are reduced. This condition is not captured in the analysis due to the limitations of the available data.

To trigger any of the government payments linked to price and/or production, BCAP would have to affect the overall level of prices and or production for the major crops eligible for those payments. However, payments are only available if prices fall below some level of the loan rate, or if they are below the target prices or the calculated state revenue. USDA's long term projections, the baseline for this analysis, describe a situation in which farm prices and state revenue are likely to be above the trigger levels, consequently the level of these government payments would be likely to be close to zero. As in the perennial herbaceous crop section, it is not expected that either of the two BCAP scenarios would impact this type of payments.

The government commodity payments that could be affected are (a) the ones received from BCAP itself and (b) any payments that would result from driving acres enrolled in the CRP to exit the program before the contract expires.

As the BCAP projects are implemented the production of feedstock associated with the projects would induce a first level or direct shift as it displaces crops previously produced in those acres. If the displacements of acreage are large enough, market prices would be impacted and those changes in prices would induce a second level of land shifts in response to those new prices. Alternative 1 would introduce changes in land use at the very local level, i.e., at the county or multi-county region. Table 4.2-8 indicates the changes in land use in the areas of influence of each of the potential locations for BCAP projects, summarizes the changes caused by implementing Alternative 1 from the No Action Alternative, and consequently indicates which crops are giving up area for the planting of dedicated energy crops in each of the potential locations.

Table 4.2-8. Change Under Alternative 1 from the No Action Alternative in Cropland Use in the Selected Site for Potential SRWC BCAP Project Areas (acres)

Site	Feedstock	Barley	Corn	Cotton	Hay	Oats	Rice	Sorghum	Soybeans	Wheat	SRWC
1	Poplar	183	192	0	(642)	0	0	0	(93,687)	0	96,728
3	Poplar	0	(599)	(34,253)	537	0	0	0	(734)	(487)	41,339
4	Poplar	0	(2,164)	(50,172)	7,846	0	0	0	354	(2,901)	70,372
6	Poplar	0	0	(19,842)	496	0	(34,355)	(2,067)	0	(867)	58,007
7	Poplar	0	(1,093)	(842)	860	0	(63,334)	(3,042)	(8,849)	0	86,218
9	Poplar	0	(36)	(28,794)	1,885	0	(18,014)	(1,043)	0	(1,046)	52,199
10	Poplar	0	(26,301)	0	(22,292)	0	0	(9,397)	(7,260)	(23,307)	88,557
1	Willow	0	(586)	0	3,873	(3,136)	0	0	(10,412)	(13,313)	44,585
3	Willow	0	(28,253)	0	2,871	(242)	0	0	0	(430)	44,306

INDIRECT IMPACTS

Economic impacts vary by plant location. The impacts of growing a dedicated energy crop in a region would impact several sectors. The agricultural sector, defined in broad terms which would include input suppliers, would be impacted by the creation of a new market for the dedicated energy crop and would also be impacted by changes in land use. Additional local transportation would be required to move the biomass from the farm gate to the BCF. Finally, it is assumed that a $45 per ton payment would be made to farmers delivering biomass to the BCF, equaling the matching payment of $45 per ton. Since the biomass price used in the analysis was $70 per ton for poplar and $90 per ton for willow, a $20 per ton impact is incorporated as an impact gain to farmer's (Proprietor's) income for poplars with no impact on Proprietor's income for willows. These impacts are estimated for the regions previously identified by POLYSYS.

Direct Payments

Under Alternative 1 for SRWC, land use changes occur and farmers sell poplar and willow at $70 per ton and $90 per ton, respectively. In addition, these changes would lead to increased direct transportation costs (approximately $1.3 million) in each state.

The first impact estimated is the impact as a result of producing the dedicated energy crop. It was estimated that producers of the dedicated energy crop would require $11.7 million and $15.0 million for poplar and willow, respectively, in gross returns each year. This is not a windfall; however, because to receive the returns producers must convert some of their land currently producing traditional crops or pasture into the dedicated energy crop. This requires the purchase of inputs to establish, maintain, and harvest their dedicated energy crop. The impact of this return differs depending on the community. The range in total economic impact for the poplar sites as a result of establishing, maintaining, and harvesting the SRWC ranges from $19 million to $22 million depending on the site (Table 4.2-9). In the two willow sites, the total direct economic impact of the $15 million is estimated to create total TIO of $23 million and $27 million at Region 1-Willow and Region 3-Willow sites, respectively.

Table 4.2-9. Direct, Indirect, and Induced Economic Impacts by Initial State Year 3 (TIO [$thousands] and Jobs Number

Region and economic Indicator	Dedicated Energy Crops				Land Use				Transportation			
	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total	Direct	Indirect	Induced	Total
Region 1- Poplar												
TIO	11,667	523	9,861	22,051	(20,836)	(5,551)	(10,822)	(37,208)	4,583	1,733	2,339	8,656
Jobs	96	7	109	212	(156)	(46)	(119)	(321)	38	15	26	79
Region 3- Poplar												
TIO	11,667	505	7,594	19,766	(16,841)	(6,209)	(5,634)	(28,684)	4,583	1,519	1,704	7,806
Jobs	196	7	84	287	(177)	(77)	(63)	(317)	40	14	19	73
Region 4- Poplar												
TIO	11,667	533	8,834	21,033	(20,644)	(6,485)	(7,864)	(34,993)	4,583	1,704	2,060	8,348
Jobs	223	7	93	324	(196)	(93)	(85)	(373)	39	16	22	77
Region 6- Poplar												
TIO	11,667	576	9,599	21,842	(24,182)	(9,538)	(11,798)	(45,517)	4,583	2,024	2,796	9,403
Jobs	255	7	92	354	(403)	(91)	(115)	(609)	36	15	27	77
Region 7- Poplar												
TIO	11,667	418	8,078	20,162	(24,221)	(7,649)	(9,886)	(41,756)	4,583	2,396	2,109	9,088
Jobs	113	5	83	200	(423)	(42)	(100)	(565)	41	14	23	78
Region 9- Poplar												
TIO	11,667	587	9,678	21,932	(23,695)	(9,634)	(11,840)	(45,169)	4,583	2,065	2,914	9,562
Jobs	288	7	93	388	(419)	(102)	(116)	(637)	35	14	29	78
Region 10- Poplar												
TIO	11,667	455	9,414	21,536	(23,414)	(8,487)	(11,153)	(43,054)	4,583	2,886	2,937	10,406
Jobs	175	6	90	271	(447)	(59)	(107)	(613)	37	16	29	82
Region 1 - Willow												
TIO	15,000	1,334	6,677	23,011	(3,892)	(528)	(1,453)	(5,874)	4,583	1,246	1,832	7,661
Jobs	291	27	75	393	(173)	(4)	(16)	(194)	39	10	21	70
Region 3 - Willow												
TIO	15,000	2,300	9,871	27,171	(6,374)	(1,404)	(3,204)	(10,982)	4,583	1,939	2,631	9,153
Jobs	200	23	91	314	(169)	(10)	(29)	(207)	35	12	24	71

TIO = total industry output

Not all impacts would be positive. The community would be impacted as a result of changes in land use required to meet the demand for dedicated energy crops. This change in land use would result in negative impacts within the community as inputs for those traditional crops would not be purchased. For willow, it is estimated that a reduction in crop acreage planted to traditional crops would result in a decrease in direct economic activity because of the reduction in sales of $3.9 million at Region 1-Willow and $6.4 million at Region 3-Willlow. For poplar, the impact would be greater because of the number of acres required to produce an annual production level of 166,667 tons. The estimated direct impact ranges from $16.8 million at Region 3-Poplar to $23.4 million at Region 10-Poplar. These impacts result as acreage is shifted from traditional crops to dedicated energy crops. Changes in total economic activity as a result of land use change are also displayed in Table 4.2-9 and range from $34 million to $45 million for poplar and approximately $5 million to $10 million for willow.

The third impact that is measured in this report considers the impact of transporting the cellulose produced from the SRWC to the BCF. To transport approximately 0.2 million dry tons of woody biomass to the BCF each year, an estimated $4.6 million would be required. When added to the economy, this would result in increased economic activity ranging from a low of $7.8 million in Region 3-Poplar to a high of $10.4 million in the areas surrounding Region 10-Poplar.

The fourth and final direct impact is a result of the $90 per dry ton payment to "producers" ($45 matching payment plus $45 from the BCF). Since the projected cost of the poplar was $70 per ton, the farmer would receive $20 per ton when the crop was delivered. Per the BCAP proposed rule, matching payments would only be available for two years during the contract period from the date of delivery and acceptance of the first matching payment; it is assumed that the matching payments would be received in only in the final years for poplars. In reality, this fee could be split among several economic entities. In this analysis, it is assumed that proprietors in the community would receive the $3.3 million. Therefore, a one-time impact would occur with poplars and the economic activity generated ranges from $4.3 million to $5.0 million (Table 4.2-10). Another measure of success would be the number of jobs created. The analysis with regard to both poplar and willow indicated that this might be a net wash. As seen in Tables 4.2-9 and 4.2-10, each economic impact has an impact on the number jobs. Growing the SRWC would create between 200 and 400 jobs depending on the species and the community. However, shifting out of more labor intensive production to perennial dedicated energy crops results in a decrease in jobs ranging from just under 200 to more than 600 (see Table 4.2-9). The increase in Proprietor's Income as a result of planting poplar is estimated to increase the number of jobs by approximately 30 in each region.

TOTAL ECONOMIC IMPACTS

Only one poplar region demonstrates positive economic activity as a result of planting, maintaining, harvesting, and transporting poplar (Region 3-Poplar). The other poplar regions show decreases in economic activity. However, one must remember these data

Table 4.2-10. Economic Activity as a Result of Increased Proprietor's Income within the Poplar Regions

Poplar Region	Economic Indicator	Direct	Indirect	Induced	Total
1	TIO	$3,333,340	$417,871	$865,415	$4,616,626
	Jobs	18.2	4.2	9.8	32.2
3	TIO	$3,333,340	$359,882	$632,529	$4,325,751
	Jobs	16.6	3.6	7.3	27.5
4	TIO	$3,333,340	$450,927	$833,567	$4,617,834
	Jobs	17.5	4.3	9.2	31.0
6	TIO	$3,333,340	$543,675	$1,140,480	$5,017,495
	Jobs	17.2	4.6	11.4	33.2
7	TIO	$3,333,340	$402,441	$833,965	$4,569,746
	Jobs	17.7	3.8	9.0	30.5
9	TIO	$3,333,340	$526,043	$1,188,991	$5,048,374
	Jobs	17.2	4.5	12.0	33.7
10	TIO	$3,333,340	$578,621	$1,038,888	$4,950,849
	Jobs	17.2	4.7	10.4	32.3

TIO = total industry output

estimates do not include the impacts of manufacturing and transporting the fuel. Both willow regions have a positive impact with Region 1-Willow displaying a $24.8 million and Region 3-Willow a $25.3 million impact (Table 4.2-11 and Figure 4.2-8). This difference is largely a result of the contractual arrangements. With poplar, the assumption is that you get a single harvest 8 years into the future during your eight year contract. The willow contract can go 12 years and during those 12 years you establish once and harvest three times.

Table 4.2-11. Estimated Total Economic Impacts by Activity Type

Site	Dedicated Energy Crops	Land Use	Transpor-tation	Proprietor's Income	Total Economic Impact
			Thousand Dollars		
Region 1- Poplar	22,051	(37,208)	8,656	4,617	(1,884)
Region 3- Poplar	19,766	(28,684)	7,806	4,326	3,213
Region 4- Poplar	21,033	(34,993)	8,348	4,618	(994)
Region 6- Poplar	21,842	(45,517)	9,403	5,017	(9,254)
Region 7- Poplar	20,162	(41,756)	9,088	4,570	(7,936)
Region 9- Poplar	21,932	(45,169)	9,562	5,048	(8,626)
Region 10- Poplar	21,536	(43,054)	10,406	4,951	(6,161)
Region 1 - Willow	23,011	(5,873.94)	7,661	0	24,798
Region 3 - Willow	27,171	(10,981.9)	9,153	0	25,342

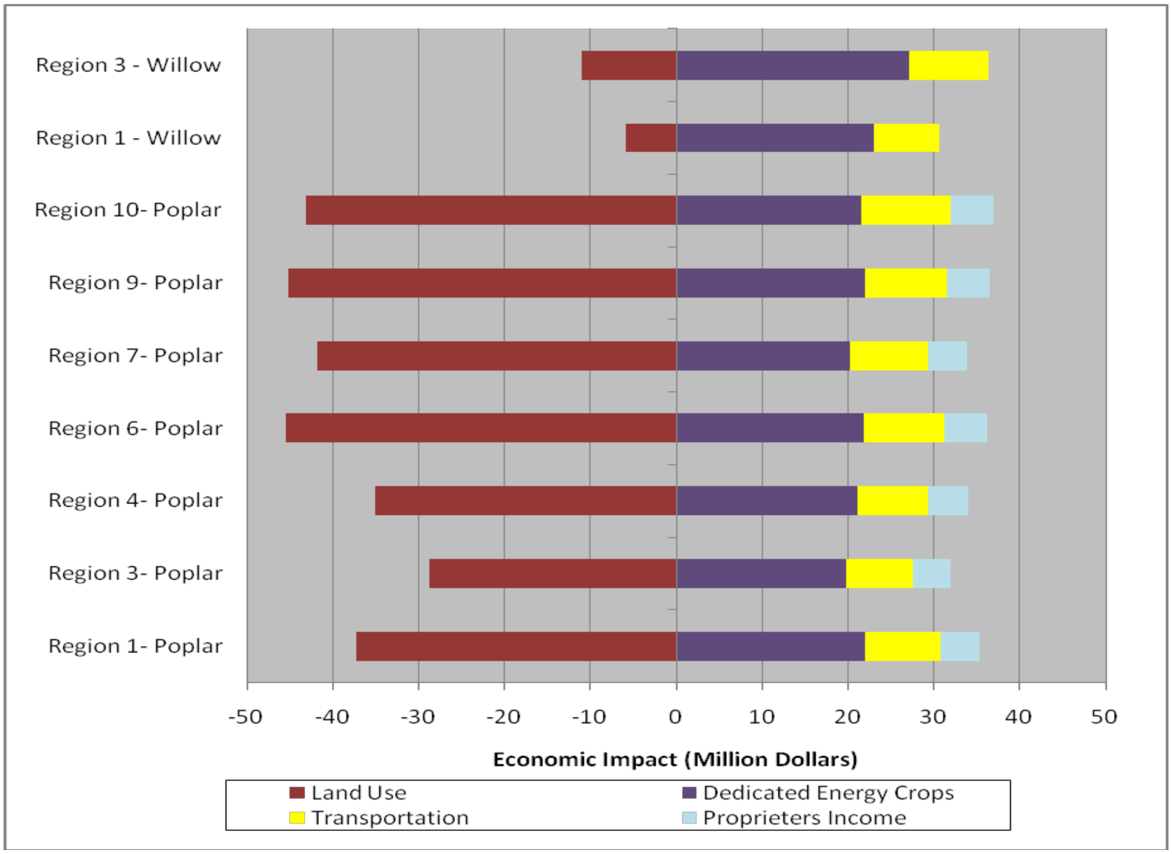


Figure 4.2-8. Estimated Total Economic Impacts as a Result of Establishing Sufficient Dedicated Energy Crops to Supply a 15 Million Gallon Ethanol Facility by Potential BCAP Project Location

4.2.3.3 Annual Herbaceous Species

Forage sorghum, an annual herbaceous species crop requiring establishment each year, is used as a model crop to examine the economic impacts of planting dedicated annual energy crops. Since this is not a perennial, it qualifies for both the annual payment during the contract period and the matching payments for two years; however, that crop would not be eligible for establishment payments. Assuming that the firms are willing to purchase the biomass at $45 per ton, the sorghum producer would receive a BCAP matching payment for two years equal to $45 per ton. It is assumed that these payments would be made in years 1 and 2. Using a similar selection process as was previously discussed, nine sorghum sites were selected (Figure 4.2-9), shows the general locations and specific counties of influence.

Figure 4.2-9. Potential Forage Sorghum BCAP Project Areas in States with Sufficient Feedstock Production Potential

DIRECT IMPACTS

As with perennial herbaceous and woody crops, Realized Net Farm Income at the national level under Alternative 1 using annual herbaceous species would be expected to remain unchanged from the baseline conditions due to the limited funding assumption under Alternative 1. It is assumed that there would not be any national level effects. It is also expected that net returns at the farm level would likely improve for those producers selected as part of the project area for BCAP under this alternative. The production of a dedicated energy crop would be expected to create a higher valued opportunity for producers or those producers would not have selected to participate in BCAP. Depending on the overall acres in a county involved in the BCAP, under Alternative 1 the net returns for agriculture for that county or region could see significant gains.

The information in Table 4.2-12 indicates the impact on total net returns for forage sorghum adoption in the agricultural sector generated by the potential BCAP projects under this alternative. BCAP matching payments were assumed available for the final two years and annual payments were available the initial three years of the 5-year contract. Therefore, in Table 4.2-12, the annual payment is paid to the producer for each of the first three years and the matching payment for each of the final two. As indicated by the proposed rule, the annual payment would be reduced by 25 percent when the crop is delivered to the BCF.

Table 4.2-12. Net Returns for Growing Forage Sorghum

		Annual Components				
Site Number	Annual Crop	Reduced Crop Net Returns including Costs of Production	Annual Payment	Total Matching Payments	Payment from Plant	Total Change in Returns
1	Sorghum	(10,887,426)	4,407,152	7,500,015	7,500,015	8,519,756
2	Sorghum	(6,838,006)	357,829	7,500,015	7,500,015	8,519,853
3	Sorghum	(9,461,925)	2,981,685	7,500,015	7,500,015	8,519,790
4	Sorghum	(7,427,523)	947,331	7,500,015	7,500,015	8,519,838
5	Sorghum	(8,224,879)	1,744,668	7,500,015	7,500,015	8,519,819
6	Sorghum	(7,997,117)	1,516,912	7,500,015	7,500,015	8,519,825
7	Sorghum	(6,756,921)	276,745	7,500,015	7,500,015	8,519,854
8	Sorghum	(9,635,377)	3,155,132	7,500,015	7,500,015	8,519,785
9	Sorghum	(9,048,981)	2,568,751	7,500,015	7,500,015	8,519,800

Evaluating each forage sorghum site results in reduced traditional crop returns as a result of shifts in land use as well as incurring costs of production when establishing and harvesting forage sorghum. These losses range from a low of $6.7 million in Region 7-Sorghum to a high of $10.8 million at Region 1-Sorghum. These losses are offset by the value of the biomass grown and paid for by both the plant and through the BCAP. At all sites the total change in annual net returns are positive if the producer receives $90 per ton, $45 per ton from the plant and $45 per ton from BCAP.

As the BCAP projects are implemented, the production of feedstock associated with the projects would induce a first level or direct shift as it displaces crops previously produced in those acres. If the displacements of acreage are large enough, market prices would be impacted and those changes in prices would induce a second level of land shifts in response to those new prices. Alternative 1 would introduce changes in land use at the very local level, i.e., at the county or multi-county region. Table 4.2-13 indicates the changes in land use in the areas of influence of each of the potential locations for BCAP projects, summarizes the changes caused by implementing Alternative 1 from the No Action Alternative, and consequently indicates which crops are giving up area for the planting of annual energy crops in each of the potential locations.

Table 4.2-13. Change Under Alternative 1 from the No Action Alternative in Cropland Use in the Selected Sites for the BCAP Areas for Forage Sorghum

Site	Feed	Barley	Corn	Cotton	Hay	Oats	Rice	Grain Sorghum	Soybeans	Wheat	Annual Energy Crops
1	Sorghum	0	0	0	(50)	0	0	(575)	0	(17,893)	18,519
2	Sorghum	0	0	(2,075)	(1,101)	127	0	(4,266)	0	(11,203)	18,519
3	Sorghum	0	(1,472)	(7,412)	0	0	(6,267)	(597)	(1,210)	(1,560)	18,519
4	Sorghum	0	(2,040)	0	(1,220)	0	0	(3,867)	(429)	(10,963)	18,519
5	Sorghum	(27)	(6,263)	0	(1,361)	(30)	0	(88)	(7,980)	(2,768)	18,519
6	Sorghum	(160)	(3,977)	0	(645)	(50)	0	0	(11,980)	(1,708)	18,519
7	Sorghum	(842)	0	0	(937)	0	0	0	0	(16,739)	18,519
8	Sorghum	(13)	(7,563)	0	0	(282)	0	0	(10,206)	(455)	18,519
9	Sorghum	0	0	(7,956)	(87)	0	(8,530)	(811)	(724)	(411)	18,519

INDIRECT IMPACTS

The impacts of growing a dedicated energy crop in a region would impact several sectors and the magnitude of these impacts varies by region. The agricultural sector, defined in broad terms which would include input suppliers, would be impacted by the creation of a new market for the dedicated energy crop and would also be impacted by changes in land use. Additional local transportation would be required to move the biomass from the farm gate to the BCF. Finally, it is assumed that a $45 per ton payment would be made to farmers delivering biomass to the BCF equaling the matching payment of $45 per ton. Since the biomass price used in the analysis for forage sorghum was $60, a $30 per ton impact is incorporated as a gain to farmer's (proprietor's) income. These impacts are estimated for the regions previously identified by POLYSYS.

Direct Payments

The first impact estimated is the impact as a result of producing the dedicated energy crop. It was estimated that producers of the annual dedicated energy crops would require $10 million in gross returns each year ($60 per ton X 166,667 tons). This is not a windfall as producers must convert some of their land currently producing traditional crops or pasture into the dedicated energy crop. This requires the purchase of inputs to establish, maintain, and harvest their dedicated energy crop. The impact of this return differs depending on the community. The range in total economic impact for the forage sorghum sites for establishing and harvesting forage sorghum ranges from $13 to $19 million depending on the site (Table 4.2-14).

Not all impacts will be positive. The community would be impacted as a result of changes in land use required to meet the demand for dedicated energy crops. This change in land use would result in negative impacts within the community as inputs for those traditional crops are not purchased. For forage sorghum, it is estimated that a reduction in crop acreage planted to traditional crops would result in a decrease in direct economic activity because of the reduction in sales of up to $7.8 million at Region 9-Sorghum and a low of $1.6 million at Region 2-Sorghum. Changes in total economic activity as a result of land use change are also displayed in Table 4.2-14 and range from $2.6 million to $14.3 million for Region 2-Sorghum and Region 10-Sorghum, respectively.

The third impact that is measured in this report considers the impact of transporting the cellulose produced from the forage sorghum to the plant. To transport 166,667 dry tons of forage sorghum to the plant each year, an estimated $4.6 million would be required. When added to the economy, this would result in increased economic activity ranging from a low of $7.8 million in Region 2-Sorghum, Region 5-Sorghum, and Region 7-Sorghum to a high of $9.5 million in the area surrounding Region 3-Sorghum.

Table 4.2-14. Direct, Indirect, and Induced Economic Impacts for Forage Sorghum by Initial State Year 3 (TIO [$thousands] and Jobs [number])

Sorghum Region	Economic Indicator	Dedicated Energy Crops					Land Use					Transportation			
		Direct	Indirect	Induced	Total		Direct	Indirect	Induced	Total		Direct	Indirect	Induced	Total
1	TIO	10,000	1,065	2,345	13,411		(2,651)	(678)	(639)	(3,967)		4,583	2,207	1,311	8,100
	Jobs	97	9	24	130		(26)	(5)	(7)	(37)		39	12	14	65
2	TIO	10,000	1,699	3,239	14,938		(1,660)	(425)	(528)	(2,613)		4,583	1,514	1,682	7,780
	Jobs	492	16	32	540		(57)	(5)	(5)	(67)		35	10	17	61
3	TIO	10,000	3,830	5,825	19,654		(7,351)	(2,965)	(3,740)	(14,056)		4,583	2,070	2,912	9,565
	Jobs	255	27	57	338		(134)	(28)	(36)	(199)		36	15	28	78
4	TIO	10,000	1,553	4,063	15,616		(3,804)	(1,068)	(1,567)	(6,439)		4,583	2,239	2,268	9,090
	Jobs	154	13	40	207		(56)	(7)	(16)	(79)		38	12	23	74
5	TIO	10,000	3,139	4,949	18,088		(5,031)	(729)	(2,171)	(7,931)		4,583	1,494	1,720	7,797
	Jobs	102	32	58	192		(43)	(8)	(25)	(76)		40	14	20	74
6	TIO	10,000	2,622	5,262	17,885		(5,265)	(1,291)	(2,670)	(9,227)		4,583	1,798	2,360	8,741
	Jobs	108	23	58	189		(44)	(12)	(29)	(85)		39	16	26	80
7	TIO	10,000	1,053	3,882	14,935		(2,988)	(420)	(1,123)	(4,531)		4,583	1,354	1,873	7,810
	Jobs	137	10	44	191		(40)	(5)	(13)	(58)		37	11	21	69
8	TIO	10,000	3,103	5,547	18,650		(6,206)	(1,549)	(3,093)	(10,848)		4,583	1,587	2,778	8,948
	Jobs	252	24	53	328		(128)	(12)	(29)	(169)		34	13	27	74
9	TIO	10,000	2,440	4,686	17,126		(7,803)	(2,954)	(3,544)	(14,300)		4,583	1,695	2,325	8,603
	Jobs	183	21	52	256		(82)	(34)	(39)	(154)		39	15	26	80

TIO = Total industry output

The fourth and final direct impact is a result of the $90 per dry ton payment to "producers" ($45 matching payment plus $45 from the BCF). Since the projected cost of forage sorghum was $60 per ton, the farmer would receive $30 per ton "bonus" when he/she delivers the crop. Based on the proposed rule, this is available for only two years from the date of the first matching payment. In reality, this additional payment could be split among several economic entities. In this analysis, it is assumed that proprietors in the community would receive the $5 million annually (Table 4.2-15). Assuming proprietors spend this as they do other income, indirect and induced benefits occur and the final impacts to the economy as a result of this $5.0 million range from $5.9 million to $7.6 million.

Another measure of success would be the number of jobs created. The analysis, with regard to forage sorghum, indicated that this might be a net wash. As seen in Tables 4.2-15 and 4.2-16, each economic impact has an impact on the number jobs. Growing forage sorghum would create between 130 and 500 jobs depending on the community. Transportation could add 80 jobs to the region's economy. However, shifting out of more labor intensive production to annual dedicated energy crops result in a decrease or jobs of approximately 100 to 200 (see Table 4.2-14). The increase in proprietors' income as a result of adopting this new crop is also estimated to increase the number of jobs by as much as 50 within each of the regions.

TOTAL ECONOMIC IMPACTS

All forage sorghum regions have a positive annual impact as a result of the BCAP and the establishment of an annual dedicated energy crop. The shifts in land use are significantly lower than those reflected in the SRWCs primarily because establishment costs are lower and yields are significantly higher. In addition, these data estimates do not include the impacts of manufacturing and transporting the fuel. The economic impact is estimated to range from $18 million to $26 million depending on the site (Figure 4.2-10).

4.2.4 Alternative 2

For the analysis of Alternative 2 no detailed location analysis is presented, as it is currently impractical to perform; however, geographic distribution of the feedstock would drive potential BCAP project locations.

Alternative 2 addresses the impacts of an expanded BCAP, in which the basic assumption would be that BCAP would play a key role in achieving the goals established by the EISA legislation for advanced biofuels. To model this, POLYSYS was used to estimate the quantity and price of feedstock necessary to achieve the EISA targets through 2023. To meet DOE goals of $1.76 per gallon of ethanol and $51 per dry ton of herbaceous feedstock by 2012 (Ferrel 2009), the role, size, and funding of a potential expanded BCAP was estimated, based on the estimated prices of feed stock.

Table 4.2-15. Economic Activity as a Result of Increased Proprietor's Income within the Forage Sorghum Regions

Region	Dedicated Energy Crop	Economic Indicator	Direct	Indirect	Induced	Total
1	Sorghum	TIO	$5,000,010	$381,390	$514,948	$5,896,348
		Jobs	20	3	6	29
2	Sorghum	TIO	$5,000,010	$387,055	$774,389	$6,161,454
		Jobs	23	4	8	34
3	Sorghum	TIO	$5,000,010	$814,932	$1,791,821	$7,606,763
		Jobs	26	7	18	51
4	Sorghum	TIO	$5,000,010	$632,052	$1,313,096	$6,945,158
		Jobs	26	5	14	45
5	Sorghum	TIO	$5,000,010	$478,467	$920,315	$6,398,792
		Jobs	26	5	11	42
6	Sorghum	TIO	$5,000,010	$649,296	$1,311,218	$6,960,524
		Jobs	28	6	15	49
7	Sorghum	TIO	$5,000,010	$439,365	$951,032	$6,390,407
		Jobs	26	5	11	42
8	Sorghum	TIO	$5,000,010	$720,587	$1,601,483	$7,322,080
		Jobs	25	6	16	47
9	Sorghum	TIO	$5,000,010	$668,347	$1,362,653	$7,031,010
		Jobs	27	6	16	49

TIO = Total Industry Output

Table 4.2-16. Direct, Indirect, and Induced Economic Impacts by Initial State Year 3 (TIO [$thousands] and Jobs [number])

Region and economic Indicator	Dedicated Energy Crops	Land Use	Transportation	Proprietor's Income	Total Economic Impact
Region 1- Sorghum	$13,411	($3,967)	$8,100	$5,896	$23,440
Region 2- Sorghum	$14,938	($2,613)	$7,780	$6,161	$26,266
Region 3- Sorghum	$19,654	($14,056)	$9,565	$7,607	$22,770
Region 4- Sorghum	$15,616	($6,439)	$9,090	$6,945	$25,212
Region 5- Sorghum	$18,088	($7,931)	$7,797	$6,399	$24,353
Region 6- Sorghum	$17,885	($9,227)	$8,741	$6,961	$24,360
Region 7- Sorghum	$14,935	($4,531)	$7,810	$6,390	$24,604
Region 8- Sorghum	$18,650	($10,848)	$8,948	$7,322	$24,072
Region 9- Sorghum	$17,126	($14,300)	$8,603	$7,031	$18,460

TIO = total industry output

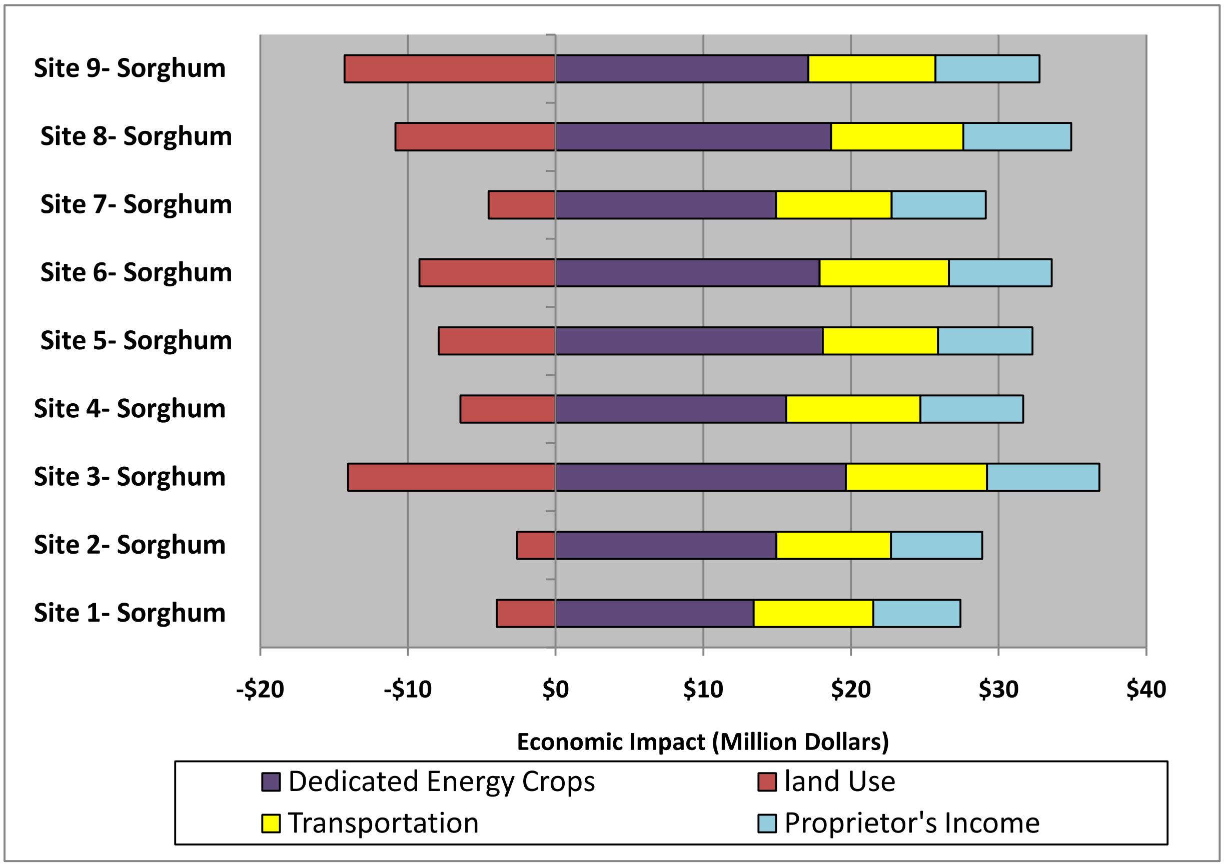


Figure 4.2-10. Estimated Total Economic Impacts as a Result of Establishing Sufficient Dedicated Forage Sorghum to Supply 15 Million Gallon Ethanol Facility by Potential BCAP Project Areas

4.2.4.1 Direct Impacts

Figure 4.2-11 illustrates the resulting contribution of the above-mentioned feedstock to achieve the EISA goals. One can observe the significant contribution that crop and forest/wood residues would make in the short term, while the contribution of dedicated energy crops would be essential to achieve the targets beyond 2016. When accounting for the contribution for forest residues, it would be expected that residues would make a significant portion of the feedstock supply and influence a reduction in feedstock prices.

However, under Alternative 2, an expanded BCAP, significant changes can be expected in net revenues as the value of the total revenues increase more than the cost of producing the feedstock, and as the increase of feedstock production reduces the supply of other crops and consequently increases in their prices would be anticipated. Government commodity payments can also be expected to increase.

Under Alternative 2, it would be expected that the potential expansion of BCAP would have significant impacts in the production of the crops experiencing loss of acreage as a result of an expanding feedstock market under the BCAP.

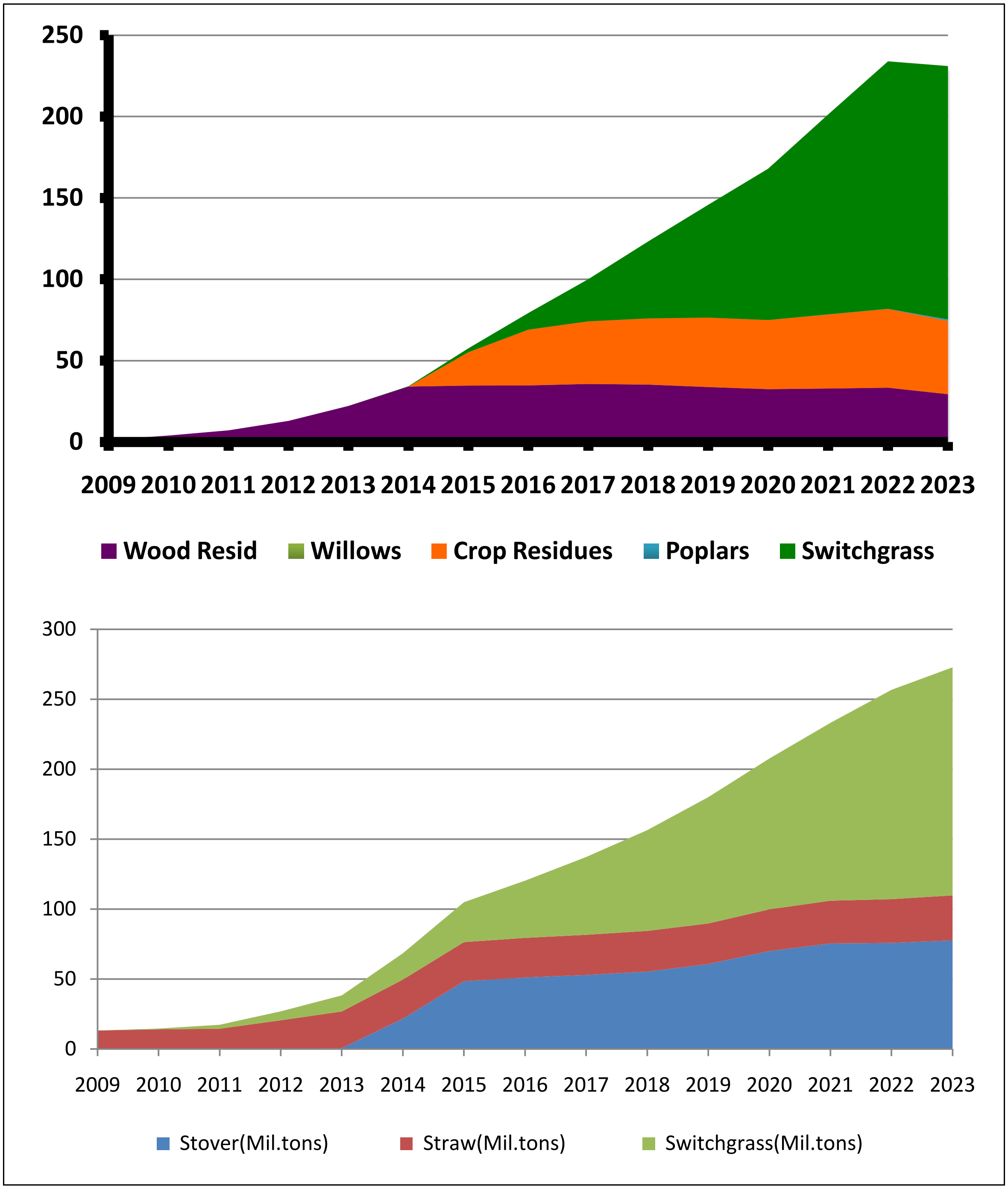


Figure 4.2-11. Feedstock Participation in Achieving EISA Targets (millions of dry tons)

For Alternative 2, the aggregate impacts on the sector's Realized Net Farm Income are presented in Table 4.2-17. These figures summarize the impacts on prices of the major commodities, the changes in land use, in government payments BCAP payments, and the contribution of the value of the energy feedstock production. As POLYSYS does not have a fully integrated hay sector, these figures may underestimate the impacts of increasing hay prices, caused by the conversion of hay and the reconversion of cropland in pasture towards hay acreage.

Table 4.2-17. Aggregate Realized Net Farm Income for Alternative 2 as Compared to the No Action Alternative ($thousands)

Year	No Action Alternative	Alternative 2	Change
2009	$76,292	$76,292	$0
2010	$74,876	$75,474	$598
2011	$76,473	$77,518	$1,045
2012	$76,010	$79,749	$3,739
2013	$77,135	$82,131	$4,996
2014	$79,148	$85,322	$6,174
2015	$80,470	$85,809	$5,339
2016	$81,589	$86,527	$4,938
2017	$82,660	$88,157	$5,497
2018	$84,393	$89,671	$5,278
2019	$78,156	$84,133	$5,977
2020	$76,076	$82,980	$6,904
2021	$74,674	$83,808	$9,134
2022	$73,507	$83,142	$9,635
2023	$72,505	$81,757	$9,252

Under implementation of Alternative 2, changes in farm prices become a very important impact. Crop prices would be expected to increase due to the increase in the demand for cropland to plant dedicated energy crops. Price increases are most significant in wheat, corn, and soybeans. Table 4.2-18 shows that price changes are in the order of 15 to 20 percent at their highest level of impact. The addition of forestry resources as feedstock would reduce these price pressures, as less cropland would be needed to produce biomass from dedicated energy crops. Increases in crop yields would also reduce the

Table 4.2-18. Crop and Feedstock Prices for Alternative 2 as Compared to the No Action Alternative

	Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
No Action Alternative	Corn	4.00	3.90	3.80	3.70	3.65	3.70	3.75	3.75	3.75	3.75	3.64	3.73	3.75	3.73	3.74
	Grain Sorghum	3.50	3.45	3.40	3.30	3.25	3.30	3.35	3.35	3.35	3.35	3.38	3.36	3.37	3.37	3.36
	Oats	2.50	2.45	2.40	2.35	2.30	2.35	2.35	2.35	2.35	2.35	2.33	2.33	2.33	2.33	2.33
	Barley	4.30	4.15	4.00	3.90	3.85	3.90	3.95	3.95	3.95	3.95	3.93	3.90	3.89	3.90	3.90
	Wheat	5.75	5.60	5.50	5.35	5.30	5.40	5.45	5.45	5.45	5.45	5.43	5.45	5.49	5.53	5.57
	Soybeans	8.85	8.75	8.75	8.70	8.60	8.70	8.75	8.75	8.75	8.80	8.68	8.58	8.60	8.63	8.61
	Cotton ($/lb)	0.50	0.55	0.60	0.61	0.61	0.62	0.62	0.63	0.63	0.64	0.64	0.64	0.64	0.64	0.65
	Rice ($/cwt)	12.50	11.45	10.90	10.60	10.80	11.03	11.27	11.52	11.78	12.04	12.10	12.18	12.26	12.37	12.47
	Hay	136.82	131.80	129.40	129.23	129.78	131.70	134.49	136.60	139.08	141.90	141.90	141.90	141.90	141.90	141.90
	Switchgrass	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Poplars	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Willows	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Alternative 2	Corn	4.00	4.02	3.77	4.14	3.78	4.36	3.60	4.31	3.64	4.18	3.67	4.21	4.01	4.40	3.82
	Grain Sorghum	3.50	3.46	3.42	3.32	3.34	3.43	3.55	3.64	3.64	4.10	3.67	4.18	4.01	4.19	3.82
	Oats	2.50	2.47	2.41	2.44	2.41	2.78	2.45	2.70	2.45	2.74	2.45	2.76	2.75	2.94	2.61
	Barley	4.30	4.15	4.02	3.96	3.97	4.07	4.19	4.30	4.45	4.68	4.63	4.36	4.67	4.73	4.89
	Wheat	5.75	5.61	5.52	5.42	5.47	5.69	5.87	6.01	6.27	6.38	6.46	6.62	7.05	7.02	7.00
	Soybeans	8.85	8.78	9.39	9.59	10.19	9.31	10.65	9.03	10.16	9.26	9.87	9.59	10.29	9.58	10.79
	Cotton ($/lb)	0.50	0.55	0.60	0.61	0.61	0.62	0.63	0.65	0.67	0.68	0.69	0.69	0.70	0.71	0.71
	Rice ($/cwt)	12.50	11.45	10.90	10.60	10.80	11.03	11.28	11.54	11.80	12.07	12.12	12.20	12.30	12.40	12.50
	Hay	136.82	131.80	129.40	129.23	129.78	131.70	134.49	136.60	139.08	141.90	141.90	141.90	141.90	141.90	141.90
	Switchgrass	30.00	30.00	30.00	30.00	30.00	31.00	38.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00
	Poplars	30.00	30.00	30.00	30.00	30.00	31.00	38.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00
	Willows	30.00	30.00	30.00	30.00	30.00	31.00	38.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00

Table 4.2-18. Crop and Feedstock Prices for Alternative 2 as Compared to the No Action Alternative (cont'd)

	Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Change Due to Alternative 2	Corn	0.00	0.12	(0.03)	0.44	0.13	0.66	(0.15)	0.56	(0.11)	0.43	0.03	0.48	0.26	0.67	0.08
	Grain Sorghum	0.00	0.01	0.02	0.02	0.09	0.13	0.20	0.29	0.29	0.75	0.29	0.82	0.64	0.82	0.46
	Oats	0.00	0.02	0.01	0.09	0.11	0.43	0.10	0.35	0.10	0.39	0.12	0.43	0.42	0.61	0.28
	Barley	0.00	0.00	0.02	0.06	0.12	0.17	0.24	0.35	0.50	0.73	0.70	0.46	0.78	0.83	0.99
	Wheat	0.00	0.01	0.02	0.07	0.17	0.29	0.42	0.56	0.82	0.93	1.03	1.17	1.56	1.49	1.43
	Soybeans	0.00	0.03	0.64	0.89	1.59	0.61	1.90	0.28	1.41	0.46	1.19	1.01	1.69	0.95	2.18
Change Due to Alternative 2	Cotton ($/lb)	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.04	0.04	0.05	0.06	0.06	0.06	0.06
	Rice ($/cwt)	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.02	0.02	0.03	0.02	0.02	0.04	0.03	0.03
	Hay	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	Switchgrass	30.00	30.00	30.00	30.00	30.00	31.00	38.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00
	Poplars	30.00	30.00	30.00	30.00	30.00	31.00	38.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00
	Willows	30.00	30.00	30.00	30.00	30.00	31.00	38.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00	48.00

price impacts; however, if crop yields increase too much, the impacts on farm prices could be reduced or even reversed and the impacts in realized net farm income could also be reduced and even reversed.

The price for feedstock starts at $30 per dry ton, and increases until reaching a level of $48 per dry ton at the end of the period. Increases in the latter years show the need to increase the plantings of dedicated energy crops, to ensure that enough biomass would be made available to reach the EISA target.

Under Alternative 2, commodity government payments would decrease in response to price impacts triggered by the additional demand of cropland for the production of energy crops.

Given that the USDA baseline (No Action Alternative) provides an outlook of relatively high crop prices, the increase in prices does not trigger an across the board reduction in payments from commodity programs, since some are already at zero level. However, in this case, there are some reductions in payments as indicated in Table 4.2-19. The modest reductions are the result of decreases in counter cyclical payments, particularly in cotton.

Alternative 2 would cause land use shifts, particularly among the major crops. Wheat and soybeans are the most impacted, while corn, because of the increased revenues from the collection of stover, is able to increase its acreage (Table 4.2-20). The acreage of hay shows some increase. The increase in hay acreage is an approximation of the increase in forage productivity that needs to occur in pastureland. There is expected to be an increase in the total land under cropping. This increase indicates how many acres of cropland in pasture have left pasture to a higher value use. All of these changes are in response to the increase in the plantings of dedicated energy crops, which by 2023 reach over 50 million acres, which includes land in pasture shifting to hay and dedicated energy crops.

The extent of the impacts of the shift of pasture in cropland to dedicated energy crops, particularly, switchgrass, would depend on the ability of ranchers to increase the forage productivity of the more than 350 million acres in pastureland. Increased forage productivity could be achieved by fertilization, and/or by increasing the management intensity of pastures. By the year 2023, 49 million acres in cropland pasture shift into a higher use; about 15 million acres to account for the shift of hay acreage to dedicated energy crops and the other 34 million acres would shift to dedicated energy crop production. Given that the number of acres of cropland in pasture whose productivity would need to be accounted for, about 15 million acres, would not be very large given the total amount of forage used, it would be possible that in many counties or multi-county areas the negative effects would be easily overcome. Perhaps, in some limited number of counties, livestock would have to be moved to neighboring areas.

Table 4.2-19. Changes in Commodity Government Payments ($thousands) Under Alternative 2

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Loan Deficiency	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Contract	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Counter Cyclical	0	0	(7)	(2)	2	0	(72)	(243)	(272)	(173)	(217)	(195)	(178)	(149)	(123)
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total Payments	0	0	(7)	(2)	3	0	(72)	(243)	(272)	(173)	(217)	(195)	(178)	(149)	(123)

Table 4.2-20. Land Use Impacts of Alternative 2 as Compared to the No Action Alternative (millions acres)

	Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
No Action Alternative	Corn	88.0	89.0	90.0	90.0	90.0	90.0	90.0	90.5	90.5	90.5	90.4	89.6	90.0	90.4	90.4
	Grain Sorghum	7.8	7.6	7.6	7.5	7.5	7.4	7.4	7.4	7.4	7.3	7.3	7.3	7.3	7.3	7.3
	Oats	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4
	Barley	4.1	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
	Wheat	60.5	60.5	61.0	60.5	60.0	60.0	59.5	59.5	59.5	59.5	59.5	59.4	59.5	59.7	59.9
	Soybeans	74.0	73.0	72.0	71.5	71.5	71.0	71.0	71.0	71.0	71.0	71.1	71.1	70.5	70.2	70.2
	Cotton ($/lb)	8.4	8.8	9.5	9.7	9.8	9.9	10.0	10.1	10.2	10.3	10.4	10.3	10.4	10.4	10.4
	Rice ($/cwt)	3.0	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1	3.1
	Hay	61.7	61.9	61.7	61.5	61.4	61.3	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2	61.2
	Switchgrass	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Poplars	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Willows	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	310.9	311.2	312.2	311.1	310.7	310.1	309.6	310.2	310.3	310.3	310.4	309.5	309.4	309.6	309.8

Table 4.2-20. Land Use Impacts of Alternative 2 as Compared to the No Action Alternative (millions acres) (cont'd)

	Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Alternative 2	Corn	88.0	89.0	91.5	88.9	92.6	89.3	95.7	88.9	94.1	87.8	91.3	86.6	89.3	86.5	90.7
	Grain Sorghum	7.8	7.6	7.6	7.5	7.3	7.3	7.1	7.1	6.9	6.7	6.9	6.8	6.7	6.5	6.3
	Oats	3.4	3.4	3.4	3.4	3.3	3.3	3.4	3.4	3.3	3.3	3.3	3.2	3.2	3.1	3.1
	Barley	4.1	4.0	4.0	4.0	3.9	4.0	3.9	3.9	3.8	3.8	3.9	3.9	3.7	3.8	3.8
	Wheat	60.5	60.5	60.8	60.2	59.1	59.1	57.4	56.6	55.2	54.5	53.2	52.2	51.6	51.8	51.8
	Soybeans	74.0	73.0	70.8	73.2	70.9	74.0	68.6	74.7	68.8	73.4	68.8	71.2	67.8	69.9	65.4
	Cotton ($/lb)	8.4	8.8	9.5	9.7	9.8	9.9	9.8	9.5	9.4	9.4	9.0	8.9	8.7	8.6	8.6
	Rice ($/cwt)	3.0	3.0	3.0	3.0	3.0	3.0	2.8	2.5	2.3	2.1	2.1	2.0	1.9	1.9	1.8
	Hay	61.7	61.9	61.7	61.3	60.8	60.1	59.5	59.7	60.5	61.9	64.3	67.2	70.5	73.6	76.6
	Switchgrass	0.0	0.0	0.0	0.0	0.0	0.1	1.5	5.8	11.0	16.9	23.6	31.6	38.8	44.9	50.7
	Poplars	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3
	Willows	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	310.9	311.2	312.2	311.1	310.7	310.1	309.6	312.1	315.4	319.9	326.5	333.8	342.4	351.0	359.2
Change Due to Alternative 2	Corn	0.0	0.0	1.5	(1.1)	2.6	(0.7)	5.7	(1.6)	3.6	(2.7)	0.9	(3.0)	(0.7)	(3.9)	0.3
	Grain Sorghum	0.0	0.0	0.0	0.0	(0.2)	(0.1)	(0.3)	(0.3)	(0.5)	(0.6)	(0.4)	(0.6)	(0.6)	(0.8)	(1.0)
	Oats	0.0	0.0	0.0	0.0	(0.1)	(0.1)	0.0	0.0	(0.1)	(0.1)	(0.1)	(0.2)	(0.2)	(0.3)	(0.3)
	Barley	0.0	0.0	0.0	0.0	(0.1)	0.0	(0.1)	(0.1)	(0.2)	(0.2)	(0.1)	(0.1)	(0.3)	(0.2)	(0.2)
	Wheat	0.0	0.0	(0.2)	(0.3)	(1.0)	(0.9)	(2.1)	(2.9)	(4.3)	(5.0)	(6.3)	(7.2)	(8.0)	(7.8)	(8.0)
	Soybeans	0.0	0.0	(1.2)	1.7	(0.6)	3.0	(2.4)	3.7	(2.2)	2.4	(2.4)	0.1	(2.7)	(0.4)	(4.8)
	Cotton ($/lb)	0.0	0.0	0.0	0.0	0.0	0.0	(0.2)	(0.6)	(0.8)	(0.9)	(1.3)	(1.5)	(1.7)	(1.7)	(1.8)
	Rice ($/cwt)	0.0	0.0	0.0	0.0	0.0	(0.1)	(0.3)	(0.6)	(0.8)	(1.0)	(1.1)	(1.1)	(1.2)	(1.2)	(1.3)
	Hay	0.0	0.0	(0.1)	(0.3)	(0.6)	(1.2)	(1.7)	(1.6)	(0.7)	0.7	3.1	6.0	9.3	12.4	15.4
	Switchgrass	0.0	0.0	0.0	0.0	0.0	0.1	1.5	5.8	11.0	16.9	23.6	31.6	38.8	44.9	50.7
	Poplars	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.2	0.2	0.3	0.3	0.3
	Willows	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
	Total	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.9	5.1	9.6	16.1	24.3	33.1	41.3	49.4

INDIRECT IMPACTS

Direct Payments

The direct impacts of Alternative 2, as measured in the Year 2020, include $5.7 billion for the establishment and CHST of switchgrass (tons grown X $53 per ton) and $5.3 billion for CHST of crop residues (tons of crop residues X $53 per ton), the impacts resulting from changes in land use (a decline of $3.2 billion), the impacts of increased transportation ($1.6 billion), approximately $15.8 billion as a result of traditional crop price changes, and nearly $4.0 billion as a result of farmer payments of $37 per ton above and beyond the cost of establishment and CHST of the dedicated energy crop ($90 - $53 per ton) (Table 4.2-21).

The establishment and CHST of the dedicated energy crops would produce effects to producers, which would flow through the rest of the economy as increased economic output and additional employment positions. It was estimated that the producers of the dedicated energy crop feedstocks would require $53 per dry ton or a total payment of $5.7 billion. Corn and wheat producers would provide 99.8 million tons of feedstock and would receive approximately $5.3 billion. It was estimated that CHST activities would create a total gain of an additional 280,000 jobs. This is not a windfall; however, because to receive the over $11 billion, producers must convert some of their land producing traditional crops into a dedicated energy crop. This would result in negative impacts within the community as inputs for those traditional crops are not purchased. These costs depend on the community and the changes in land use required to meet the demand for dedicated energy crops and crop residues. The direct costs for this land use change would be estimated at a decline of $3.2 billion with a loss of 41,000 jobs.

As in Alternative 1, transportation costs were estimated based on Brechbill and Tyner (2008). Using the area of each of the 5-mile increments as weights, a weighted cost of $7.78 per dry ton was estimated. Multiplying this per ton cost times the number of tons required annually by the BCF, it was determined that transportation costs would be approximately $1.6 billion nationally and require 12,600 additional jobs.

A fourth impact occurs at the national scale due to commodity price changes. These price changes increase farm income and thus provide money to communities as producers spend that additional income. In this analysis, it was assumed that the producer consumption function would be similar to that of proprietors. Producers across the nation would receive an additional $15 billion as a result of increased commodity prices.

The final direct impact was a result of the $90 per dry ton payment to “producers” ($45 matching payment and $45 from the BCF). Since the projected cost of the biomass was $53 per ton, the producer would receive a $37 enticement fee. In reality, this fee could be split among several economic entities. In this analysis, it was assumed that proprietors in the community would receive $4.0 billion. In total, approximately $29.2 billion is directly contributed to the nation’s economy creating 262,000 jobs.

Table 4.2-21. National Economic Impacts Resulting from Achieving EISA Targets (TIO and Jobs)

Direct	Indirect	Induced	Total
National Farm Impact as a result of producing dedicated energy crops:			
$5,713,400,000	$892,033	$13,821,586,568	$19,535,878,601
93,637	8	101,202	194,847
National Farm Impact as a result of collecting crop residues:			
$5,289,400,000	$1,600,030	$12,797,553,299	$18,088,553,329
86,688	15	93,704	180,407
National Farm Level Impacts as a result of changing land uses:			
($3,202,976,400)	($2,900,063,535)	($5,910,728,462)	($12,013,768,397)
(41,265)	(18,500)	(43,298)	(103,063)
National impacts as a result of transporting cellulosic materials:			
$1,615,128,000	$1,432,340,848	$3,275,528,986	$6,322,997,834
12,658	7,508	24,166	44,332
National impacts as a result of changing commodity prices:			
$15,803,976,400	$7,601,240,255	$21,780,238,019	$45,185,454,674
88,074	46,340	161,478	295,892
National impacts as a result of BCAP matching payments:			
$3,988,600,000	$1,918,397,326	$5,496,885,975	$11,403,883,301
22,228	11,695	40,754	74,677
Total national impacts:			
$29,207,528,000	$8,054,406,957	$51,261,064,385	$88,522,999,342
262,019	47,066	378,007	687,092

Total Economic Impacts

Total economic impact is estimated to be $88.5 billion with a significant portion of this derived from induced or household expenditures. In addition, nearly 700,000 jobs would be created through the development of the cellulosic industry.

4.2.5 No Action Alternative

Selecting the No Action Alternative would not result in significant changes to current land use, current farm prices, or current farm revenue measures. The No Action Alternative is the baseline, upon which both Alternatives 1 and 2 have been compared, previously. Under the No Action Alternative, in the short-term it would be unlikely that domestic production of biomass for bioenergy would meet the demand for EISA advanced biofuels components.

Under the No Action Alternative, BCAP would not be implemented for establishment and annual payments for dedicated energy crops. Under the No Action Alternative, dedicated energy crops would be established only in limited demonstration-scale (e.g., Vonore demonstration plant in Tennessee) with other public and private funding sources. Commercial-scale production using dedicated energy crops would more than likely not occur in the short-term due the current lack of technological availability of processes to fully convert cellulosic components into bioenergy products. Short term effects under the No Action Alternative would be a greater use of existing crop and forestry residues as feedstock for existing commercial-scale and demonstration-scale facilities as supplemented by matching payments. Additionally, more residues could be utilized for co-generation of electricity or power generation at facilities that currently process forestry products or sugar crops (e.g., bagasse).

4.3 BIOLOGICAL RESOURCES

It is desirable that BCAP have no significant negative impacts upon existing biological resources, and not result in a reduction to overall environmental sustainability. Environmental sustainability simply stated is the long-term maintenance of ecosystem components and functions. This is an area that has become of increasing importance in the last decade. Within the sustainability of the environment, a key barometer of the overall health and dynamics of an environment is biodiversity. Environments with greater degrees of biodiversity have been shown to be more sustainable. Biological diversity helps maintain a cycled environment; each organism directly or indirectly affects another by its function in the food chain or by its actions. Removal of one or more of these organisms could have deleterious impacts on the other species that rely upon it.

4.3.1 Significance Thresholds

The outcome of any BCAP Action would be considered significant if its implementation results in any permanent or long-lived adverse impacts (direct or indirect) on any plant or animal species or ecological community. The purpose of this document is to qualitatively make general assessments based upon anticipated outcomes driven by existing data in the scientific literature as to what outcomes are likely to occur. Prior to inclusion of any potential BCAP site into the active program, a thorough site-specific environmental evaluation would be required to assess the possible presence of rare, sensitive, and protected species and critical habitat. At that time, the values of ecological criteria such as species richness, population dynamics, reproductive fitness, distribution, conservation value, and long-term population viability are some of the countless characteristics by which the degree of impacts (if any) would be quantified to assess their level of significance. Any negative impact to the long-term existence, persistence, or distribution of any species, but particularly Federally protected species, and or their associated critical habitat would be considered significant.

Prior to site development a site specific environmental evaluation of lands proposed for enrollment in BCAP would be conducted. If protected species are identified during the evaluation, consultation with the USFWS would be required to determine potential impacts. If negative impacts to protected species would occur, it is unlikely the proposed activity would be authorized. To avoid impacts to protected species USFWS may require site-specific BMPs during site preparation and management.

4.3.2 Methodology/Background

A radial distance of 50 miles is widely accepted as the maximum buffer distance in which biomass transportation costs do not exceed value of the fuel produced from that commodity in the facility (see Section 4.2.2.3; ORNL 2009a; English *et al*. 2008; Zeman 2007). The land use shifts resulting from potential BCAP project areas discussed previously in Section 4.2 were used for this analysis. For Alternatives 1 and 2, changes in available and eligible vegetative land types from the No Action Alternative were contrasted. Potential outcomes on vegetation were then analyzed using current available literature.

The same methodologies applied in vegetation analyses were applied to assess the impacts of landscape level vegetation changes on existing wildlife biodiversity and habitat resources. The key difficulty in assessing the effects of land use changes on wildlife is the inability to quantify and assess the changes to biodiversity as a result of the action. The analysis of feedstock impacts on wildlife must take into account a range of factors, and the time and money necessary to quantify long-term impacts of program implementation on population dynamics are outside the realm of this PEIS. Additional factors including land resource scale, landscape patterns, landscape complexity, resource interspersion and juxtaposition, and temporal relationships may all play vital roles in determining the effect on wildlife. For Alternatives 1 and 2, based on changes in available and eligible vegetative land types from the No Action Alternative, potential outcomes on wildlife were then analyzed using current available literature, habitat management strategies and concerns identified within representative SWAPs (see Section 3.2).

The resolution of this approach is considered suitable for regional and national analyses but inappropriate for site-specific analyses or the interpretation of rare land use occurrences. As discussed in Section 2.1.3.2, more detailed site-specific analyses of vegetation would be required as a component of the BCAP project area selection.

4.3.3 Alternative 1

Under Alternative 1, the economic analyses indicate that given a limited funding supply, BCAP sites should only target those areas able to support two to five BCFs (demonstration or commercial-scale). Only large, new commercial BCFs that are limited to producing energy in part from only newly established crops on BCAP contract acres are eligible under this alternative; there can be no new non-agricultural lands allowed to enroll in the program under Alternative 1. Similar to the CRP administered by FSA, the number of acres enrolled in BCAP project areas for crop production would be limited to no more than 25 percent of the eligible cropland in a given county. Additional discussion of eligibility may be found in Section 2.1.5.

4.3.3.1 Perennial Herbaceous Species

The selection process discussed in Section 4.2 resulted in the selection of the top five potential switchgrass sites presented in Figure 4.2-2, where the general locations and specific counties of influence are shown. The process also identified the top potential switchgrass BCAP project site for each state as shown in Figure 4.2-3. In the selection of the top BCAP project site for each state, the regional competition for feedstock was not enforced, as one of the objectives was to emphasize multiple state projects.

DIRECT IMPACTS

Vegetation

The direct impacts to vegetation are not limited to site-specific events and, because the impact on a particular species would vary by some degree, it is difficult to assess impacts without performing a site specific analysis. While the dynamics of a plant species may be directly impacted at the local site scale, if the composition of the species throughout the broader landscape is one that can absorb short-term local disturbances so long as there remain un-impacted population centers, then the direct impact can be said to be measurable locally (i.e., site-specific) but inconsequential at the landscape level. Furthermore, if at an ecoregion scale the species has several landscapes over which it is distributed or several ecoregions throughout the national geographic level then there is no cause for concern.

Considering a radius buffer composes approximately 5.0 million acres and these analyses are unable to identify how BCAP dedicated energy crops would be spatially and temporally distributed within a buffer area, it is expected that the impact of implementing Alternative 1 on vegetation communities in any of the selected regions would not have a long-term significant impact at a local or regional scale. As a worst case, the potential BCF having the highest land use shift for switchgrass production (44,002 acres) is in South Carolina (LRR P and T) (Table 4.2.4). This represents less than one percent of the 5.0 million acres surrounding the BCF, less than one third of one percent of cropland in the state of South Carolina and less than two tenths of one percent and less than one tenth of one percent of the total Level 1 land cover (Table 3.2-2) for LRR T and P, respectively.

A variety of plants currently being evaluated and grown for dedicated energy crops include genera and species non-native to the areas where production is proposed; several are known invasive pests in other regions where they have been introduced (DiTomaso *et al.* 2007). Under BCAP, excluded crops include those plants that have the potential to be invasive or noxious, or as determined further by the Secretary of Agriculture in consultation with other Federal or State agencies. It is the biogeographical context of a given plant that is important in determining whether it may be invasive in a particular location. Therefore, the site specific environmental evaluation required prior to BCAP project area selection would identify the potential invasiveness of a specific dedicated energy crop proposed for establishment on an individual parcel of land. In general, the site-specific analysis would determine if the proposed dedicated energy crop is on a Federal or State Noxious Weed list, conduct a Weed Risk Assessment and climate matching analysis, and evaluate the potential of the dedicated energy crop to cross-pollinate with related species or other closely related taxa. BMPs would be implemented that minimize the potential inadvertent spread of dedicated energy crops out of the field area such as timing the harvest to minimize the spread of seed, and inspection and washing of mechanical equipment prior to exiting a field.

Potential impacts of GE plants on the environment could be caused by the hybridization of the GE plants and their wild relatives that may result in a weedy or invasive plant species causing economic or ecological damage. Such hybridization could occur in either case of GE crops or non-GE crops; and research has not shown that GE organisms are more likely to be invasive than non-GE organisms (Chapman and Burke 2006). Potential risk to biodiversity includes gene transfer from a genetically modified feedstock to wild relatives within an area of genetic diversity (Firbank 2008). Such risk is considered by BRS prior to use of GE organisms outside controlled conditions and any dangers of monoculture are the same for both non-genetically modified dedicated energy crops or its genetically modified counterpart.

Any genetically engineered biomass feedstock proposed for establishment under BCAP has first to be approved by BRS and depending on the nature of the GE trait, by EPA for use. In addition, the site-specific environmental review required prior to BCAP contract approval would determine the potential invasiveness of a specific dedicated energy crop proposed for establishment on an individual parcel of land. This review would determine if additional assessment under NEPA is required prior to approval of the BCAP contract. The potential for significant impacts from establishment of invasive species grown as biomass feedstocks are therefore minimal, regardless of whether the feedstock is developed as a GE or non-GE crop.

Wildlife

Direct consequences to wildlife from implementing Alternative 1 relate to changes in habitat form and function at the site specific and regional landscape scales. Currently, no consensus exists on how best to assess and quantify the sustainability of renewable energy production at a local scale (Ogle 2008). These consequences would have the greatest impact upon area sensitive wildlife. Protection of biodiversity is becoming increasingly important as naturally occurring habitat is increasingly diminished (Wilson 1988). Biodiversity is difficult to define and even more difficult to protect because of its inherent complexity. The concept includes endangered species and critical habitats as well as regional species. It is defined by species distributions at large scales (regional or global), but is determined by species presence at the local scale (Ranney and Mann 1994). In instances where an existing fragmented landscape is further degraded into poorer quality habitat, wildlife species that were in a state of decline may become further isolated. Then, the effects of fragmentation may result in a trickle-down effect that may result in impacts to the species richness of an area, because local species extinctions would reduce the overall biodiversity for that area. At the local scale, biodiversity includes the numbers of species in a given area, species composition, genetic variability, and the habitat diversity and ecosystem function necessary for survival of those species. On a larger scale, landscape pattern is a more important characterization of biodiversity.

The direct impacts to wildlife resulting from land use changes associated with BCAP would range over a continuum, and the degree of the effect would depend upon the spatial scale at which the impacts are felt. The direct impacts of BCAP can impact wildlife at three distinct spatial scales, each one characterized differently; local (site specific), regional (landscape), and national (ecoregions). In order to assess direct impacts of any BCAP action on wildlife, a clear understanding of the local intensity of the action must be made, the dynamic context of the local habitat matrix within the broader regional environment must be studied and observed, and the distribution of those regional habitat components throughout the ecoregions that contains all similar types of habitat must be analyzed and accommodated for in any future adaptive management plan designed to mitigate said impacts. The direct effect of any BCAP action on the broader collection of organisms under the umbrella term of biodiversity, may be a more proficient measure of the impact at a national level since the nature of intensive study of most wildlife species to collect any data that is statistically meaningful is time, money, and labor intensive in nature at a national level.

Using the worst case scenario, it is uncertain that all 44,000 acres converted would be existing monoculture or fallow habitat (these could only be examined once actual sites are identified during site-specific analyses), yet if existing monoculture cropland is converted to switchgrass there must be an overall benefit to biodiversity. Monoculture cropland provides a fair amount of forage and cover for specific wildlife, but overall it does not sufficiently provide for the ecological needs of most wildlife (especially neo-tropical migratory birds). The maximum percentage of land that would be converted under BCAP in any given region is only a mere fraction (0.86 percent) of the total area. The nature of this PEIS is not to examine site-specific impacts, but to address regional and national scale impacts that are universal in nature in terms of the way land use changes can affect wildlife. The probability that there would be significant impacts to wildlife in localized portions of a BCAP site under the aforementioned scenario is minimal. If measured impacts to wildlife populations do not affect rare, threatened, endangered, or species of concern, and if they do not result in the regional decline of more common wildlife species, then the overall assessment should be no significant impact (only protected species). It would not be deemed that the BCAP is damaging to biodiversity in the region.

If an area is planted as a switchgrass monoculture, it would never provide as much ecological benefit as a naturally diverse habitat, but it still is an improvement over more traditional crops. If the choices are between a traditional agro-crop monoculture and a switchgrass monoculture, then pure switchgrass stands have a marked benefit, especially for fields experiencing soil erosion, organic matter loss, and annual nutrient depletion. A perennial switchgrass stand can offer nesting for birds (NRCS 2006b), a variety of birds and small mammals would eat switchgrass seeds, and Eastern cottontails and muskrats would eat the leaves. Switchgrass can provide excellent cover for birds and small animals, provided it is managed to enhance wildlife values. The establishment phase can alter the behavior of wildlife during their breeding seasons, and result in loss of individuals due to establishment related mortalities. Changes in vegetation structure result in changes in cover for wildlife including cover associated with reproduction success (nesting and rearing young), and food sources (Klute 1994; Horn and Koford 2000; Hughes *et al.* 2000; Madden *et al.* 2000). Conflicts between animals that are nesting or rearing young are possible during the establishment phase due to displacement (Labisky 1957; Gates 1965; Calverley and Sankowski 1995; Renner *et al*. 1995; Reynolds *et al.* 2001). Ground-nesting grassland birds are particularly susceptible to direct impacts associated with ground disturbance (NRCS 2006b).

Research has shown that the diversity and abundance of wildlife are extremely low in corn fields (Best *et al*. 1997). As a result, the conversion from corn into switchgrass would have either no negative effect or perhaps a net benefit for wildlife. The effects associated with conversion of hay/pasture or herbaceous lands into intensive switchgrass production on wildlife are not well-studied, but are likely to be site-specific and dependent upon relative management intensity. While significant areas of deciduous forest and, to a much lesser extent, evergreen forest are also shown as potential switchgrass growing areas, direct conversion of natural forest into switchgrass feedstock is excluded under Alternative 1.

Mammals

The largest mammal impacted by BCAP is the white-tailed deer, a species commonly associated with agricultural habitats throughout the regions eligible under BCAP. The loss of existing agricultural and fallow environments could potentially cause shifts at the local level in deer populations. It has been suggested that a reduction in white-tailed deer home range size would be observed where cropland is converted under BCAP, but there is no apparent connection between an increase in deer densities at the local scale and any reduction in deer reproductive dynamics (Walter *et al.* 2009). On the contrary, Harper and Keyser (2008) suggest that newly converted switchgrass fields could provide improved thermal cover and concealment from predators for does and fawns during the springtime, and that deer may utilize the rhizomes of the switchgrass as a food source. There could be some impact to deer fawning and rearing seasons if switchgrass were harvested twice a year (spring and fall) since the birthing period for deer begins in May and can extend into August (Snyder 1991), but this may be mitigated by the requirement that no management occur under BCAP during PNS.

Direct impacts on small mammal species from BCAP should be minimal. Small mammals are mobile and are able to escape from machinery used during the establishment period, although some mortality is likely. Direct effects of conversion on small mammals are associated with reproductive success and mortality of individuals and populations. Small mammals are an important component of the grassland ecosystem, primarily due to their intermediate trophic position and high dispersal abilities (Colorado State University 2008). Prairie rodents are omnivorous, consuming significant numbers of arthropods, whereas rabbits and other small mammals are the most important prey of hawks, eagles, owls, and coyotes. Small mammals alter the vegetative structure through consumption of vegetation, the disbursement of seeds, and the construction of mounds and colonies. Burrowing small mammals also enhance the soil by increasing water retention and providing refuges for other small animals, as well as aerating soil and moving soil nutrients. Studies on the viability of small mammal communities in regions of restored prairie utilizing switchgrass have indicated they can provide adequate components (forage, cover) to support viable small mammal communities (Kezar and Jenks 2004).

Birds

Cropland conversion to switchgrass under BCAP has the potential to impact grassland bird species, specifically altering their presence in certain areas (Grandfors *et al*. 1996; Warner *et al*. 2000); their reproductive success (i.e., destruction of nests, eggs, or young) (Wooley *et al*. 1982; Grandfors *et al*. 1996; Lokemoen and Beiser 1997); increase in predation (Lokemoen and Beiser 1997; Best *et al*. 1997; Horn and Koford 2000); increase in brood parasites (Grandfors *et al.* 1996), and individual collisions with farm equipment and vehicles (Wooley *et al.* 1982; NRCS 2006b). The bunchgrass nature of switchgrass can benefit species like Northern bobwhite and Wild turkey because it provides overhead cover yet allows the broods to wander freely searching for insects and other sources of nourishment (Harper and Keyser 2008). There is limited data on the direct effects of cropland conversion into switchgrass on avian species population dynamics due to the complexity of issues surrounding pre-existing declines of many of these grassland associated species. Some research suggests that grassland and area sensitive bird species avoid switchgrass planted fields. Other studies have found that switchgrass provides a better habitat for grassland bird breeding success compared to cropland.

One study in Wisconsin observed that for 25 grassland bird species of concern, species' richness and density were noticeably higher in harvested areas of switchgrass versus unharvested areas (Sample *et al.* 1998). Switchgrass plantings as a native replacement for row crop agriculture in Iowa have shown an increase in grassland bird species (Hoffman *et al.* 1993).

The conversion of row cropland into switchgrass fields for use as a dedicated energy crop can provide a variety of useable habitat for grassland birds. Even though under the BCAP, fields would only be harvested outside of the critical PNS (Table 4.3-1) within each region during the fall and winter, there would be unavoidable issues related to avoidance and spatial reorganization by some species. Representative grassland birds by state are detailed in Table 4.3-2. Some research suggests that Northern Bobwhite, a popular yet declining game bird throughout much of the potential BCAP region, shows an avoidance of grassland complexes comprised of switchgrass (Richardson *et al*. 2008). Nest success rates of Grasshopper Sparrows and Common Yellowthroats (*Geothlyps trichas*) are able to be sufficiently maintained in switchgrass fields planted for harvest (Murray and Best 2003). There is support for the improvement of available songbird habitat by planting annual croplands into perennial switchgrass (Beyea *et al*. 1994; Hoffman *et al*. 1995).

The widespread loss of the native grasslands throughout North America prompted the creation of the CRP under the USDA, a voluntary program under which private landowners voluntarily establish grass and other conservation vegetation on highly erodible or sensitive agricultural land. The CRP is a good example of how the reintroduction of grasslands into the agricultural matrix at the landscape level can benefit grassland birds. Benefits to date have been quantified locally (King and Savidge 1995; Best *et al*. 1997; Rodgers 1999; Reynolds *et al.* 2001), but they may be scalable given the relationship of the disturbance associated with the BCAP at regional and national levels. The approach of the CRP with the multi-agency Conservation Effects Assessment Project (CEAP) shows that benefits to grassland birds and other wildlife can be designed and implemented within the context of an agricultural landscape when multiple resource management strategies are applied, and that these efforts can augment knowledge of agricultural practices on wildlife locally and regionally while benefitting existing resources. One concern is that as CRP contracts expire, areas would be returned to row crop status, but if the BCAP allowed for the continued development of these areas as a dedicated energy crop it would then continue to improve the richness and abundance of grassland birds shown to benefit from such habitat management actions. Areas that have been converted from row crop to grasslands have been shown to provide better arthropod diversity for grassland birds to forage than more intensively managed agricultural areas (McIntyre and Thompson 2003). The highest potential for mortality due to site management occurs during spring and fall migrations to and from breeding or wintering habitats (NRCS 2006b).

Grassland bird species respond to habitat manipulations in a variety of ways (reviews by Saab *et al.* 1995; Ryan *et al.* 1998; Johnson *et al.* 2004) based on many factors, and the issues previously mentioned regarding questions of appropriate scale apply especially to this group of species. The vegetation analysis concluded that changes to the vegetation would be primarily to the structure. Strategies that combine a varying array of harvest strategies would benefit grassland bird diversity.

Table 4.3-1. Primary Nesting Season Dates by State

State	Dates	State	Dates
Alabama	April 15 – July 15	Nebraska	May 1 – July 15
Alaska	May 15 – June 25	Nevada	May 1 – July 15
Arizona	April 1 – July 1	New Hampshire	April 15 – August 1
Arkansas	April 1 – July 15	New Jersey	April 1 – July 15
California	April 1 – July 1	New Mexico	March 1 – July 1
Colorado	March 15 – July 15	New York	April 1 – August 1
Connecticut	April 15 – August 1	North Carolina	April 15 – September 15
Delaware	April 15 – August 15	North Dakota	April 15 – August 1
Florida	March 1 – July 15	Ohio	March 15 – July 15
Georgia	April 1 – August 31	Oklahoma	May 1 – July 1
Idaho	April 1 - August 1	Oregon	March 1 – July 15
Illinois	April 15 – August 1	Pennsylvania	April 1 – August 1
Indiana	April 1 – August 1	Rhode Island	April 1 – August 1
Iowa	Jun 1 –August 1	South Carolina	April 1 – September 1
Kansas	April 15 – July 15	South Dakota	May 1 – August 1
Kentucky	May 15 – August 1	Tennessee	April 15 – July 1
Louisiana	April 15 – July 15	Texas	March 1 – July 1
Maine	May 1 – August 1	Utah	April 1 – July 15
Maryland	April 15 – August 15	Vermont	April 15 – July 31
Massachusetts	April 1 – August 1	Virginia	April 15 – August 15
Michigan	April 1 – July 31	Washington	April 1 – August 1
Minnesota	May 15 – August 1	West Virginia	March 15 – July 15
Mississippi	April 1 – August 15	Wisconsin	May 15 – Aug 1
Missouri	May 15 – August 1	Wyoming	May 15 – July 15
Montana	May 15 – August 1	- - - - -	- - - - -

Table 4.3-2. Representative Grassland Birds by State

State	Common Name	Scientific Name
Idaho	Grasslands - Savannah Sparrow	*Passerculus sandwichensis*
Kansas	Grasslands - Grasshopper Sparrow	*Ammodramus savannarum*
Montana	Grasslands - Savannah Sparrow	*Passerculus sandwichensis*
North Dakota	Grasslands - Grasshopper Sparrow	*Ammodramus savannarum*
Nebraska	Grasslands - Savannah Sparrow	*Passerculus sandwichensis*
New Mexico	Grasslands - Savannah Sparrow	*Passerculus sandwichensis*
Oklahoma	Grasslands - Grasshopper Sparrow	*Ammodramus savannarum*
Oregon	Grasslands - Savannah Sparrow	*Passerculus sandwichensis*
South Dakota	Grasslands - Grasshopper Sparrow	*Ammodramus savannarum*
Texas	Grasslands - Northern Bobwhite	*Colinus virginianus*
Utah	Grasslands - Savannah Sparrow	*Passerculus sandwichensis*
Washington	Grasslands - Savannah Sparrow	*Passerculus sandwichensis*
Wyoming	Grasslands - Savannah Sparrow	*Passerculus sandwichensis*

Amphibians and Reptiles

Even less data exists on the effect of cropland conversion into switchgrass for reptiles and amphibians (collectively referred to as herptiles or herpetofauna), and while some species may experience negative impacts from BCAP, other species would experience positive impacts. Grasslands that have recently been disturbed may be used more frequently by herpetofauna because the variable habitat structure provides more micro sites (i.e., sunning and shading spots) (Partners in Amphibian and Reptile Conservation [PARC] 2008). Additionally, some reptiles and amphibians, especially members of the genus *Phrynosoma* (horned lizard), may benefit from disturbance due to the reduction of dense vegetation which increases the open areas for foraging (Pianka 1966; Fair and Henke 1997). Increasing native vegetation, or the semblance of an environment more native than cropland, could lead to an increase in the diversity and densities of invertebrate populations, indirectly increasing the herpetofauna that may forage upon them (PARC 2008). Herpetofauna need various stages of vegetative succession within their habitat, which historically was achieved through natural disturbance regimes (NRCS 2005).

Some populations of herptiles may experience localized extirpations during the establishment phase due to direct contact with mechanized equipment used in the planting of switchgrass. Many herpetofauna are not fast enough to move out of the way of potential danger. However, many amphibians breed in early spring, laying eggs in wetlands and other aquatic habitats, and then move into terrestrial areas to winter, and so these direct mortalities may be minimal.

Invertebrates

Invertebrate community studies have indicated that the diversity of invertebrates is often related to plant species diversity, structural diversity, patch size, and density (Jonas *et al.* 2002; McIntyre and Thompson 2003). Species richness in invertebrate communities appears to be greatest in mid to late June in temperate regions of the U.S. (Burke and Goulet 1998; Jonas *et al.* 2002). Total biomass of invertebrates has been documented to be significantly greater in areas with greater forb coverage (Klute 1994). Invertebrate species responses to conversion correlate to the life-style and habitat preferences for a species. Managed monoculture would create a uniform plant height and remove smaller topographical features, such as grass tussocks (Morris 2000). This would result in a decrease in plant structural diversity within a field and thus a potential decrease in invertebrate diversity based on a species preference for structure. However, long-term abandonment of management in formerly farmed fields can also lead to insect declines, primarily resulting from floristic changes (Swengel 2001). Properly managed commercial switchgrass for dedicated energy crop production would result in a dense, uniform plant stand that would have minimal structural diversity, thereby minimizing niches for invertebrates. The relative merit of switchgrass habitat for invertebrates (and wildlife in general) is dependent on what other agricultural systems it is replacing. Commercial switchgrass production would result in a net improvement in habitat when compared to traditional row crop agriculture, but it may be equal to or lower than the habitat value provided by properly managed improved hay or native grass hay lands.

Direct mortality to invertebrates from conversion would be dependent upon the degree to which a species is exposed, specifically if the species is a below ground insect, and to mobility of the species or life stage (Swengel 2001). Arthropod populations have been documented to decline immediately after mid-summer disturbances related to mowing, but only for a two week period (Bulan and Barrett 1971). Impacts to invertebrates from the establishment phase include destruction of potential nest sites, existing nests, and contents; direct trampling of invertebrates; and removal of food resources (Sugden 1985). Pollinator invertebrate species including butterflies, moths, bees and wasps, beetles, and flies are a critical component of both grassland ecosystem and crop production. Pollinators include generalists that forage from a range of plants and specialists that are limited in their sources for nectar and pollen. Primary habitat needs for all pollinators include a diverse native plant community and egg laying or nesting sites.

Aquatic Resources

The two direct impacts from BCAP implementation that can be expected to have an effect on aquatic resources are the dangers associated with toxins and increased sediment load in the waterways. It has been suggested that the impacts from herbicides and pesticides used on perennial herbaceous species would be greatly reduced as compared to their threat and usage levels when the environment is developed in row crop agriculture (Ranney and Mann 1994). A major management goal in agricultural areas that are also concerned with conservation of native wildlife is sustainable management of watersheds. The hydrological component of the landscape is inextricably linked to the soil and air and the plants animals, and humans that live in those types of environments. Land clearing, leveling, draining, tilling, fertilizing, and harvesting together create prolonged perturbations manifested in the ecological and physical conditions of streams and rivers. Regardless of the cause of a problem in a watershed, its effect on aquatic habitats and their biological communities can be dramatic. Physical damage due to channelization, erosion, sedimentation, and altered hydrological regimes, coupled with ecological damage due to excessive nutrients, pesticide contamination, and riparian clearing cumulatively diminish the quality of aquatic habitats and threaten their biological communities (Knight and Boyer 2007). Kort *et al*. (1998) observed that perennial herbaceous and woody biomass crops stabilized soil better than row crops, which would result in a reduced sediment load in waterways adjacent to those areas. Another recent survey of the available scientific literature on dedicated energy crop conversion has suggested a similar improvement to water quality as a result of the transference of row crop agricultural areas into switchgrass or other woody dedicated energy crops (Simpson *et al.* 2008). Snagging and clearing is generally considered detrimental to aquatic fauna because of the important role large wood plays in providing habitat and carbon. However, removal of some material may prevent bank erosion and failure, thus reducing suspended sediment loads (Knight and Boyer 2007). Field borders are often too far removed to have a significant impact on aquatic fauna; however, additional research may be necessary to explore off-site impacts of these practices.

INDIRECT IMPACTS

Vegetation

The measurement of the indirect effects the BCAP would have on the vegetative resources of regions under consideration under Alternative 1 must be assessed in terms of sustainability. Indirect effects on vegetation would include other land use shifts to compensate for agricultural land which has been converted to biomass production, changes in water quality or quantity, and changes in relationships with beneficial wildlife such as pollinators. Because of the scale of Alternative 1, indirect effects on vegetation are not expected to be wide ranging across any given region.

Wildlife

The magnitude of indirect impacts from BCAP Alternative 1 require an understanding of the relationship between the disturbance or conversion process (i.e., the areas) which are being planted in switchgrass, the vegetation that is present within that local area, the wildlife species richness for that specific site, and the context of that land area within a broader landscape scale context. The indirect impacts associated with the alternatives analyzed on all wildlife species would result principally from changes in the vegetation structure, in the soil structure, and in the hydrological cycle. These indirect effects can also include changes resulting from the conversion process that subsequently alter food abundance (seeds, insects) and cover for thermal protection, escape, or breeding (courtship, nests) (NRCS 1999b). Indirect effects resulting from the implementation of this alternative that affect wildlife may include changes in predation pressure, parasitism, disease, and competitive and social interactions (Kaufman *et al*.1990). The measurement of the indirect effects require study and observation over temporal scales measured in years, and dynamics like species population trajectories and regional biodiversity sustainability require assessments over large spatial scales over long periods of time.

The key issue that confronts conservation managers regarding the potential indirect impacts on wildlife by the project area establishment deals with the consequences of fragmentation. Excessive fragmentation stresses many species (e.g., genetic drift), and the concern should be in cases where an already fragmented landscape is further parceled up into poor quality habitat that further serves to isolate those species that were already in a state of decline. The effects of fragmentation can cause a trickle-down effect that results in impacts to the species richness of an area, because local species extinctions do reduce the overall biodiversity for that area. Of equal importance may very well be the spatial arrangement of the habitat patches in the landscape, and these again are questions that must be dealt with in a site specific examination of the proposed BCAP project area (Morrison *et al.* 1992).

A large percentage of the indirect impacts to wildlife would stem from the direct impacts to vegetation, and there has been scant examination of the broader ecological and associated indirect effects on wildlife. These impacts result from changes in plant community composition, structure, and productivity, which together largely determine wildlife habitat suitability. Another potential indirect impact involves the loss of biodiversity on surrounding lands, if the wildlife finds the conversion areas more favorable and thereby vacates the adjacent substandard land. Possibly, one of the most pervasive indirect impacts is the effect of edge and patch dynamics on the wildlife. It is also possible that genetic heterogeneity may become reduced for certain species that require a more connected environment at a landscape scale.

Land use is the principal factor determining the base level of abundance of indigenous species. In most cases land use has a greater impact on species abundance than does the management of land (e.g., application of practices for agricultural production or soil and water conservation). Agriculture affects habitat directly through converting natural habitats to cultivation, grazing, or other manipulation and the associated repeated disturbances that accompany those conversions. Agriculture indirectly affects wildlife habitat through water management practices for irrigation and drainage, soil erosion and sedimentation, and elevated nutrient and pollutant discharges into the environment. The direct effects of land use conversions on habitat are more easily measured than are the indirect effects. While the use of land is relatively easy to document, assessing its quality (productive, economic, habitat, etc.) is more challenging.

Most indicators of agriculture's affect on habitat reflect habitat patterns across the landscape. Those patterns and the biological diversity associated with them are the cumulative result of many ecological processes operating over time. It is much easier to describe the resulting patterns than it is to quantify the processes. Natural systems are inherently variable, and this variability is expressed both spatially and temporally. Because wildlife populations are the result of many processes operating together, the quantity and quality of habitat are just two of the indicators affecting the distribution and abundance of wildlife. Population density is often an inaccurate estimator of habitat quality (Brady and Flather 2001) and some population fluctuations are not related to habitat but may be the result of catastrophic weather conditions, disease, or overexploitation (Schamberger 1988). Habitat indicators may be useful for comparing alternative agricultural land management scenarios for regional or national program planning and related purposes. However, they must be designed so that they may be tested against empirically derived wildlife population estimates. Ideally, they would be designed as falsifiable hypotheses. Testing of habitat indicators should be done with multiple measures of biological diversity to properly reflect the complexity of natural systems. This is a problem because extant data sources representing many species are usually not available. Where data are available for a class of organisms, such as birds, the measures of diversity within that class should include statistical estimates of species richness as well as equitability or dominance. One should examine population responses by the very abundant species, very rare species, and those in between. Tests of habitat indicators for community diversity should accompany tests of habitat indicators for favored species (e.g., Ring-necked Pheasants [*Phasianus colchicus]*, or Gray Partridge [*Perdix perdix]*). The measurement of the indirect effects the BCAP would have on the wildlife resources of regions under consideration under Alternative 1 must be assessed in terms of sustainability and temporal fluctuations. The indirect effects that would potentially occur from the conversion to dedicated energy crops would not be immediate, but rather they would slowly emerge over time.

Indirect effects of dedicated energy crop conversion on small mammals may include habitat changes, which in turn can result in a change in abundance, diversity, and composition of small mammal species. General composition of grassland small mammal communities is determined primarily by structural attributes of the habitat (Grant *et al*. 1982). Some species, such as voles, require more cover and litter, others require a mosaic landscape, and others prefer the more open structure provided by areas in the early stages of establishment (Clark *et al*. 1998; Yarnell *et al*. 2007). The establishment phase of dedicated energy crop conversion would involve a periodic, temporary change in the structure of the vegetation. Species that do not favor reduced cover would potentially find refuge in areas adjacent to the conversion area, at least temporarily. As long as weather patterns and other factors are favorable, switchgrass would establish itself within a year of planting, and research has shown that herbivorous litter-dwellers, such as voles, re-established themselves in tall grass prairie one year after disturbance (Grant *et al*. 1982). Movement of voles, and possibly other small mammal species, could be restricted by disturbance during establishment activities. Some species, such as deer mice and jackrabbits however, prefer reduced cover or mosaic landscapes and populations of these species may increase following disturbance events (Rickel 2005). Reduced cover could also increase the access of predators to small mammal prey species, but the overall effects are not know (Torre *et al*. 2007).

An indirect effect on birds, in particular, may include increased exposure (thermal) and predation due to vegetation removal and composition shifts (Brady 2007). Any practice that improves runoff water quality and/or reduces sediment delivery would have beneficial effects to aquatic ecosystems (*Ibid*). Generally, as soil conserving measures increase, upland wildlife habitat quality also improves (Lines and Perry 1978; Miranowski and Bender 1982). Direct changes in land use can have greater effects on habitat quality than changes in management practices (Miranowski and Bender 1982). Riparian herbaceous buffers tend to have indirect effects on aquatic organisms by affecting channel morphology and erosion control, and as a source of organic materials (Knight and Boyer 2007).

Indirectly, herptiles may see reduced population sizes resulting from increased predation risks associated with a more open environment prior to switchgrass emergence and growth phases.

MITIGATION MEASURES

Vegetation

The conversion of agricultural land from row crops to dedicated energy crops under Alternative 1 has the low potential for negative effects upon the vegetation. Even so, mitigation methods such as protecting sensitive habitats, diversifying crop species, reducing pesticide usage, and carefully considering bioengineered species would not only decrease impacts but could improve vegetation resources.

It is important to identify and protect areas of greatest conservation concern. States have already developed wildlife action plans which identify many habitats that need conservation. It is only in situations where a species does not have the buffers of larger spatial scales in the context of the overall species population dynamics that it should be paramount that extraordinary measures be considered to negate or at least minimize any and all impacts local in scale. When considering locations for a BCF and the eligible cropland surrounding it, biological priority areas should be avoided.

Iowa State University (2009b) proposes using a targeted approach to improve environmental quality. Several ways to promote habitat quality in agricultural landscapes are: protecting native ecosystems where they remain; creating and maintaining large, contiguous patches of native vegetation; and providing better habitat by increasing the amount and diversity of perennial and natural cover types. Infield management and land care play a role in habitat quality as well. Reduced fertilizer, herbicide and pesticide use, tilling, and field size would improve overall land health. Researchers continue to evaluate mixed stands of big bluestem, indiangrass and other native grasses as desirable dedicated energy crops (Harper and Keyser 2008). Diverse fields of native grasses and forbs, where applicable, would provide better habitat than dedicated energy crop monocultures.

Another strategy to achieve conservation goals for a wide range of species is to apply different management techniques to different fields in an area during the year instead of applying the same management schedule to all fields at the same time. Additionally, irregular management versus frequent harvesting would increase the biodiversity of the grassland via multiple stages of succession (Rahmig *et al*. 2009). Gill *et al*. (2006) determined that spatial and temporal rotation of prescribed fire and herbicide applications in CRP grasslands helped maintain and sustain vegetative structure where the species composition of an area was of less concern to management.

Wildlife

The conversion of agricultural land from row crops to dedicated energy crops under Alternative 1 has the potential for positive and negative effects upon wildlife. In a broad context, the conversion into dedicated energy crops is suggested to help mitigate the negative effects of GHG emissions, which in turn may help benefit biodiversity that has been continuously under siege as a result of the implications GHG have on the regional climate regime (Firbank 2008). The suggested appropriate manner in which to suggest effective mitigation approaches to conservation of wildlife when dealing with these issues begins by understanding the processes that take place and how these actions either positively or negatively impact the resident wildlife.

What is important to maintain when developing an appropriate mitigation strategy is to utilize regional specific native species, where possible, to maintain as much of the native heterogeneity as is possible during any planting stages. Also paramount is the development of a framework that has the flexibility to address positive and negative impacts on different taxa at different spatial and temporal scales, recognizing that there are trade-offs that would be determined by managers on a site specific basis that involve weighing short-term-localized effects with long-term-regional impacts on sustainability and biodiversity (Firbank 2008). Further, Firbank (2008) suggests that it is useful to separate impacts at the local, regional, and national level spatially so that the detrimental or beneficial processes can be identified more readily.

Plant diversity is critical to the successful survival of numerous wildlife species. By harvesting switchgrass outside of PNS, and not destroying the cover needed grasses if management plans take the needs of wildlife into account during the earliest stages of project development.

Fargione *et al*. (2008) in BioScience lay out a set of various characteristics related directly to the impact of dedicated energy crops on wildlife persistence within the area under impact, breaking down the effects into three distinct categories (each comprised of several characteristics, with each characteristic being scaled along a continuum from lowest to highest value to wildlife). It is a straight forward assessment, identifying those areas having the lowest value as habitat to wildlife species being comprised of monocultural cropland, consisting of non-native species, harvested, and/or disturbed during PNS multiple times a year, when harvested cut to ground with no percentage of the field left unharvested, and isolated from surrounding patches.

It is generally noted that suitability of agricultural lands for abundant and diverse wildlife populations varies considerably. Agricultural lands include intensively farmed row crops to extensively grazed native rangelands. While efforts are often made to exclude wildlife from fields of row crops, wildlife utilization may actually be encouraged on rangelands. Many farmers may actually manage their field crops to increase game animal and bird activities on their land. Crop rotation, strip cropping, grass and forested riparian buffers, seeded food plots, and grassed waterways are common methods that agricultural producers can create habitat complexity, travel corridors, and foraging, and denning, and nesting habitat on their lands with little to no compromise in agriculture production. It must also be noted that managing vegetation like switchgrass for wildlife habitat is much different than managing switchgrass for biomass yield as a dedicated energy crop. This said, native unfarmed lands typically provide more of the life history requirements for most vertebrates and many invertebrates, because of the more diverse and natural matrix of habitat types than managed commercial agricultural lands. The result is a net increase to biodiversity at the local scale.

Most wildlife species begin to decline when agriculture expands to the point of replacing extensive tracts of native habitat, and a study in Iowa showed that breeding bird species associated with the agricultural landscape were lowest under an intensively managed farmed row crop monoculture scheme and highest in a diverse mosaic of crop and non-crop habitats (Best *et al*. 1995). Native grasses, like switchgrass, may furnish greater long-term and seasonal benefits to wildlife than introduced grasses (Brady 2007). Theoretically, there exists an optimum degree of fragmentation at the landscape scale (e.g. to maintain both interior and edge species) that would permit an integrative approach to sustainable agriculture, as well as to conserve biotic diversity at a greater spatial and temporal scale (Barrett and Peles 1994). Grassland bird species showed marked increases in diversity and richness in conversion areas where there was also suitable woody cover (Coppedge *et al*. 2001). As agricultural intensification declines, correlative increases in food web complexity can be observed (Culman *et al*. 2009).

At the local scale, the pressure applied to the existing biodiversity under Alternative 1 is the replacement of one form of vegetation with another. This may lead to substantial changes in the growth form, phenology, and disturbance regimes of that area, resulting in a change in the area's biodiversity. At the regional scale, the pressure applied to the existing biodiversity under Alternative 1 is on the spatial structure (from fragmentation and edge effects) of the various habitat components in the ecological matrix. The biodiversity of a landscape is closely related to the quality of individual habitats, their successional stages, and the way in which they are relating to each other at the regional level in a dynamic-fluid environment (Firbank 2008). For example, areas that have been less disturbed over time would tend to exhibit a greater stability in the face of a transitional environment or stochastic event. The highest quality habitats tend to be those that have remained undisturbed or minimally undisturbed over time. The greater the diversity of habitats at the landscape level, the greater the biodiversity of wildlife species (Benton *et al*. 2003; Firbank *et al*. 2008). At the National scale under Alternative 1, the potential exists to further fragment ecosystems that may be isolated or already degraded within the agricultural context of existing land use practices. This corresponds to a change in the intensity of how the land is used, and it must be weighed with the potential local impacts to biodiversity. The easiest way for this danger to be avoided would be to focus on implementing dedicated energy conversion on lands of marginal quality.

The conversion of land to dedicated energy crop production is a broad initiative that requires a thorough assessment that balances the goals of all stakeholders involved with the desire to not harm the existing regional biodiversity, while allowing for an economic increase in the potential of the existing lands under agricultural use. There is a good reason why the specifics of many aspects of this plan have been referred to as requiring or needing site specific assessments, and it is largely because every situation is going to be unique enough in biodiversity composition and abiotic characteristics associated with the landscape that there would be no way to programmatically account for them all. However, what can be offered is a set of guidelines (following Firbank 2008) that are designed to provide an initial baseline idea of what the interaction between the land use and biodiversity would be; thereby, resulting in an educated and scientifically informed suggestion of whether or not it is worthwhile to proceed to the site specific analysis stage. The project areas that should be likely candidates should be those that:

1) Avoid management actions that have the potential to allow the transference of non-wild genetic material to wild stock;
2) Do not create a situation where the dedicated energy crop becomes an invasive;
3) Are biodiverse on their own merit, meaning taking advantage of local strains to maintain genetic diversity and minimize the potential of having an effectively genetic monoculture across the region;

4) Enhance local biodiversity by management actions such as rotation of harvest sectors, alternating planting densities, and trying to create niches for grassland birds and small mammals;
5) Increase landscape diversity, which would be achievable via a good understanding of the habitat matrix;
6) Do not threaten high value habitats and sensitive, rare or threatened species at the local scale;
7) Promote sustainability of biodiversity; and.
8) Do not increase the risk to primary habitats.

The easiest way to prevent future conflicts and negative impacts to biodiversity, regarding the implementation of Alternative 1, would be to take full advantage of existing agricultural lands, preferably those which are marginal, and offer the minimal amount of conflict between land use goals. By taking full advantage of these lands, which are likely already low in biodiversity, there can be little question about a positive effect on biodiversity, both locally and regionally.

The conservation of regional biodiversity in agricultural landscapes is vital to maintain proper ecosystem functioning, and to protect and buffer global biodiversity (Fischer *et al*. 2006). To ensure the long-term economic success of the BCAP and to provide for a transparent integration of agricultural and conservation associated management goals, it is important that management choices on where to implement BCAP be scientifically defensible (*Ibid*). Therefore, strategies that bolster biodiversity resilience in these areas would focus upon landscape or regional patterns (Guidelines 1 through 5) while supplementing these strategies to focus special conservation attention on more sensitive species and at risk areas (Guidelines 6 through 10). These specific guidelines are steeped in scientific evidence, and are:

1) Design and maintain structurally complex natural complexes. Structural complexity supports species complexity. Attempts should be made to identify “keystone habitat features” that can act as a foundation upon which to base biodiversity.
2) Avoid monoculture based landscapes. Three key benefits of a structurally complex habitat matrix are the existence of native habitat for native species, reduced landscape contrast between conversion and native habitat areas, and a mitigation of the negative effects on species from edge and fragmentation effects.
3) Buffer sensitive areas. This serves to augment and support the suggestions made in Guideline (2).
4) Connect areas of native habitat with corridors and islands of refuge for migratory species. It is not only important to manage the habitat matrix on a regional scale, but it is important to connect all of the various elements within the matrix so that they can function as a cohesive unit. This helps to mitigate the effects of any localized disturbance by allowing the replenishment of an area’s biodiversity from other areas within the matrix.
5) Maintain landscape heterogeneity and maximize the existing range of environmental gradients. Heterogeneous landscapes can be designed to mimic natural patterns, and

this helps to maximize associated biodiversity by expanding the range of environmental conditions and habitats over which the gradient is found (Fischer *et al*. 2006). Or to put it another way there is more benefit to having something other than a vast monoculture from a biodiversity standpoint.

Guidelines 6 through 10 address specifics related to processes at work within the landscape, and are designed to augment the pattern-oriented Guidelines 1 through 5 offered above.

6) Enhance keystone species and functional diversity. In the case of grassland birds, it may be possible to treat grassland nesting birds as a functional guild that for management purposes is used as a keystone group. By creating an environment within the BCAP areas suitable and beneficial for grassland nesting birds, the amount of surrogate benefit to be gained by the other areas of the region's biodiversity also improve. When many species occur within a single functional group, the potential negative effects on the ecosystem and the chances of a disturbance causing a large scale decline in biodiversity associated with that system are minimized (Walker 1995; Elmqvist *et al*. 2003). In order to achieve this it is necessary to identify the key processes that would affect, in this example, grassland birds' nesting success. The easily identifiable way to ensure that management activities related to Alternative 1 do not negatively affect grassland birds while nesting is to prohibit all management related disturbance to these areas during the entire PNS for the species known or expected to be present in a given area.

7) Apply the proper disturbance regimes to maintain a semblance of natural processes. The prairies and grasslands that are primarily the affected areas under the BCAP evolved under a natural regime of fire. It would be wise to consider the use of prescribed burning in maintaining and improving these areas. Disturbance regimes that attempt to mimic natural historical ones are a good starting point (Lindenmayer and Franklin 2002; Bowman *et al*. 2004; Fischer *et al*. 2006).

8) Control invasive species.

9) Minimize any ecosystem processes that have the potential to infect the entire system (i.e. chemical toxins).

10) Be sure to catch species that may "fall" through the cracks, because they tend to be the rarer species.

To reduce impacts of increased dedicated energy crop production on wildlife and biodiversity in a more general sense, it is recommended that land-cover change toward intensive crop production be limited, chemical applications be limited, usage of adaptive management schemes be used to increase vegetation structure heterogeneity within and between fields, and that harvesting be delayed during critical life-history stages (Fletcher *et al*. 2009). Techniques recommended to minimize direct impacts to other wildlife would likely benefit small mammals as well (NRCS 2006b). Landscape-level effects on bird abundance should be studied because abundances of some species are related to the amount of different habitats in the surrounding landscape. Research studies indicate that in areas that were formerly native grassland habitat, if the current cropland is replaced by perennial herbaceous crops like switchgrass, then there can be some benefit in the form of suitable habitat for some prairie-dependent bird species (Beyea *et al*. 1994, Hoffman *et al*. 1995). Direct impacts to invertebrates could be reduced if the establishment process occurs outside of senescence periods, if planting is conducted in a manner that would produce a mosaic of vegetation patches, and if an area is only disturbed once a year (DiGiulio *et al*. 2001). It is suggested by the Xerces Society for Invertebrate Conservation (Xerces) that prior to any implementation of management techniques a biological inventory be conducted to identify important plant resources and pollinator habitat for generalist and specialized pollinator species (Black *et al*. 2007). Xerces emphasizes that some areas remain untreated when implementing management techniques to promote recolonization of the treated areas. Furthermore, disturbance of a site in multi-year cycles provides a source from which pollinators can spread (*Ibid*). Specific recommendations by Xerces relating to harvesting include delaying management practices until a majority of the pollinators are in diapause (a state of dormancy) or have successfully laid eggs, which typically occurs in late summer or early fall.

One important way to ensure the minimization of impacts to grassland birds would be to avoid any management activities during the PNSs of all grassland birds associated with an area under consideration for development based upon an expected species assemblage and the calendar for the PNS for that area under site specific analyses (Table 4.3-1; Bowen and Kruse 1993; Knopf *et al*. 1988; NRCS 2006b). Research examining the effects of SRWC on nesting birds revealed that to ensure successful nesting it is best to establish and locate plantings on a rotational basis (Tolbert *et al*. 1997). Switchgrass that is only harvested in the fall helps prevent mortality in wildlife that nest in these areas or uses them for cover during spring and summer. This especially provides benefits for grassland birds and white-tailed deer that raise their young in these environments (Harper and Keyser 2008). If the decision is made to wait even further into the winter season there would be a benefit to wildlife in the form of continued cover (Harper and Keyser 2008). Exposure and predation rates are highest on adults in the wintertime, and leaving this cover can help increase adult survival rates, which in turn can result in increased population densities. If switchgrass is harvested in the fall, some should be left unharvested whenever possible to continue to provide cover (Murray and Best 2003). Harper and Keyser (2008) suggest a minimum of five percent left unharvested around edges or some other form of cover to provide continuity in protection. This combined with an approach that either leaves whole fields unharvested or only 50 percent harvested can dramatically benefit resident wildlife (Roth *et al*. 2004).

Findings based upon CRP fields shows that there is no difference in production value of a fallow switchgrass field versus a previously harvested switchgrass field, and that when retaining cover the strips of unharvested switchgrass should be 50 feet wide and/or at least 0.5 acre in size (Harper and Keyser 2008); thereby, reducing negative impacts on wildlife associated with fragmentation effects, smaller patches have more edge and less interior and thereby result in a greater chance of predation related mortality for small mammals and grassland birds. As has been discussed before, monoculture switchgrass fields offer little food in the form of seed and soft-mast producing forbs. Harper and Keyser (2008) suggest that incorporating various forbs into the switchgrass mixture would enhance its value as forage to wildlife tremendously, while minimizing the production value, minimally. The addition of field borders planted with forbs and other native shrubs could provide a softer transition between fields and increase food availability and winter cover for many small mammals and grassland and upland game birds.

The conclusion is that switchgrass as a crop grown for use in the dedicated energy crop production process holds promise as being "better wildlife habitat than non-native grasses" if managed with consideration for wildlife (Lindberg *et al*. 1998; Harper and Keyser 2008). Farrand and Ryan (2007) suggest that field size, shape, and context within the greater landscape, were all critical factors in the establishment of grasslands for the conservation of birds. Riffell *et al*. (2006) observed that grassland bird abundance (n = 15 species) was greater in relation to the amount of CRP grasslands in the regional landscape. Veech (2006) found a similar finding in 36 species of grassland birds in the Midwest and Great Plains, including the popular Northern Bobwhite. Again, any "immediate effects" on nesting grassland birds resulting from the conversion of cropland into dedicated energy crop converted lands can be negated completely by avoiding any and all regular management activities during the set PNS.

One of the best strategies to achieve conservation goals for a wide range of species would be to apply different management techniques to different fields in an area during the year instead of applying the same management schedule to all fields at the same time. Additionally, irregular versus frequent management would increase the biodiversity of the grassland via multiple stages of succession (Rahmig *et al*. 2009). Stone (2007) found that timing and scale of conversion were important in their impact on the small mammal community, and that by staggering disturbance over a period of years the negative impacts could be mitigated. Gill *et al*. (2006) determined that spatial and temporal rotation of prescribed fire and herbicide applications in CRP grasslands helped maintain and sustain vegetative structure where the species composition of an area was of less concern to management. Renfrew *et al*. (2005) observed an avoidance of edge areas by grassland birds, leading them to conclude that the complexity surrounding their strategies for minimizing predation must be more complex than first thought.

Originally, the CRP was aimed at areas where soil was highly erodible, and the same tenets can and should be used in applying the BCAP to benefit not only terrestrial wildlife, but aquatic biodiversity as well. By stabilizing the soils of these steeper sloped areas and reducing the sediment load in the riparian areas of these agricultural systems, the water clarity improves and subsequent aquatic ecosystems are capable of improving as well. There are many overlaps in the desired management objectives between the CRP and BCAP. Another CRP initiative, which BCAP may consider in designing ways to mitigate impacts on wildlife resources and maximize the selection of the best areas for the combined goal of improved wildlife biodiversity and sustainability and dedicated energy crop production, is some form of the CRP's own Environmental Benefits Index (EBI). The EBI is applied to potential CRP enrollments and is geared towards maximizing erosion control, water quality, and benefits to wildlife and their habitat. It could certainly be modified to add in the economic incentives at the root of the BCAP.

The abundance of select grassland bird species has been shown to vary little between different harvest regimes for switchgrass, thereby suggesting that one effective mitigation technique would be to combine a variety of harvest regimes within a region to match the specific needs of the species found there (Murray and Best 2003). By providing a range of harvested conditions in an area, species preferring different types of grassland habitats from a structural perspective can be accommodated. Murray and Best (2003) observed in Iowa that while Grasshopper Sparrow abundance was greatest in the shorter, more sparsely vegetated portions of harvested switchgrass fields, Sedge Wrens (*Cistothorus platensis*) on the other hand preferred the taller, denser residual vegetation in non-harvested areas. This residual vegetation in non-harvested areas also plays a vitally important role in providing effective cover for species that nest early such as the Ring-necked Pheasant and Northern Harrier (*Circus cyaneus*).

The analysis indicated that a need for a suite of approaches to protect and enhance biodiversity on lands intended for dedicated energy crop production. To promote practices that minimize potential negative effects of dedicated energy crop production on biodiversity such as undertaking minimum tillage, reduced fertilization, and pesticide application, voluntary approaches and educational programs serve best. For mitigating the impacts of forest practices such as minimal construction of roads and other structures for biomass harvest, suitable BMPs for dedicated energy crop production need to be developed by modifying and upgrading the existing silvicultural BMPs. To protect sensitive areas such as wildlife corridors, riparian zones, and buffer strips identified based on regional and landscape analyses, mandatory BMPs may be developed. Similar legal measures may also be necessary to restrict the introduction of exotic and genetically modified species and varieties for dedicated energy crop production. To enable landowners to undertake practices that enhance habitat for biodiversity such as species mixtures and crop rotations, and retaining sufficient quantities of harvest residues, market based incentives are needed.

Techniques that may be implemented to reduce negative impacts to herpetofauna include initiating any disturbance at the center of a treatment area and progressively moving out from the center to allow wildlife to flee in all directions and not become trapped to one side.

Wildlife habitat relationships are very complex and at best theoretical frameworks have been developed against hypotheses about how these relationships work can be tested. Predictive models based upon empirical data about species-habitat relationships have proven useful for land managers. However they are more apt to confirm what is known about the studied area than to accurately yield a biodiversity profile of similar habitats that as yet have not been inventoried (i.e., models tend to lack generality). This is not to say that the task to define these relationships should be abandoned, but rather that the advancement of the state-of-the-art regarding habitat indicators must be undertaken with scientific rigor. As habitat indicators are selected and evaluated they must be tested against empirically derived patterns of biodiversity, including even the basic verification of presence/absence of a species on a landscape. This is an iterative process based upon continually refining the store of knowledge.

The measurement of land use changes between agriculture and other land uses, and changes within different agricultural land uses can only be accomplished accurately by an inventory or census where specific fields or sample points are tracked repeatedly over time. Merely reporting the total area of agricultural lands or specific crop types over time fails to document actual dynamics of land use change (Brady and Flather 2001). The ecological context plays an important role in determining the value of habitats associated with agricultural lands. Correct interpretation of these spatial patterns can only be made via empirical studies correlating measures of biodiversity with these spatial landscape patterns. Practices installed to reduce soil erosion can be applied in such manner as to add habitat elements to agricultural lands (Brady

1985). More comprehensive habitat management practices can also be installed and integrated into the overall agricultural land management scheme (Warner and Brady 1994). It is important to note that many of these practices may not be obvious to the casual observer nor would they necessarily be easy to quantify. For example the combination of conservation tillage, grass back-sloped terraces, grass border strips (i.e., field margins), and contour strip cropping would improve habitat values on a farm without reducing economic production. Wildlife habitat management at this level is not intensive, but may be extensive. The beneficial effects of habitat elements occurring on agricultural fields (e.g., field margins of beneficial perennial vegetation, hedgerows, etc.) are directly dependent upon the landscape setting, particular ecological region, and intensity of land uses. Studies of bird communities indicate that different measures of bird diversity respond differently to land use and land cover patterns leading us to conclude that multiple measures of wildlife community structure should be examined in assessing impacts from land intensification (Brady and Flather 2001). Empirical analyses of wildlife abundance with habitat attributes occurring on agricultural fields are confounded by other habitat attributes occurring across the landscape matrix. Consequently, it is important to conduct empirical studies using measures of biodiversity with the full suite of landscape attributes. Perhaps from such analyses meaningful indicators of habitat would be identified.

Stream crossing, bank protection, and exclusions improve water quality and intuitively should have a positive impact on aquatic fauna; however, documentation remains a significant gap. Cumulative effects of multiple practices, and the time scale at which effects of practices on aquatic communities can be demonstrated, have not been reported. Determining key indicators relevant to the appropriate time scale in the continuum of conversion actions is needed and would easily coincide with the examination of site specific assessments in the future.

4.3.3.2 Short Rotation Woody Crops

The selection process discussed in Section 4.2 resulted in the selection of the seven poplar and two willow sites presented in Figures 4.2-7 and 4.2-8, where the general locations and specific counties of influence are shown.

DIRECT IMPACTS

Vegetation

The direct effects from SRWC under Alternative 1 result from land use shifts from cropland to SRWC. These lands would not only have a fundamentally different cover type (herbaceous to woody) but would experience harvesting disturbances on a different time scale. Despite these differences, because of the scale of Alternative 1, the direct effects on vegetation are not expected to be wide ranging across any given region.

In a worst case scenario at Region 1-Poplar, there would be a shift from predominately soybean production (a decline of 93,687 acres) to an increase of 96,728 acres of woody crop production. This is over twice the amount of land use change expected with switchgrass. However, this only represents about two percent of the 5.0 million acre area surrounding this BCF and is not a significant impact.

Wildlife

The direct effects from SRWC to wildlife under Alternative 1 would be similar to those discussed under Section 4.3.3.1 for switchgrass. Because of the scale of Alternative 1, direct effects regional wildlife populations and biodiversity are not expected to be wide ranging across any given region.

Recent studies have found that if traditional row crop agricultural lands are replaced by native woody biomass crops (or hybrids with a native parent) that it can lead to increases in populations of some forest-dependent birds in those areas where a loss or fragmentation of forested lands has occurred (Beyea *et al*. 1994; Christian *et al*. 1994; Hanowski *et al* 1997). Further, data indicates that bird species richness values and overall densities associated with woody crops are no less than those observed in traditional row crop agricultural areas, although they are less than those in native habitat. There is the ability to improve the value of marginal agricultural lands for native wildlife by replacing traditional row crop agriculture with woody tree crops for dedicated energy crop production (Christian *et al*. 1994; Hoffman *et al*. 1995). Diversity of bird species utilizing woody cropland is comparable to that found in natural habitats like shrubland, eastern deciduous forests, and traditional coppice (Sage 1998; Dhondt and Wrege 2003).

Christian *et al*. (1998) found that small mammal species richness and abundance levels were greater in Populus plantings for harvest compared to row crops. Christian *et al*. (1994) found avian abundance and species richness to be consistently higher in these four to five year old hybrid poplar plantings than in row crop or small grain fields. However, use of these plantings was more similar to that of forests than to croplands. Few differences in small mammal abundance and diversity were found between the poplar plantings and row crops. The absence of ground cover was the single most important factor in reducing the abundance of small mammals using plantings compared with hay/pasture lands and grain crops. Both birds and small mammals used plantings in open landscapes of agricultural settings more extensively than those in more forested areas. Little overall change in the biodiversity of birds and small mammals was projected if annual row crops or small grain fields were replaced with hybrid poplar plantings (Christian *et al*. 1994). However, these plantings were found to experience high species turnover rates which are indicative of bird community instability (Hanowski *et al.* 1997). More vegetatively heterogeneous sites, as the result of weediness or failed tree clones, had more bird species present. Early successional species such as common yellowthroat (*Geuthlypis trichas*), clay-colored sparrow (*Spizella pallida*), song sparrow (*Melospiza melodia*), and American goldfinch (*Carduelis tristis*), were found to be most common on sites of three to five years of age.

Avian studies have shown that birds use more mature plantings in a manner similar to natural forests (Hoffman *et al*. 1995, Beyea *et al*. 1996). Hoffman *et al*. (1995) found in Oregon that breeding birds used hybrid poplar plantings more extensively than fall migrants and that the use of these plantings peaked following canopy closure. In Minnesota, Hanowski *et al.* (1997) found that the similarity between bird species occupying hybrid poplar plantings and surrounding forests increased as the maturity of the plantings increased. Although Christian *et al*. (1994) concluded that there appeared to be no negative habitat effects for birds and small mammals from including biomass tree crops in the landscape, it is important to remember that different animal species have different environmental requirements and that the positive habitat provided for some species by including trees or switchgrass in the landscape may be a negative factor for other species. For example, placement of short rotation tree plantings within the agricultural landscape in prairie landscapes of the north-central region of the U.S. may interfere with the broad skyline expanse required by species such as the sharp-shinned grouse (a species experiencing severe decline in numbers). This interference may be particularly noticeable during their breeding season as the tree crops mature to a taller, more closed canopy and provide a larger, more extensive presence on the horizon. Higher densities and species richness values for birds have been shown to be greater in Populus plantings for harvest versus row crop/small grain fields and pasture/hayfield cover types (Hanowski *et al*. 1997; Chrisitian *et al*. 1998).

INDIRECT IMPACTS

Vegetation

The measurement of the indirect effects from SRWC under Alternative 1 would be similar to those discussed for perennial herbaceous species in Section 4.3.3.1. Because of the scale of Alternative 1, indirect effects on vegetation are not expected to be wide ranging across any given region. Indirect effects on vegetation would include limited changes in land use resulting in land conversion for uses other than biomass production, changes in water quality or quantity, and changes in relationship with beneficial wildlife such as pollinators.

Wildlife

The measurement of the indirect effects from SRWC under Alternative 1 would be similar to those discussed for perennial herbaceous species in Section 4.3.3.1. Because of the scale of Alternative 1, indirect effects on biodiversity and wildlife are not expected to be wide ranging across any given region. Indirect effects on wildlife would include changes in distribution and population densities and associated changes in specialized wildlife (i.e., pollinators) that would benefit from the incorporation of greater SRWC into the heterogeneity of the landscape. SRWCs established on agricultural lands as shelterbelts or buffer zones to protect riparian areas are likely to reduce soil erosion and runoff of agricultural inputs and improve wildlife habitat (Joslin and Schoenholtz 1997; Tolbert & Wright 1998; Thornton *et al*. 1998).

MITIGATION MEASURES

Vegetation

The mitigation measures for SRWC under Alternative 1 would be similar to those discussed for perennial herbaceous species in Section 4.3.3.1.

Wildlife

The mitigation measures for SRWC under Alternative 1 would be similar to those discussed for perennial herbaceous species in Section 4.2.3.1.6.

The appropriate placement of woody crops between patches of natural habitat that have become disjunct can help provide critical corridors connecting these areas, facilitating migration, gene flow and act as a buffering force (Sage 1998). Research suggests that in areas to be planted in woody crops, the most beneficial management plan to benefit wildlife would be to site these crops in and around gaps in existing forest cover, serving the dual purpose of buffering fragmented forest parcels from cleared areas, reducing the effects of habitat fragmentation, and augmenting the availability of forest-interior habitats. Under traditionally held planting regimes for woody crops, a combination of varying stage and varieties provides a structurally diverse and dynamic three-dimensional environment which can be beneficial to wildlife compared to poorer quality fallow ground (Brady and Flather 2001). When designing areas to be converted into herbaceous dedicated energy crops, it would be beneficial to grassland bird species to incorporate the relationship of patch size to the landscape matrix. Helzer and Jelinksi (1999) observed that to achieve the maximum species richness in grasslands, careful attention should be paid to perimeter-to-area ratio relationship, as the areas comprised of the largest patches exhibited the greatest species richness. It has been observed that within species, such as the Mourning Dove (*Zenaida macroura*), the species response to the habitat variables can vary depending upon the scale of the observations. The use of habitat by species can be hypothetically positive at a site-specific scale while exhibiting negative characteristics at a landscape scale, for example. It is not enough to assess how the presence of specific vegetation alone can affect species at different spatial scales, it is also necessary for proper adaptive management to incorporate terrain and human influences on species utilization of an area (Osborne *et al*. 2001; Obrecht 2008).

4.3.3.3 Annual Herbaceous Species

The selection process discussed in Section 4.2 resulted in the selection of nine sorghum sites (Figure 4.2-9), where the general locations and specific counties of influence are shown.

DIRECT IMPACTS

Vegetation

The measurement of the direct effects from annual herbaceous crops under Alternative 1 would be similar to the no action alternative in that a traditional annual row crop would be exchanged for an annual dedicated energy crop. Changes in vegetative patterns would be similar to those discussed for perennial herbaceous species in Section 4.3.3.1, except that the crop would be an annual. Because of the scale of Alternative 1, direct effects on vegetation are not expected to be wide ranging across any given region.

Wildlife

The direct effects from forage sorghum to wildlife under Alternative 1 would be similar to those discussed under Section 4.3.3.1 for switchgrass. Because of the scale of Alternative 1, direct effects regional wildlife populations and biodiversity are not expected to be wide ranging across any given region.

INDIRECT IMPACTS

Vegetation

The measurement of the indirect effects from annual herbaceous crops under Alternative 1 would be similar to the no action alternative. Patterns of establishment, fertilization and cropping would be similar to traditional crops. Because of the scale of Alternative 1, indirect effects on vegetation are not expected to be wide ranging across any given region. Indirect effects on vegetation would include changes in land use resulting in land conversion for uses other than biomass production, changes in water quality or quantity, and changes in relationship with beneficial wildlife such as pollinators.

Wildlife

The measurement of the indirect effects from forage sorghum under Alternative 1 would be similar to those discussed for perennial herbaceous species in Section 4.3.3.1. Because of the scale of Alternative 1, indirect effects on biodiversity and wildlife are not expected to be wide ranging across any given region. Indirect effects on wildlife would include changes distribution and population densities and associated changes in specialized wildlife (i.e., pollinators) benefitting from the incorporation of greater forage sorghum into the heterogeneity of the landscape. Forage sorghum established on agricultural lands as shelterbelts or buffer zones to protect riparian areas are likely to reduce soil erosion and runoff of agricultural inputs and improve wildlife habitat (Joslin and Schoenholtz 1997; Tolbert & Wright 1998; Thornton *et al*. 1998).

Converting a substantial fraction of current agriculture cropping systems into dedicated energy crops could lead to the possibility that currently undisturbed natural grassland and forest systems would be converted to land for traditional crops. The BCAP thus has the potential to enhance the negative impact of agriculture crop production on the environment. This could result in an increase on GHG fluxes and nitrate leaching from agricultural systems and lead to further degradation of wildlife habitat. The scale of BCAP under Alternative 1 would minimize any impacts, and they would not be significant.

MITIGATION MEASURES

Vegetation

The mitigation measures for forage sorghum under Alternative 1 would be similar to those discussed for switchgrass in Section 4.3.3.1.

Wildlife

The mitigation measures for forage sorghum under Alternative 1 would be similar to those discussed for switchgrass in Section 4.3.3.1.

4.3.4 Alternative 2

Alternative 2 addresses the impacts of an expanded BCAP, in which the basic assumption would be that BCAP would play a key role in achieving the goals established by the EISA legislation for advanced biofuel. For the analysis of Alternative 2 no detailed location analysis is presented, as it is currently impractical to perform; however, geographic distribution of the feedstock would drive potential BCAP project locations.

Using the findings from Alternative 1, differences between available and eligible land resources between the No Action and Alternative 2 were compared to determine significant impacts.

4.3.4.1 Perennial Herbaceous Species

DIRECT IMPACTS

Vegetation

Direct effects of implementing Alternative 2 would be similar to effects of implementing Alternative 1; however, on a much larger scale. There is far more potential for impacts on the biological environment under this alternative. Direct impacts to vegetation resulting from conversion of agricultural areas and NIPF would vary from region to region. Areas of the Midwest may see a shift from row crops such as corn to perennial grasses representing a positive change. Areas with mosaic landscapes that shift from non-crop pasturelands or non-agricultural lands to dedicated energy crops may see a shift from diverse communities to monocultures. Herbicide, pesticide, and fungicide overspray and drift would continue to be a concern.

As required to meet the EISA targets, corn production would need to be 42 percent above the 2007 total to produce the 15 billion gallons of ethanol by 2015 (Biomass Research and Development Board 2008). In one example, a study of the Missouri Coteau region of North and South Dakota, Stephens *et al* (2008) estimated the probability of conversion of native grassland to cropland. In the years 1989 and 2003, 90,292 acres (5.2 percent) of native grassland in the area were converted to cropland (Stephens *et al*. 2008). This annualized rate of 0.4 percent per year is expected to increase with the demand of increased corn production for ethanol. It remains to be seen if replacing corn production with dedicated energy crops with increased output for ethanol would be sufficient to preclude the conversion of wildland for agriculture.

While socioeconomic and land use results indicate that production costs and maintenance of dedicated energy crops may be less than row crops, it is understood that the establishment of dedicated energy crops has the potential to require the use of pesticides and fertilizer in the first couple of years of growth; however, model results indicate, for most agricultural chemical types, that the amounts would generally decline with the conversion to dedicated energy crops from traditional row crops. Any change from annual row crops to perennial herbaceous or woody crops would reduce groundwater and surface-water contamination significantly, whereas conversions of hay land, pasture, or forage crop to energy crops are expected to generate little change in water quality.

Wildlife

The direct effects from switchgrass to wildlife under Alternative 2 would be similar to those discussed under Section 4.3.3.1 for switchgrass under Alternative 1; however, on a much larger scale. The potential for negative impacts on wildlife under this alternative is much greater, primarily due to that fact that the types of lands eligible for consideration under Alternative 2 are much broader. Direct impacts to wildlife would vary from region to region. The negative effects associated with the application of herbicides, pesticides, and fungicides would continue to be a concern. The direct impacts to wildlife are not limited to site-specific events and, because the impact on a particular species would vary by some degree, it is difficult to assess impacts without performing a site specific analysis. While the dynamics of a particular wildlife species may be directly impacted at the local site scale, if the composition of the species throughout the broader landscape is one that can absorb short-term local disturbances so long as there remains un-impacted population centers then the direct impact can be said to be measurable locally (i.e., site-specific).

The same conclusions discussed under Alternative 1 apply in the case of Alternative 2. The only difference is that Alternative 2 has a much larger pool of potential BCAP locations to select from, both in geographical scope and in the types of land that may be considered. Alternative 2 enlarges the category of lands eligible for consideration of conversion into BCAP to include new non-agricultural land (e.g., the conversion of NIPF to cropland), an elimination of the 25 percent cap on the amount of land in a single county that can be in BCAP, and the small/pilot BCFs and crops would qualify for BCAP consideration. Because of the scale of Alternative 2, direct effects on wildlife have potential for significant impacts on wildlife at the local level. Land conversion will affect wildlife habitat and species occurring in the converted land. However, as stated in the discussion of the direct effects of Alternative 1 on large mammals, especially white-tailed deer, large mammals are not expected to be impacted from the conversion of croplands and areas of marginal habitat quality.

INDIRECT IMPACTS

Vegetation

As was the case under Alternative 1, the majority of indirect effects remain unknown because of differences in temporal scale and issues pertaining to stability. The indirect impacts associated with vegetation can include changes in abundance, diversity, and composition of communities. When discussing the indirect impacts of the BCAP, of importance is the description of the relationship between the disturbance or conversion process (i.e., the area(s) which are being turned into dedicated energy crops), the vegetation that are present within that local area, the species richness for the landscape within which the BCAP area resides, and the context of that particular landscape within the broadest context spatially of the ecoregions itself.

The key issues that confront conservation managers regarding the potential indirect impacts on vegetation by the BCAP deal with the consequences of fragmentation. Excessive fragmentation stresses many species (e.g., genetic drift), and the concern should be in cases where an already fragmented landscape is further parceled up into poor quality habitat that further serves to isolate those plant species that were in a state of decline originally. The effects of fragmentation then cause a trickle-down effect that results in impacts to the species richness of an area, because local species extinctions do reduce the overall biodiversity for that area. Of equal importance may very well be the spatial arrangement of the habitat patches in the landscape, and these again are questions that must be dealt with in a site specific examination of the proposed BCAP developmental area (Morrison *et al*. 1992).

Vegetation depends on specific requirements to persist. Both water quantity and quality affect the growth potential for any plant species. Some plants are relatively hardy and grow in a wide range of site conditions. Of particular concern are plants with very specific water quality tolerance or hydrological needs. Vegetation communities are connected across landscapes by both the watersheds that drain the area and the aquifers underlying it.

Increased demand in recent years for corn production to feed BCFs has put an increased strain on aquifers systems in the Midwest (Roberts *et al.* 2007). Converting additional agricultural lands and possibly NIPF to dedicated energy crops could put increased stress on already depleted aquifers. Many plant communities are adapted to very specific hydrologic requirements. A reduction in groundwater levels would precipitate a conversion of mesic and wetland communities. Already shrinking patches of sensitive habitats would become even smaller.

The potential effect of feedstock production on the reduction or increase of non-point source pollution of water quality depends greatly on the amount and type of land converted to dedicated energy crop production (Ranney and Mann 1994). The potential for nutrients entering groundwater is principally a function of the amount of fertilizer applied, the rate of plant uptake, the amount of nutrients bound to soil and organic matter, and weather conditions. Additionally, pesticides, including herbicides, insecticides, and fungicides, can potentially contaminate water supplies. However, it is important to note that there are potential positive benefits on water quality from dedicated energy crop plantings. At least some perennial dedicated energy crops, for example, could be established between waterways and annual row crop plantings to serve as filters for agricultural crop runoff. These sites would be less susceptible to soil erosion. If matched appropriately to the site, perennial dedicated energy crop species would better utilize growing conditions where traditional agriculture crops do poorly, thus increasing productivity. It is also anticipated that perennial energy crop plantings would require fewer fertilizers than most food crops (Ranney and Mann 1994). The potential net effect of dedicated energy crops on overall fertilizer use and nutrient runoff would be difficult to assess until commercial production begins; however, it appears based on model results to be generally less than for traditional row crops.

Wildlife

As was the case under Alternative 1, the majority of indirect effects remain unknown because of differences in temporal scale and issues pertaining to stability. The results of the vegetation analysis are relied upon to assess indirect impacts to wildlife. The indirect impacts associated with vegetation can include changes in abundance, diversity, and composition of communities

MITIGATION MEASURES

Vegetation

Significant negative impacts to vegetation communities from implementation of Alternative 2 may be avoided if established USDA recommended conservation practices, procedures, and guidelines are followed, and the BCAP Conservation Plan, Forest Stewardship Plan, or equivalent for the specific site is adapted to resource conditions on the area just prior to engaging in active establishment of the dedicated energy crop. The mitigation measures discussed for perennial herbaceous species in Section 4.3.3.1 are also applicable to Alternative 2.

Grassland conversions are occurring for many reasons throughout the Midwest. As discussed in Section 4.3.3.1, it is important to use state wildlife action plans to identify, avoid, and protect areas of greatest conservation concern. In the example of a study of the Missouri Coteau region of North and South Dakota, Stephens *et al* (2008) found only about 14 percent of unprotected grasslands in biological priority areas were “under substantial risk of conversion”. Stephens *et al* (2008) suggests that although limited funding is currently available to mitigate losses, accurate predictions of probability of conversion would increase the efficiency of conservation measures.

As discussed in Section 4.3.3.1, in addition to reduced pesticide usage, several ways to promote habitat quality in agricultural landscapes are: protecting native ecosystems where they remain; creating and maintaining large, contiguous patches of native vegetation; and providing better habitat by increasing the amount and diversity of perennial and natural cover types. Diverse fields of native grasses and forbs, where applicable, would provide better habitat than dedicated energy crop monocultures. Additionally, irregular management versus frequent harvesting would increase the biodiversity of the grassland via multiple stages of succession (Rahmig *et al*. 2009).

All of these problems associated with pesticide and herbicide application can be controlled if not eliminated. Proper application methods can correct drift; alternative herbicides and modified weed control protocols under certain weather conditions can correct leaching into groundwater; and the development of safety measures, frequent training, regulations and clear labeling practices can address chemical spills. According to the Iowa State University factsheet on Switchgrass (2009a), except for localized feeding by non-selective feeders like grasshopper and armyworms, Iowa switchgrass producers do not have much concern about insect damage. Using a nurse crop such as corn can reduce weed competition during the long establishment period, thus reducing the need for herbicides.

As previously noted, it is the biogeographical context of a given plant that is important in determining whether it may be invasive in a particular location. Therefore, the site specific environmental evaluation required prior to BCAP project area selection would identify the potential invasiveness of a specific dedicated energy crop proposed for establishment on an individual parcel of land. In general, the site-specific analysis would determine if the proposed dedicated energy crop is on a Federal or State Noxious Weed list, conduct a Weed Risk Assessment and climate matching analysis, and evaluate the potential of the dedicated energy crop to cross-pollinate with related species or other closely related taxa.

In order to minimize the risk of plants hybridizing with wild populations and preventing the spread of potentially invasive species, plant geneticists are emphasizing the practice of creating sterile plants. Sterile cultivars can decrease the likelihood of feedstock escaping from production fields and becoming established, however continued sterility is not guaranteed (Raghu *et al*. 2006). Additionally, sterile cultivars are capable of vegetative reproduction; many invasive species including giant reed (*Arundo donax*), common reed (*Phragmites australis*), and Johnsongrass (*Sorghum halepense*), reproduce primarily through vegetative means, regardless if viable seed is produced or not. These species are able to colonize vast regions and inflict economic and ecological damage (Swearingen *et al*. 2002; DiTomaso *et al*. 2007).

For some dedicated energy crop candidates, the use of sterile cultivars may not be an option as viable seeds are needed to create a stock source. As new traits and transgenic technologies are applied to perennial out-crossing species, ecological risks must be assessed and safety established by rigorous research/field tests (agronomic and ecological analyses) such as those already mandatory for biological control agents and transgenic plants (Raghu *et al*. 2006). Mechanisms for responsible introductions could be modeled on the horticulture industry in which local and regional organizations cooperate with the nursery industry to restrict sale and distribution of species and cultivars that pose quantifiable threats to native species and ecosystems. Pre-introduction, science-based risk assessment tools to estimate quantitatively the risk of a nonnative species becoming invasive should be adopted.

Farmers are reducing the risks posed by invasive or noxious plants by utilizing research tested BMPs. These practices include crop rotation, strategic pesticide usage, and the use of bait crops to attract and control pests. In particular, crop rotation and strategic pesticide use are key elements in minimizing and/or avoiding the creation of resistant pests (weeds, insects, fungi, bacteria, and viruses).

Because the specific locations of the BCAP project areas and the numbers of participants are not known, and the choice of specific measures cannot be determined at this time, conditions under which particular component actions of the BCAP would have the potential for significant environmental impact would require site-specific environmental reviews and compliance with applicable environmental laws.

Wildlife

Significant negative impacts to vegetation communities from implementation of Alternative 2 may be avoided if established USDA recommended conservation practices, procedures, and guidelines are followed, and the BCAP Conservation Plan, Forest Stewardship Plan, or equivalent for the specific site is adapted to resource conditions on the area just prior to engaging in active establishment of the dedicated energy crop. The mitigation measures discussed for perennial herbaceous species in Section 4.3.3.1 are also applicable to Alternative 2.

4.3.4.2 Short Rotation Woody Crops

DIRECT IMPACTS

Vegetation

The measurement of the direct effects from SRWC under Alternative 2 would be similar to those discussed for SRWC in Section 4.3.3.2. Because of the scale of Alternative 2, direct effects on vegetation would be wide ranging with potential to have significant impacts across any given region. Land use shifts discussed in Section 4.2 would directly affect vegetation communities occurring in the converted land. Conversion from annual agricultural systems to SRWC would improve vegetative structure and diversity (Volk *et al* 2004). Additionally, double-cropping SRWC with overstory trees in NIPF has potential to alter forest understory and ground cover vegetation structure and diversity.

Wildlife

The direct effects from SRWC to wildlife under Alternative 2 would be similar to those discussed under Section 4.3.3.2, but because of the scale of Alternative 2, direct effects on wildlife would be wide ranging with potential to have significant impacts across any given region. Land conversion would directly affect wildlife habitat and species occurring in the converted land.

INDIRECT IMPACTS

Vegetation

The measurement of the indirect effects from SRWC under Alternative 2 would be similar to those discussed for perennial herbaceous species in Section 4.3.3.2. Because of the scale of Alternative 2, indirect effects on vegetation would be wide ranging with potential to have significant impacts across any given region. Indirect effects on vegetation would include changes in land use resulting in land conversion for uses other than biomass production, changes in water quality or quantity, and changes in relationship with beneficial wildlife such as pollinators.

Wildlife

The measurement of the indirect effects from SRWC under Alternative 2 would be similar to those discussed for SRWC in Section 4.3.3.2. Because of the scale of Alternative 2, indirect effects on wildlife would be wide ranging with potential to have significant impacts across any given region.

MITIGATION MEASURES

Vegetation

The mitigation measures for SRWC under Alternative 2, to reduce impacts on species of concern, sensitive habitats, and habitat fragmentation, would be similar to those discussed for SRWC in Section 4.3.3.2. Additionally, methods described by Volk *et al* (2004) would improve conservation of biological diversity. Using a mixture of different species of hybrids across a field would increase diversity and structure. Harvesting on a three-year rotation would impact only one-third of the area per year and create greater structural diversity. Additional diversity could be achieved by planting and maintaining the unplanted area (estimated to be four to seven percent of a field) in and around the crop (Volk *et al* 2004).

Wildlife

The mitigation measures for SRWC under Alternative 2, to reduce impacts on species of concern, sensitive habitats, and habitat fragmentation, would be similar to those discussed for SRWC in Section 4.3.3.2. Additionally, methods described by Volk *et al* (2004) would improve conservation of biological diversity. Using a mixture of different species of hybrids across a field would increase diversity and structure. Harvesting on a three-year rotation would impact only one-third of the area per year and create greater structural diversity. Additional diversity could be achieved by planting and maintaining the unplanted area (estimated to be four to seven percent of a field) in and around the crop.

4.3.4.3 Annual Herbaceous Species

DIRECT IMPACTS

Vegetation

The measurement of the direct effects from annual herbaceous crops under Alternative 2 would be similar to those discussed for annual herbaceous species in Section 4.3.3.3. Because of the scale of Alternative 2, direct effects on vegetation would be wide ranging with potential to have significant impacts across any given region.

Wildlife

The direct effects from forage sorghum to wildlife under Alternative 2 would be similar to those discussed under Section 4.3.3.3 for forage sorghum. The scale of Alternative 2 suggests that in addition to site-specific localized impacts to wildlife species and habitat, regional fluctuations and reductions in population sizes and ranges could be experienced.

INDIRECT IMPACTS

Vegetation

The measurement of the indirect effects from annual herbaceous crops under Alternative 2 would be similar to those discussed for annual herbaceous species in Section 4.3.3.3. Because of the scale of Alternative 2, indirect effects on vegetation would be wide ranging with potential to have significant impacts across any given region. Indirect effects on vegetation would include changes in land use resulting in land conversion for uses other than biomass production, changes in water quality or quantity, and changes in relationship with beneficial wildlife such as pollinators.

Wildlife

The measurement of the indirect effects from annual herbaceous crops under Alternative 2 would be similar to those discussed for annual herbaceous species in Section 4.3.3.3. Because of the scale of Alternative 2, indirect effects on wildlife would be wide ranging with potential to have significant impacts across any given region.

MITIGATION MEASURES

Vegetation

The mitigation measures for annual herbaceous crops under Alternative 2 would be similar to those discussed for annual herbaceous species in Section 4.3.3.3.

Wildlife

The mitigation measures for annual herbaceous crops under Alternative 2 would be similar to those discussed for annual herbaceous species in Section 4.3.3.3.

4.3.5 No Action Alternative

The No Action Alternative provides a baseline for quantifying and comparing environmental consequences associated with each BCAP alternative. Under the No Action Alternative, the

BCAP would not be implemented; therefore, there would not be financial assistance available for the establishment of new dedicated energy crops in the U.S. Thus, the impacts associated with existing facilities in each region are considered to provide a basis for analysis of the alternatives.

4.3.5.1 Direct Impacts

The No Action Alternative would maintain the status quo. Selecting the No Action Alternative would not result in significant changes to current land use trends. Under the No Action Alternative, BCAP would not be implemented for establishment and annual payments for dedicated energy crops. Under the No Action Alternative, dedicated energy crops would be established only in limited demonstration-scale (e.g., Vonore demonstration plant in Tennessee) with other public and private funding sources. Commercial-scale production using dedicated energy crops would more than likely not occur in the short-term due the current lack of technological availability of processes to fully utilize cellulosic components into bioenergy products. Short term effects under the No Action Alternative would be a greater use of existing crop and forestry residues as feedstock for existing commercial-scale and demonstration-scale facilities. Additionally, more residues could be utilized for co-generation of electricity or power generation at facilities that currently process forestry products or sugar crops (e.g., bagasse).

4.3.5.2 Indirect Impacts

The No Action Alternative would maintain the status quo. Selecting the No Action Alternative would not result in significant changes to current land use trends. Short term effects under the No Action Alternative would be a greater use of existing crop and forestry residues as feedstock for existing commercial-scale and demonstration-scale facilities. Without government funding available to absorb the potential economic risks and initial start up for producers of new dedicated energy crops, research ends would be driven to optimize first-generation energy crops already in place, such as corn.

4.3.5.3 Mitigation Measures

The No Action Alternative would maintain the status quo. Selecting the No Action Alternative would not result in significant changes to current land use trends. Mitigation measures would be similar to those discussed for all action alternatives.

4.4 AIR QUALITY

4.4.1 Significance Thresholds

An impact would be considered significant if BCAP crop production practices produce GHG emissions greater than those occurring from traditional crop production.

4.4.2 Methodology

For this analysis, the aspect of air quality with the most potential for impact from BCAP is GHG emissions that contribute to global warming. Energy use and associated CO_2 emissions can increase or decrease in response to changes in cropland management, by the type of crop planted, and associated production inputs influenced by responses to market demands or incentives for land management practices directly influencing emissions (e.g., increase carbon sequestration).

The analysis method for assessing the impact of BCAP on air quality is based on comparing estimated BCAP emissions against a baseline of traditional crop emissions by constructing Net Ecosystem Carbon Budgets (NECB) for multiple scenarios. This provides information on whether crop management practices under BCAP increase or decrease net GHG emissions. In constructing NECB, the analysis includes soil carbon, fossil-fuel emissions, other carbon emissions (CO_2 from agricultural lime), soil N_2O emissions, and upstream energy and emissions from production inputs. The analysis estimates on-site energy use and emissions from fossil-fuel consumption occurring on the farm directly related to crop production and off-site energy and emissions resulting from fossil-fuel combustion. The fossil fuel combustion component includes activities associated with the transport of crop production inputs such as fertilizer, pesticides, and seeds and includes emissions from power plants producing electricity used on-site. Thus, potential air quality impacts from establishment, growth, harvest, collection (processing), storage, and transport of biomass from the field to a BCF are examined.

The model is a statistical-based model that estimates changes in soil carbon and GHG emissions as a function of soil attributes, cropping practices, and production inputs, which are used to estimate the NECB. Calculations of soil carbon flux and stock changes are driven by statistical relationships between the aforementioned variables, and these relationships are derived from hundreds of paired field experiments (West and Post 2002; West *et al.* 2004). Energy and CO_2 emissions are derived from energy and emissions analyses conducted on regional cropping practices and production inputs (West *et al.* 2008; Nelson *et al.* 2009). Soil N_2O emissions are based on fertilizer application rates and on methods established by the Intergovernmental Panel on Climate Change (Eggleston *et al.* 2006). Estimates of N_2O are multiplied by the global warming potential factor of 286 and also multiplied by the C to CO_2 mass ratio of 12:44 to obtain units of C-equivalent emissions.

4.4.3 Alternative 1

Selecting Alternative 1 would result in net decreased CO_2 emissions generated from the conversion of traditional cropping systems to dedicated energy crops; however, given the limited acreage to be converted under this alternative, the effect would not be significant.

4.4.3.1 Direct Impacts

Tables 4.4-1 and 4.4-2 include estimates for changes in each potential project location from implementation of Alternative 1 from the baseline. These changes are for energy consumption (direct, indirect, total) and carbon equivalent emissions (direct, indirect, total).

The concept of direct refers to the energy and/or emissions related to the activities involved in on-site agricultural production (machinery use, diesel fuel, tillage operations, application of nutrients, and CO_2 and N_2O emissions from the soil).

The concept of indirect refers to activities associated with cropland production that occur off-site. This includes the manufacture and transportation of fertilizers, herbicides, seeds, and electricity for irrigation and on-farm activities.

Under Alternative 1, using the BCAP potential project locations in the top five regions would reduce direct energy consumed by 3,664 Giga Joules (GJ) through conversion of cropland to switchgrass. The top location in each of the states varies greatly in total energy consumed, sometimes showing an increase and sometimes a decrease reflecting the different energy potentials from the differing land conversion systems. The total energy change under Alternative 1 is minor, in most cases less than 0.1 percent, except for the Alabama site, which was 1.06 percent. This particular location had some hayland converted, but most land converted was not in one of the previous crops analyzed, meaning no calculated energy savings during conversion. Changes in total carbon were usually positive, although the percent changes from the No Action Alternative compared to Alternative 1 were small, usually less than 0.1 percent.

An additional direct effect associated with the implementation of Alternative 1 would be the fugitive dust emissions associated with establishment activities both within the field and with associated transportation over rural, non-paved roads. Given the limited scale of conversion associated with Alternative 1 during the establishment phase, it would be anticipated that these effects would be minor, temporary, local, and approximately equal to current fugitive dust emissions associated with on-going agricultural traditional crop production. If the conversion to perennial dedicated energy crops alters cropping systems toward limited or no tillage, there would be a reduction in fugitive dust emissions from cropping activities due to the longer life span of these species. Overall, in the longer term, these effects would be positive, but minor.

4.4.3.2 Indirect Impacts

Implementing Alternative 1 would create only limited indirect effects to air quality through establishment and growth of the dedicated energy crops. These indirect emissions could be derived from equipment exhaust or additional mobile sources required for unique techniques developed for the establishment of dedicated energy crops. However, since under existing conditions machinery would be utilized on these fields, these impacts would be similar to the No Action Alternative.

Table 4.4-1. Changes in Energy, Carbon Equivalent Emissions and Soil Carbon (Alternative 1 vs. No Action Alternative)

Top 5	Top State	Location	Direct Energy	Indirect Energy	Total Energy	Direct Carbon	Indirect Carbon	Total Carbon	Soil Carbon
			(GJ)			(Metric Tons)			
	X	Mellette, SC	(1,759)	13,683	11,924	(50)	855	805	2,258
X		Osage, KS	(442)	(2,072)	(2,514)	(12)	43	32	1,213
	X	Fremont, IA	1,685	(2,901)	(1,217)	34	30	64	1,074
	X	Pawnee, NE	1,203	(881)	322	26	102	129	1,163
	X	Roosevelt, NM	(1,997)	3,714	1,717	(42)	325	283	1,324
	X	Bent, CO	3,318	8,355	11,672	72	487	559	1,587
	X	Chautauqua, KS	768	1,037	1,805	18	125	143	1,190
X	X	Garfield, OK	1,028	(1,317)	(289)	21	(48)	(27)	1,257
X		Callahan, TX	(6,335)	(6,062)	(12,397)	(137)	(182)	(319)	1,742
	X	Hardeman, TX	320	1,086	1,406	5	96	101	1,316
X		Harmon, OK	680	1,616	2,296	13	113	126	1,283
	X	Tishomingo, MS	(10,809)	(33)	(10,842)	(239)	422	183	1,902
	X	Izard, AR	(15,779)	(3,711)	(19,490)	(340)	635	295	3,317
	X	McDonald, MO	(3,662)	1,579	(2,083)	(86)	294	208	1,651
X		Lawrence, MO	(2,781)	1,606	(1,175)	(67)	291	224	1,538
	X	Alexander, IL	550	(1,270)	(720)	10	122	131	1,192
	X	Marion, KY	(20,572)	4,527	(16,044)	(477)	620	142	2,424
	X	Lawrence, TN	(11,394)	(2,286)	(13,681)	(258)	224	(33)	1,517
	X	Colbert, AL	22,970	52,047	75,017	470	2,450	2,920	2,725
	X	Dillon, SC	1,271	(3,100)	(1,829)	30	92	121	1,117
	X	Mecklenburg, VA	(2,603)	(4,433)	(7,037)	(65)	179	114	1,719
	X	Person, NC	(1,637)	930	(707)	(41)	288	247	906

Table 4.4-2. Percent Changes in Energy, Carbon Equivalent Emissions and Soil Carbon (Alternative 1 vs. No Action Alternative)

Top 5	Top State	Location	Direct Energy	Indirect Energy	Total Energy	Direct Carbon	Indirect Carbon	Total Carbon	Soil Carbon
	X	Mellette, SC	(0.03%)	0.22%	0.10%	(0.04%)	0.33%	0.21%	1.29%
X		Osage, KS	(0.01%)	(0.02%)	(0.02%)	(0.01%)	0.01%	0.01%	0.77%
	X	Fremont, IA	0.02%	(0.01%)	0.00%	0.02%	0.00%	0.01%	0.18%
	X	Pawnee, NE	0.02%	(0.01%)	0.00%	0.02%	0.02%	0.02%	0.27%
	X	Roosevelt, NM	(0.04%)	0.05%	0.01%	(0.04%)	0.11%	0.07%	4.73%
	X	Bent, CO	0.11%	0.14%	0.13%	0.11%	0.19%	0.17%	2.52%
	X	Chautauqua, KS	0.01%	0.01%	0.01%	0.01%	0.04%	0.03%	1.15%
X	X	Garfield, OK	0.01%	(0.01%)	0.00%	0.01%	(0.01%)	0.00%	1.25%
X		Callahan, TX	(0.16%)	(0.11%)	(0.13%)	(0.16%)	(0.07%)	(0.10%)	10.14%
	X	Hardeman, TX	0.01%	0.01%	0.01%	0.00%	0.03%	0.02%	2.05%
X		Harmon, OK	0.01%	0.02%	0.02%	0.01%	0.03%	0.03%	2.17%
	X	Tishomingo, MS	(0.42%)	0.00%	(0.17%)	(0.44%)	0.31%	0.10%	4.08%
	X	Izard, AR	(0.25%)	(0.05%)	(0.14%)	(0.25%)	0.22%	0.07%	6.02%
	X	McDonald, MO	(0.06%)	0.03%	(0.02%)	(0.07%)	0.14%	0.06%	1.88%
X		Lawrence, MO	(0.05%)	0.03%	(0.01%)	(0.05%)	0.13%	0.06%	1.43%
	X	Alexander, IL	0.01%	(0.01%)	0.00%	0.01%	0.02%	0.02%	0.53%
	X	Marion, KY	(0.40%)	0.09%	(0.16%)	(0.42%)	0.31%	0.05%	1.76%
	X	Lawrence, TN	(0.32%)	(0.05%)	(0.16%)	(0.34%)	0.12%	(0.01%)	1.90%
	X	Colbert, AL	0.74%	1.30%	1.06%	0.72%	1.66%	1.37%	4.91%
	X	Dillon, SC	0.06%	(0.07%)	(0.03%)	0.07%	0.05%	0.05%	1.36%
	X	Mecklenburg, VA	(0.11%)	(0.14%)	(0.13%)	(0.13%)	0.15%	0.07%	2.87%
	X	Person, NC	(0.07%)	0.03%	(0.01%)	(0.09%)	0.30%	0.17%	1.70%

4.4.3.3 Mitigation Measures

Site specific mitigation measures would be determined based on the local or regional Air Quality Control Region, as prescribed in the BCAP Conservation Plan or Forestry Stewardship Plan or the equivalent, or through local or State regulations concerning air emissions of criteria pollutants. Some BMPs to reduce mobile sources would include proper maintenance of equipment and dust suppression activities, as required for site specific conditions.

4.4.4 Alternative 2

Implementing Alternative 2 would result in soil carbon increases over the long-term due to establishment of perennial dedicated energy crops on pasture and hay lands. Estimated changes in soil carbon range from a decline of 3.2 percent in the initial years of establishment to an over 100 percent increase in later years. These changes would be locally significant and could create significant national effects as well.

4.4.4.1 Direct Impacts

The direct carbon equivalent emissions during the period of switchgrass growth are increased. (Table 4.4-3). This is due to increased production inputs on lands that had little to no production inputs (e.g., hay and pasture) prior to cultivation of dedicated bioenergy crops. The indirect emissions, reflecting activity related to previous equipment manufacturing, etc., is difficult to interpret since numerous assumptions had to be made concerning prior ownership of switchgrass planting and harvesting equipment. The change in carbon equivalent emissions for Nitrogen, Phosphorus, and Potassium fertilizers were usually positive, but emissions associated with chemicals, seed, and lime decreased under the Alternative 2 scenario. As mentioned earlier, the total of these are small compared to soil carbon, except for the Alabama location, the site with considerable idle land brought into production. This analysis suggests that net emissions would be decreased due to the large percentage increase in the soil carbon pool.

Additional direct effects associated with the implementation of Alternative 2 would be the fugitive dust emissions associated with establishment activities, both within the field and with associated transportation over rural, non-paved roads. Given the potential scale of conversion associated with Alternative 2, it would be anticipated that these effects would be similar to Alternative 1 during the establishment phase, i.e., minor, temporary, local, and approximately equal to current fugitive dust emissions associated with on-going agricultural crop production. If the conversion to perennial dedicated energy crops alters cropping systems toward limited or no tillage, there would be a reduction in fugitive dust emissions from cropping activities due to the longer life span of these species. Overall, in the longer term, these effects would be positive and have the potential for regional effects.

4.4.4.2 Indirect Impacts

Implementing Alternative 2 would create only limited indirect effects to air quality through establishment and growth of the dedicated energy crops. These indirect emissions could be derived from equipment exhaust or additional mobile sources required for unique techniques developed for the establishment of dedicated energy crops. However, since under existing conditions machinery would be utilized on these fields, these impacts would be similar to the No Action Alternative.

4.4.4.3 Mitigation Measures

Site specific mitigation measures would be determined based on the local or regional Air Quality Control Region, as prescribed in the BCAP Conservation Plan or Forestry Stewardship Plan or the equivalent or through local or State regulations concerning air emissions of criteria pollutants. Some BMPs to reduce mobile sources would include proper maintenance of equipment and dust suppression activities, as required for site specific conditions.

Table 4.4-3. Percent Change in Net Carbon Flux, Carbon Equivalent Emissions, and Energy Consumed from No Action Alternative to Alternative 2

Item	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
NET CARBON FLUX	0	0	0.21	(0.19)	0.33	(0.23)	1.70	0.54	(0.04)	(2.43)	(3.09)	(5.23)	(5.78)	(6.83)	(6.58)
SOIL CARBON	0.00	0.00	(0.08)	0.16	(0.32)	0.55	(3.19)	3.62	18.06	35.23	51.70	72.24	87.84	100.22	110.46
Carbon Equivalent Emissions															
TOTAL CARBON	0.00	0.00	0.51	(0.43)	0.74	(0.41)	3.30	2.58	5.92	5.64	9.62	11.28	15.34	17.11	21.52
DIRECT CARBON	0.00	0.00	0.10	(0.10)	0.10	(0.10)	2.04	3.77	5.30	6.93	9.80	12.88	16.58	19.86	23.34
INDIRECT CARBON															
Fertilizers	0.00	0.00	0.59	(0.59)	0.71	(0.60)	3.46	2.26	6.29	5.82	10.33	11.93	16.45	18.07	23.07
Chemicals	0.00	0.00	1.29	(0.64)	1.28	0.64	2.56	0.00	1.91	(0.63)	1.27	0.64	1.90	1.90	4.43
Seed	0.00	0.00	0.58	0.00	0.58	0.59	1.18	(1.17)	(1.17)	(2.92)	(2.92)	(4.12)	(3.53)	(4.12)	(3.53)
Nitrogen	0.00	0.00	0.96	(0.83)	1.24	(0.83)	5.19	3.10	8.53	7.02	12.67	13.64	18.65	19.70	25.53
Lime	0.00	0.00	0.00	0.00	0.35	0.35	0.00	1.05	2.10	3.50	5.94	9.47	12.98	16.14	18.60
Total Energy															
TOTAL ENERGY	0.00	0.00	0.00	-0.88	0.89	0.00	2.68	2.68	5.36	6.25	8.93	10.71	14.29	16.07	20.54
DIRECT ENERGY	0.00	0.00	0.00	0.00	0.00	0.00	2.33	2.27	4.55	6.82	9.09	13.95	18.60	20.93	23.26
INDIRECT ENERGY															
Fertilizers	0.00	0.00	2.00	0.00	2.00	0.00	4.00	4.00	8.00	8.00	12.00	12.00	18.00	20.00	24.00
Chemicals	0.00	0.00	0.00	0.00	0.00	0.00	11.11	0.00	11.11	0.00	11.11	11.11	11.11	11.11	11.11
Seed	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-11.11	-11.11

4.4.5 No Action Alternative

Selecting the No Action Alternative would be unlikely to change either existing GHG emissions from agricultural activities or emissions of criteria pollutants within the U.S., which when compared to the alternatives would be a negative effect. Under this alternative, crops currently used to produce bioenergy would be primarily Title I crops, Title I crop residues, and woody biomass residues. There could be increased mobile source emissions and fugitive dust emissions from increased transportation for the movement of crop residues from the field to a qualified BCF; however, given the limited number of BCF throughout the country and the limited economically viable distance to transport materials via conventional means, these emissions would be limited to a local scale.

4.5 SOIL QUALITY

4.5.1 Significance Thresholds

Impacts to soil resources would be considered significant if implementation of an action resulted in permanently increasing erosion, altered soil characteristics that threaten the viability of the cover, or affected unique soil conditions.

4.5.2 Methodology

POLYSYS has an environmental module to estimate for each county changes in fertilizer and chemical expenditures, erosion and sedimentation/deposition, fossil-based carbon emissions, and soil carbon sequestration resulting from changes in cropping patterns with increased ethanol production. Changes in environmental indicators are reported in aggregate for each BCF.

Changes in fertilizer and chemical expenditures (expressed in 2007 dollars) were estimated using crop supply module budgets and by multiplying either the fertilizer or chemical expenditures by the land area for a given crop and region. The expenditures used in the analysis are a weighted average of the tillage system employed in the analysis for each county in each BCF and are determined by multiplying the change in crop acres from the baseline times the associated input cost.

Changes in water erosion (sheet and rill) incorporate computed levels of erosion for cropland, pastureland, and CRP land using the Universal Soil Loss Equation (USLE) (Wischmeier and Smith 1965). The 1997 and 2003 National Resource Inventory (NRI) data sets (NRCS 2007b) and the county-level tillage data base from the Conservation Technology Information Center (NRCS 2007a) were used to develop the USLE estimates for POLYSYS. Sheet and rill erosion (Mg ha^{-1}) for each county were estimated using the following equation:

$$USLE_i = R_{i,j} \times K_{i,j} \times L_{i,j} \times S_{i,j} \times P_{i,j} \times C_{i,k,m} \times A_{i,j,k,m}, \quad (1)$$

where *i* is CRD, *j* is land type (1= cropland, 2= pastureland, and 3 = CRP land), *k* is crop grown, *m* is tillage method (1 = conventional tillage, 2 = reduced tillage, and 3 = no tillage), *R* is a rainfall and runoff factor, *K* is a soil erodibility factor, *L* is a slope length factor, *S* is a slope steepness factor, C is the crop management factor, *P* is a crop support practice factor (based on proportion of land under terrace, strip crop, and no additional conservation practice for example) , and A is total available land area.[1]

Estimated average *R*, *K*, *L*, *S,* and *P* factors for each CRD based on the 2003 NRI data were from the USDA National Resource Conservation Service (Goebel 2007). The C factor was derived from the 1997 NRI and reflects the cropland tillage practice factor by crop and tillage system. The proportions of crop area in conventional tillage, reduced tillage, and no tillage practices in each County was fixed at 2009 county levels as used in the POLYSYS Baseline. Estimated changes in planted area crop for each county from the POLYSYS crop supply solutions were multiplied by the tillage proportions for that region to determine the land area planted using conventional, reduced, and no tillage practices by crop. These estimates were then multiplied times *KLSR*, *P*, and C factors to estimate changes in gross sheet and rill erosion levels. The changes in sheet and rill erosion are estimated for each County using Equation (1) and aggregated to the 105 U.S. Geological Survey 4-digit sub-regional hydrological units (NRCS 2007b), adjusted to county boundaries.

The soil erosion data were then used in the Micro Oriented Sediment Simulator (MOSS) to estimate aggregate soil deposited and suspended for each location (Alexander and English 1988).

4.5.3 Alternative 1

Implementing Alternative 1 would result in positive reduction in the soil erosion from all sources. Based on the average soil erosion rates, the effects from the conversion of Title I croplands to switchgrass has been estimated to conserve approximately 0.4 inch of soil per acre per year, which over a 10 year period would save approximately four inches of topsoil. This effect would be locally significant and would benefit multiple characteristics associated with topsoil retention. In addition to topsoil retention, it was estimated that Alternative 1 would increase soil carbon from 900 to 3,300 metric tons and ranged from less than one percent to a greater than 10 percent increase, depending upon the location. Depending upon the location, this additional soil carbon could be locally significant in some areas.

4.5.3.1 Direct Impacts

SOIL EROSION

The selection of the top five plant locations and implementation of BCAP resulted in an average of approximately 39,486 acres surrounding each BCF being converted to a perennial dedicated energy crop. Switchgrass was chosen in the overall analysis as the model perennial dedicated energy crop due to the available data on this species. This land conversion from various crops resulted in an average of 30,450 acres of switchgrass. This resulted in reductions in erosion across the locations of 11 to 120 tons per acre per year as determined by dividing the total soil reduction by the acres converted to a perennial dedicated energy crop compared to the previous cropping system. The average erosion reduction was 66 tons per acre per year. This is approximately equivalent to the loss of 0.4 inch of soil over each acre each year. A 10 year switchgrass production period would result in the average total saving of as much as four inches of topsoil on some of the acres previously planted to other crops. The reduction in soil loss would result in maintenance of soil carbon and reduce the potential for sediment to move from fields carrying pesticides and nutrients to surface water bodies. This is reflected in the reduced sediment being deposited off-site and the reduced suspended sediment that could move with runoff water directly into water bodies. Table 4.5-1 shows the estimated levels of reduced erosion from the implementation of BCAP.

Table 4.5-1. Estimated Reduced Levels of Erosion as a Result of Land Conversion to Dedicated Energy Crops (tons/year)

State	Location	Reduced Erosion	Reduced Sediment Deposited	Reduced Sediment Suspended
		Tons/Year		
Oklahoma	Garfield	2,750,331	667,039	550,066
South Carolina	Dillon	559,620	167,886	167,886
Tennessee	Lawrence	950,101	505,810	365,969
Texas	Hardeman	1,365,321	410,907	279,616
South Carolina	Mellette	508,506	159,324	146,174
Iowa	Fremont	4,528,640	2,899,531	1,585,024
Kentucky	Marion	1,114,820	667,912	445,946
Colorado	Bent	236,767	75,845	47,353
Missouri	McDonald	1,253,788	411,246	269,816
New Mexico	Roosevelt	579,043	71,581	69,773
Kansas	Chautauqua	1,823,858	490,822	364,772
Illinois	Alexander	3,511,271	1,737,216	1,261,032
Mississippi	Tishomingo	998,494	472,547	367,303
Alabama	Colbert	950,819	405,450	332,787
Nebraska	Pawnee	3,913,795	2,481,035	1,340,147
Virginia	Mecklenburg	887,347	270,998	270,998
Arkansas	Izard	756,739	336,211	243,720
North Carolina	Person	820,743	248,060	248,060
Top Five BCAP Potential Project Areas				
Oklahoma	Garfield, OK	2,750,331	667,039	550,066
Missouri	Lawrence, MO	1,381,868	556,977	358,779
Texas	Callahan, TX	497,337	147,685	124,334
Oklahoma	Harmon, OK	1,292,778	387,783	258,556
Kansas	Osage, KS	2,820,940	1,433,279	857,635

This reduced erosion would also be expected in SRWC systems involving either hybrid poplar or willow trees. The tree canopy and the accumulating leaf litter would provide good soil coverage and result in very little erosion potential. Even during harvest periods the accumulated surface cover would remain in place allowing good protection until the trees regrow (coppice) and reform the tree canopy.

Forage sorghum production for cellulosic bioenergy use would result in greater soil erosion hazards due to removal of the above ground biomass in the fall. This would leave the soil bare and result in possible soil erosion especially on sloping soils. This could be mitigated by timely planting of a winter cover crop of wheat or rye after harvest to provide more soil cover in late fall, winter, and spring.

Table 4.5-2 shows the percentage changes in the use of fertilizers and chemicals from implementing the BCAP projects under Alternative 1.

Table 4.5-2. Percent Changes in Use of Fertilizers and Chemicals after Implementation of Alternative 1

Top 5	Top State	Location	Fertilizer				Pesticides		Other Chemicals
			Nitrogen	Phosphorus	Potassium	Lime	Herbicide	Insecticide	
	X	Mellette, SC	5.2%	0.2%	(2.5%)	0.0%	(2.9%)	(0.8%)	na
X		Osage, KS	0.4%	(1.6%)	(7.3%)	(8.1%)	(6.5%)	(20.5%)	0.0%
	X	Fremont, IA	(0.3%)	(1.1%)	(1.1%)	(1.5%)	(1.5%)	(0.8%)	na
	X	Pawnee, NE	(0.1%)	(0.7%)	(2.8%)	(3.3%)	(2.1%)	(2.1%)	0.0%
	X	Roosevelt, NM	(10.7%)	(8.8%)	(0.1%)	(0.1%)	(10.4%)	(9.3%)	(12.2%)
	X	Bent, CO	2.6%	10.0%	(2.3%)	(2.1%)	(5.6%)	(4.4%)	0.0%
	X	Chautauqua, KS	4.6%	2.3%	(6.2%)	(7.1%)	(6.3%)	(5.1%)	(0.5%)
X	X	Garfield, OK	3.2%	15.5%	(2.4%)	(5.3%)	(2.5%)	(7.9%)	0.0%
X		Callahan, TX	1.4%	(2.6%)	(2.0%)	(2.0%)	(11.7%)	(18.6%)	(12.0%)
	X	Hardeman, TX	(1.2%)	2.3%	(1.3%)	(1.3%)	(4.6%)	(8.3%)	(5.2%)
X		Harmon, OK	(1.2%)	3.8%	(1.6%)	(1.6%)	(2.8%)	(6.8%)	(3.7%)
	X	Tishomingo, MS	(1.0%)	(0.7%)	(2.9%)	(6.0%)	(4.3%)	(3.5%)	(5.1%)
	X	Izard, AR	(0.3%)	9.4%	(3.5%)	(2.0%)	(7.6%)	(9.7%)	(5.5%)
	X	McDonald, MO	8.0%	(0.7%)	(3.2%)	(3.7%)	(4.9%)	(3.1%)	(2.3%)
X		Lawrence, MO	6.7%	(0.7%)	(2.4%)	(3.2%)	(3.9%)	(2.2%)	(2.1%)
	X	Alexander, IL	0.1%	(2.0%)	(2.8%)	(3.6%)	(3.5%)	(1.7%)	(3.5%)
	X	Marion, KY	3.2%	(0.1%)	(2.1%)	(2.7%)	(2.4%)	(2.9%)	(4.7%)
	X	Lawrence, TN	(0.5%)	(1.7%)	(2.8%)	(4.0%)	(4.2%)	(4.0%)	(6.0%)
	X	Colbert, AL	8.2%	5.8%	(2.5%)	(0.4%)	2.0%	2.3%	8.1%
	X	Dillon, SC	1.5%	(1.0%)	(4.8%)	(8.3%)	(8.9%)	(15.6%)	(13.3%)
	X	Mecklenburg, VA	0.4%	(1.7%)	(3.2%)	(7.2%)	(6.5%)	(9.1%)	(7.7%)
	X	Person, NC	3.1%	(1.3%)	(3.3%)	(7.1%)	(7.1%)	(9.2%)	(8.2%)

SOIL CARBON SEQUESTRATION

Soil carbon in all cases increased and ranged from about 900 to 3,300 total metric tons from the implementation of Alternative 1. The percent changes were usually large and ranged from about 0.2 to 10.1 percent. The Callahan, Texas, site had a 10.1 percent change, which was partly the result of changing the most acres on this site from cotton, a low surface cover crop, to switchgrass.

Soil carbon in perennial SRWC should also increase the potential for enhanced carbon storage; however, the use of the annual forage sorghum for biomass could result in no enhancement or a decrease due to removal of the above ground material and in many cases the use of tillage for replanting. Again, this could be partially mitigated by use of a winter cover crop in the rotation to enhance use of carbon dioxide and provide more surface cover.

4.5.3.2 Indirect Impacts

Indirect effects associated with implementing Alternative 1, would be increased biological diversity associated with soil living organisms, which benefit from a reduction of soil organic matter loss, and the increase of perennial vegetation. The increased biodiversity within the soil would generate additional benefits to the vegetation and wildlife, given the biological resources' dependence on this resource. Additionally, the capture and retention of topsoil within these areas would provide for overall biodiversity at the local area.

4.5.3.3 Mitigation Measures

Site specific mitigation measures would be determined based on the local or regional needs, as prescribed in the BCAP Conservation Plan or Forestry Stewardship Plan or the equivalent, or through local or State regulations concerning soil erosion. Some BMPs to reduce soil erosion would include buffer areas and limited or no tillage cropping systems. Additionally, these BMPs provide avenues for greater soil carbon retention.

4.5.4 Alternative 2

Implementing Alternative 2 would result in a significant reduction at the local and regional level in soil erosion from traditional cropping practices due to the conversion to perennial dedicated energy crops. However, given the similarity to traditional row crops, forage sorghum would be anticipated to provide only minor benefits or the same effect as traditional row crops.

4.5.4.1 Direct Impacts

At the same time as there is an increased demand for cellulose, there is a movement occurs toward reduced and no tillage production practices, driven in part by that increased demand for cellulose. These changes bring about a reduction in erosion as cellulosic ethanol increases. Increased demand for corn stover and wheat straw resulted in a shift from conventional tillage to no tillage in some regions of the country. As indicated previously, corn acreage decreases nearly 0.5 million acres by 2022, with a shift from conventional tillage toward no tillage. Two million acres of wheat is projected to shift from conventional to no tillage practices. Sorghum acreage decreases by 1.3 million acres and soybeans by 4.67 million acres (Table 4.5-3). Dedicated energy crop acreage increases from no acres in the baseline to 33 million in Alternative 2. This increase does result in a positive change in erosion from switchgrass (Table 4.5-4). However, the per-acre erosion is less than 0.5 tons per acre. Nearly 40 million tons of gross soil erosion is saved annually. If there is 160 tons of soil in an inch of top soil, then an estimated 243,000 inches of topsoil are saved each year.

Table 4.5-3. Change in Acreage Planted under Alternative 2 from the Baseline, 2022

Crop	Conventional Tillage	Reduced Tillage	No Tillage	Total Change in Acres from the Baseline
Corn	(651,107)	(440,819)	620,327	(471,599)
Sorghum	(845,738)	(398,731)	(90,647)	(1,335,116)
Oats	(73,663)	(233,016)	(10,509)	(317,187)
Barley	233,954	(438,686)	(12,227)	(216,959)
Wheat	(2,145,637)	(10,060,209)	2,219,983	(9,985,863)
Soybeans	(321,443)	(704,494)	(3,645,631)	(4,671,568)
Cotton	(2,067,534)	(235,923)	(621,155)	(2,924,612)
Rice	(442,235)	53,189	14,529	(374,518)
Dedicated Energy Crop	26,441,947	7,035,655	na	33,477,602
Hay	(6,301,127)	4,064,088	156,606	(2,080,433)

Table 4.5-4. Changes in Erosion Compared to the Baseline (Scenario 1), 2022

Crop	Change in Acres	Change in Gross Soil Erosion
Corn	(471,599)	(3,406,947)
Sorghum	(1,335,116)	(3,061,977)
Oats	(317,187)	(919,290)
Barley	(216,959)	(135,640)
Wheat	(9,985,863)	(17,899,055)
Soybeans	(4,671,568)	(10,469,936)
Cotton	(2,924,612)	(8,868,687)
Rice	(374,518)	(1,492,768)
Dedicated Energy Crop	33,477,602	7,339,343
Hay	(2,080,433)	(569,601)
Total	11,099,747	(39,484,559)

4.5.4.2 Indirect Impacts

Indirect effects associated with implementing Alternative 2 would be increased biological diversity associated with soil living organisms, which benefit from a reduction of soil organic matter loss and the increase of perennial vegetation. The increased biodiversity within the soil would generate additional benefits to the vegetation and wildlife, given the biological resources' dependence on this resource. Additionally, the capture and retention of topsoil within these areas would provide for overall biodiversity at the local area.

4.5.4.3 Mitigation Measures

Site specific mitigation measures would be determined based on the local or regional needs, as prescribed in the BCAP Conservation Plan or Forestry Stewardship Plan or the equivalent, or through local or State regulations concerning soil erosion. Some BMPs to reduce soil erosion would be buffer areas and limited or no tillage cropping systems. Additionally, these BMPs provide avenues for greater soil carbon retention.

4.5.5 No Action Alternative

Selecting the No Action Alternative would be unlikely to change current cropping practices or crop species mix, which when compared to the alternatives would be a negative, potentially significant effect. Under this alternative, crops currently used to produce bioenergy would be primarily Title I crops, Title I crop residues, and woody biomass residues. It would be plausible that an increase in the use of crop residues to supply BCFs would result in some alteration of cropping practices to minimize loss of residues; however, too great a quantity of residue not being incorporated back into the soil could require greater use of agricultural chemicals. The need for BMPs, associated by region, would be necessary to ensure that an appropriate crop residue level remain to ensure minimized soil loss.

4.6 WATER QUALITY AND QUANTITY

4.6.1 Significance Thresholds

An accounting of increases or reductions in input use such as fertilizer, herbicides, and pesticides is performed to evaluate potential changes in water quality. Water quantity changes could result in positive or negative effects on total water use compared to other cropping systems depending on the regional climate. Land use and water use changes would affect hydrology relative to runoff and stream flow.

4.6.2 Methodology

A combined approach was used to determine the potential affect to both water quality and water quantity. An analysis of the potential change in agricultural chemicals using POLYSYS was generated. Additionally, the analysis to determine the changes in soil erosion was considered under the potential for water quality changes. The land use changes as determined by the POLYSYS model were utilized in combination with estimated water use as determined by the USGS for county-level data associated with both groundwater and surface water irrigation sources.

4.6.3 Alternative 1

Implementing Alterative 1 would result in a very small positive change in nitrogen use (average 1.5 percent increase due to changing land use from hay to dedicated energy crop establishment), an overall minor increase in phosphates due to the land use changes, but in many cases a reduction and a substantial reduction in use of potassium, lime, pesticides, and other agricultural chemicals. Since switchgrass is expected to be an excellent nutrient scavenger and recycler to the switchgrass root system, and results in excellent soil surface cover to prevent erosion losses, off-site movement of nitrogen and phosphorus would be expected to be low even with slight increases in use. These inputs are also reduced under a SRWC system and less runoff, sediment loss and nutrient loss were measured on three instrumented watersheds in Tennessee, Alabama, and Mississippi (Nyakatawa *et al*. 2006; Tolbert *et al*. 1997). These same results should be expected in other areas of the country since the amounts of inputs in SRWC are generally lower than traditional row crops and the ability to harvest and allow regrowth for two to three growing cycles without replanting means a long period with very little soil disturbance. This would reduce sediment and nutrient loss in runoff to water bodies enhancing water quality.

4.6.3.1 Direct Impacts

WATER QUALITY

Table 4.5-2 indicates the percentage changes to be expected in agricultural chemical inputs for the establishment and growth of switchgrass within the top five potential BCAP project locations and across the states. For the top five potential BCAP project locations the conversion to the dedicated perennial energy crop would on average create a reduction in the use of potassium (3.1 percent), lime (4.0 percent), herbicides (5.5 percent), insecticides (11.2 percent), and other agricultural chemicals (3.6 percent). The conversion to a perennial dedicated energy crop would require an average increase across these regions in the use of nitrogen (2.1 percent) and phosphorus (2.9 percent) fertilizers. Across the states, similar declines and increases would be anticipated.

Under this alternative, with the limited number of acres to be converted, the reduction in agricultural chemical use may not be as great as the average across all regions or it may be greater, though it would be limited to the local area of effect from the conversion activities. The reduction in agricultural chemicals, as well as the reduction in erosion, Total Suspended Solids (TSS), and sedimentation from the conversion to perennial dedicated energy crops would produce a positive effect on water quality, though this effect would be most significant at the local scale. At a regional scale, given the limited amount of acreage expected to be converted under this alternative, the effect would be positive, but minor.

WATER QUANTITY

Water use relative to total quantity would probably only be affected by BCAP if land not previously irrigated is brought into production. The highest states for use of either for irrigation are California, Colorado, Idaho, Montana, Oregon, and Wyoming (Kenny *et al.* 2009). These areas are not thought to be areas generally suitable for a land base for herbaceous perennial dedicated energy crops or SRWC (Graham 1994). Residue removal after harvest of wheat might be feasible, but would still be likely limited compared to corn stover (Graham *et al.* 2007). The temperate humid land areas of the country would not likely be changed from non-irrigated to irrigated for residue or dedicated energy crop production.

Using a GIS-based analysis, agricultural irrigation-based water use was determined from the USGS water use estimates (Kenny *et al.* 2009). Table 4.6-1 and Figure 4.6-1 illustrate the estimated water use for irrigation purposes, both groundwater and surface water sources, within the top five switchgrass potential BCAP project locations. Table 4.6-2 and Figure 4.6-2 illustrate the estimated irrigation water use for the top regions within each state for both switchgrass and forage sorghum. Table 4.6-3 and Figure 4.6-3 illustrate the anticipated irrigation within the SRWC BCAP potential project locations.

Table 4.6-1. Freshwater Withdrawals for Top Five Switchgrass BCAP Potential Project Locations

Switchgrass Region	Groundwater Irrigation	Surface Water Irrigation	Total Irrigation
	(millions of gallons per day)		
1	67.29	11.44	78.73
2	17.21	8.78	25.99
3	97.91	36.20	134.11
4	298.14	100.71	398.85
5	23.17	13.40	36.57

According to Kiniry *et al.* (2008) switchgrass has a water use efficiency (WUE) of approximately 1.8 to 5.0 percent greater than corn for grain per unit of water transpired (or plant dry weight increase per unit water used). For example a 150 bushel per acre grain (15.5 percent moisture) corn crop for grain produces approximately four tons of biomass, whereas switchgrass could have a biomass yield of eight tons per acre, with greater water use efficiency in the switchgrass biomass production. The total amount of water used in the corn or switchgrass crop cannot be evaluated on the basis of WUE, but it has been documented that switchgrass is highly adaptable to various water regimes and is more drought tolerant than traditional Title I crops. If it is assumed that all acreage currently defined as cropland from Section 4.2 was irrigated acreage, then by converting approximately 133,000 acres to switchgrass and not irrigating that acreage then across the combined top five potential BCAP project locations it would save an estimated 1.2 million gallons per day of irrigation water. Across these five regions, the effect would be minimal, saving only approximately 0.2 percent of irrigated water use; however, depending upon the level of irrigation at the local level, conversion could create greater savings. When compared across all states, the savings could generate 23.6 million gallons per day, which would also be a minimal. Also, if land use conversion occurred on unirrigated pasture land, then the water quantity effects should be similar, as most dedicated energy crops could be grown in similar conditions.

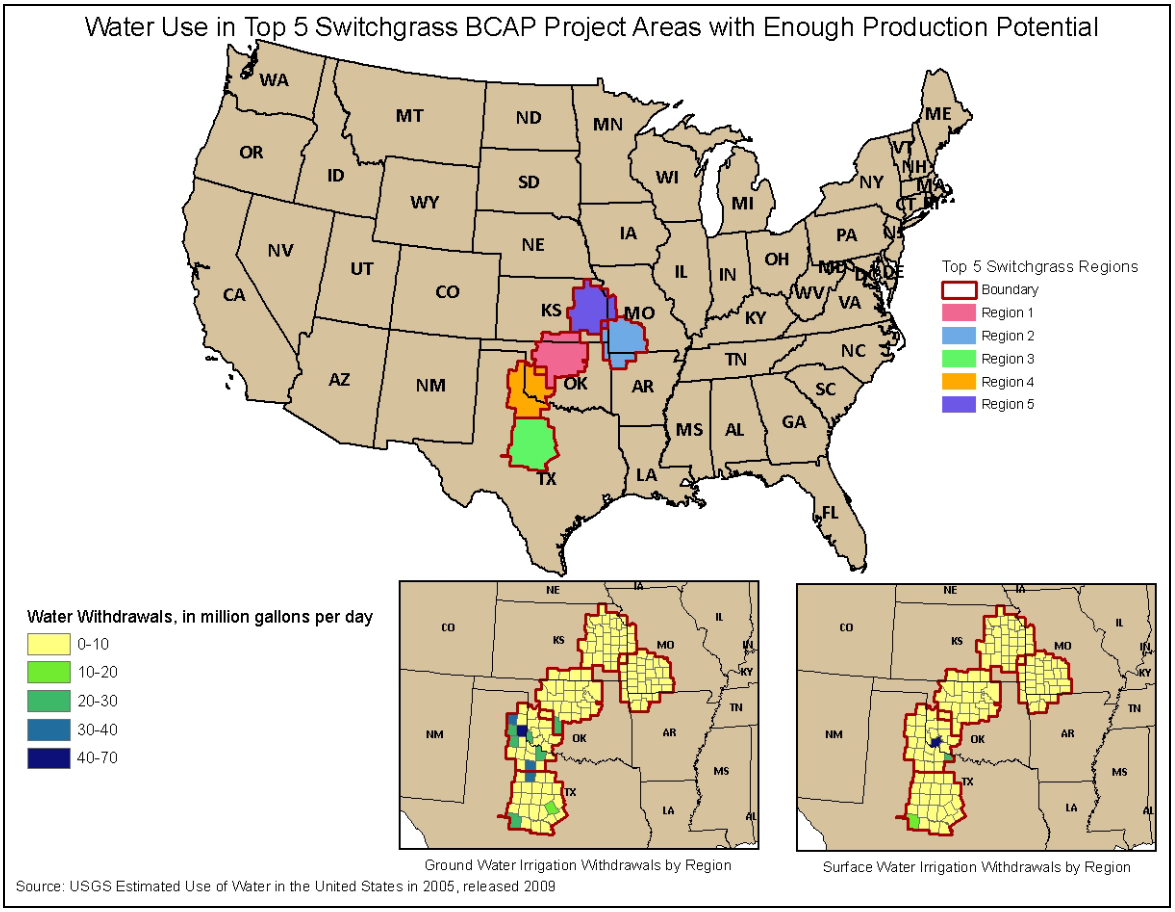


Figure 4.6-1. Estimated Water Use in Top Five Switchgrass BCAP Project Areas with Enough Production Potential

4.6.3.2 Indirect Impacts

Indirect impacts associated with implementing Alternative 1 would be the general downstream effects within the larger water courses. Implementing Alternative 1 would create significant local benefits through the reduction in most agricultural chemicals, which would in turn, indirectly benefit larger stream courses and regional water quality aspects.

Table 4.6-2. Freshwater Withdrawals for Herbaceous Potential BCAP Project Regions

Switchgrass Region	Groundwater Irrigation	Surface Water Irrigation	Total Irrigation
	(millions of gallons per day)		
1	67.29	11.44	78.73
2	26.98	77.57	104.55
3	12.99	17.34	30.33
4	297.59	99.59	397.18
5	83.18	127.10	210.28
6	295.53	54.28	349.81
7	0.14	8.55	8.69
8	541.95	1,306.12	1,848.07
9	16.52	14.02	30.54
10	2,688.77	204.35	2,893.12
11	38.16	7.27	45.43
12	1,266.91	14.74	1,281.65
13	8.88	24.55	33.43
14	10.95	27.36	38.31
15	567.80	104.63	672.43
16	13.42	65.38	78.80
17	2,776.03	323.98	3,100.01
18	12.27	69.68	81.95
Sorghum Region	Groundwater Irrigation	Surface Water Irrigation	Total Irrigation
	(millions of gallons per day)		
1	2,975.80	457.80	3,433.60
2	103.65	10.25	113.90
3	4,274.19	244.57	4,518.76
4	170.71	9.66	180.37
5	71.93	34.58	106.51
6	74.48	14.50	88.98
7	21.56	51.36	72.92
8	297.10	6.71	303.81
9	4,381.49	1,104.06	5,485.55

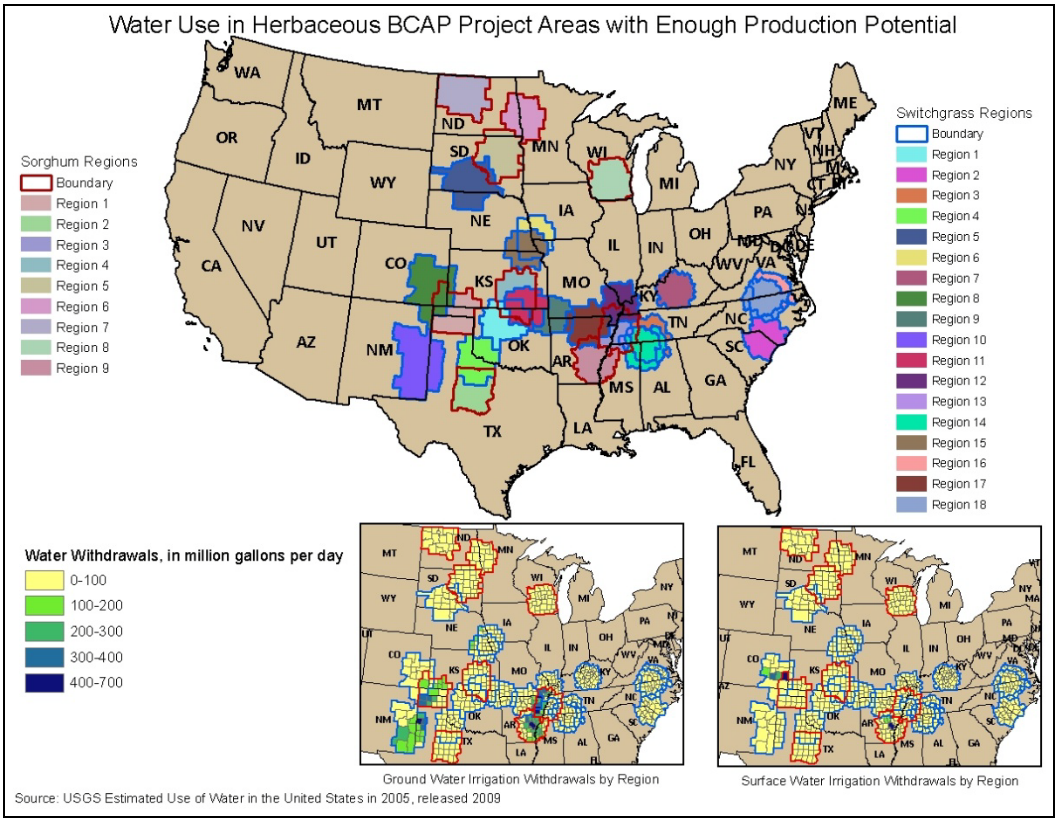


Figure 4.6-2. Estimated Water Use in Herbaceous BCAP Project Areas with Enough Production Potential

Table 4.6-3. Estimated Freshwater Withdrawals for Potential SRWC BCAP Project Regions

Willow Region	Groundwater Irrigation	Surface Water Irrigation	Total Irrigation
	(millions of gallons per day)		
1	11.80	10.24	22.04
3	12.49	6.94	19.43
Poplar Region	**Groundwater Irrigation**	**Surface Water Irrigation**	**Total Irrigation**
	(millions of gallons per day)		
1	16.22	16.02	32.24
3	348.93	242.96	591.89
4	177.86	42.69	220.55
6	3,698.65	372.06	4,070.71
7	928.41	86.69	1,015.10
9	388.38	101.79	490.17
10	24.09	9.90	33.99

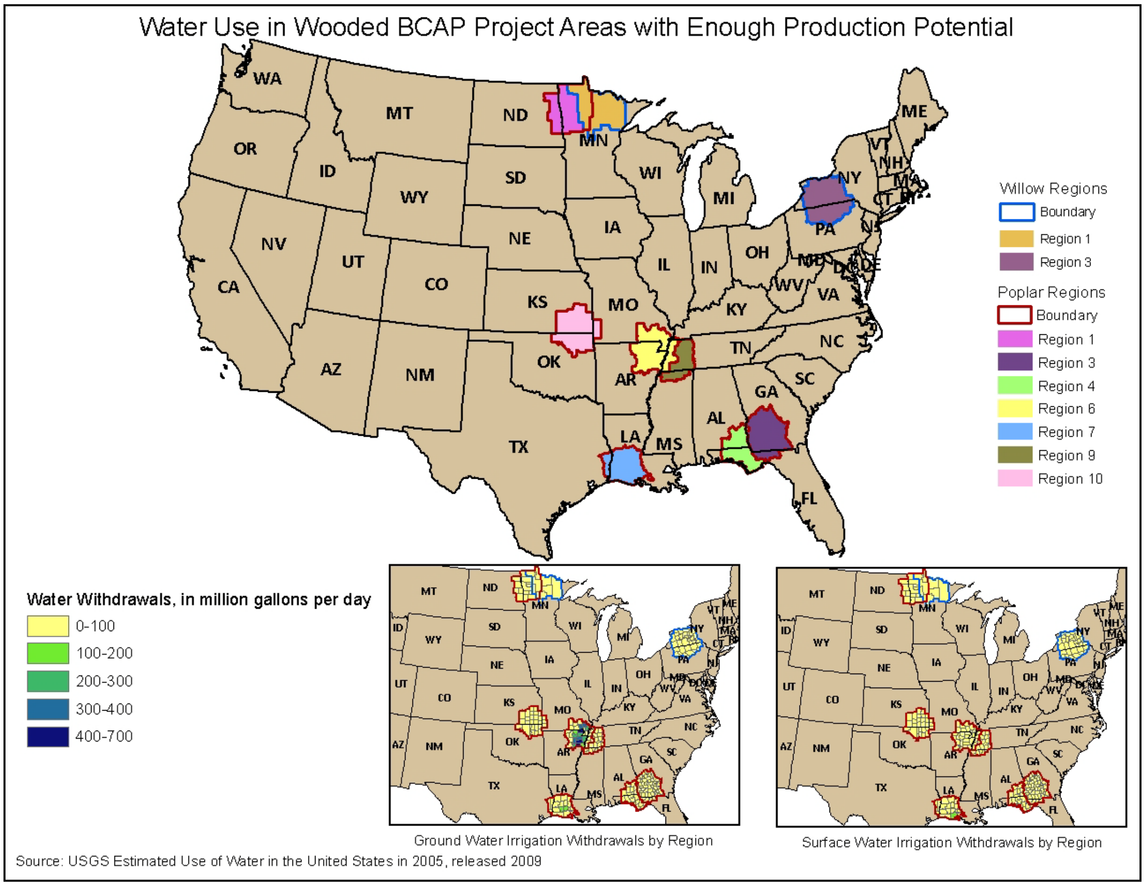


Figure 4.6-3 Water Use in Wooded BCAP Project Areas with Enough Production Potential

4.6.3.3 Mitigation Measures

To further reduce impacts to water quality, buffer strips of mixed native species should be utilized prior to any agricultural storm water flows from monoculture fields reaching stream courses. The mixed native species would provide additional mechanism for sediment and nutrient retention prior to reaching ephemeral or intermittent streams in rural areas. The use of buffer strips as part of the site specific conservation planning, along with other mechanisms as prescribed by the NRCS would create additional water quality benefits associated with the conversion of Title I croplands to perennial herbaceous dedicated energy crops.

4.6.4 Alternative 2

4.6.4.1 Direct Impacts

Implementing Alternative 2 would produce similar benefits to water quantity as Alternative 1; however, as the acreage converted to perennial dedicated energy crops increases, the benefits to water quality and quantity would increase.

4.6.4.2 *Indirect Impacts*

Implementing Alternative 2 would produce similar benefits to water quantity as Alternative 1; however, as the acreage converted to perennial dedicated energy crops increases, the benefits to water quality and quantity would increase.

4.6.4.3 *Mitigation Measures*

Implementing Alternative 2 would produce similar benefits to water quantity as Alternative 1; however, as the acreage converted to perennial dedicated energy crops increases, the benefits to water quality and quantity would increase.

4.6.5 No Action Alternative

Implementing the No Action Alternative, with the primary reliance on Title I crops and crop residues would not produce a significant change in water quality or water quantity used for irrigation purposes, unless there was a substantial increase in land use toward Title I crops. Based on agricultural crop production projections, planted corn acreage is anticipated to increase by approximately 5.4 percent between 2008 to 2017; however, all other primary field crop planted acreage is anticipated to decline. Overall, the change in land use through the selection of the No Action Alternative would not indicate increased acreage with a need for increased agricultural chemicals or agricultural irrigation.

4.7 RECREATION

4.7.1 Significance Thresholds

Overall trends in outdoor recreation participation in the U.S. have shown positive trends in both the number of participants and the number of participant days. Based on these on-going trends, impacts to recreational resources would be considered significant if there were long-term reductions in recreational participation or expenditures after implementation of an action.

4.7.2 Methodology

This section uses the changes in wildlife caused by changes in land use and vegetative cover that are identified in Section 4.3, Biological Resources, to estimate changes in recreational spending and non-market impacts. The impact analysis uses, as applicable, the data from the *2006 National Survey of Fishing, Hunting, and Wildlife-Associated Recreation* (USFWS 2007) report.

4.7.3 Alternative 1

4.7.3.1 *Direct Impacts*

As discussed in Section 4.3.3.1, the addition of perennial dedicated energy crops would add diversity to regions consisting of monocultures of traditional annual row crops. Within regions, the relatively small amount of conversion to cropland would be small, although impacts to wildlife habitat could be large on a very local scale if biodiversity is lessened. Site specific analyses would be required to assess impacts of a BCAP project area on wildlife and subsequent impacts on hunting or other wildlife activities.

In general, impacts to ground-nesting grassland birds would be greatest during establishment of crops, but this would be a short, transitory impact, minimized if the disturbances are outside the PNS. Impacts to white-tailed deer, the large mammal most likely to be affected under this Alternative and the target of hunters and those involved in wildlife watching, are expected to be minimal. Impacts to small mammals, including rabbits and other small mammals that are prey to predatory birds and coyotes, are expected to be limited to the establishment period and as such are expected to be transitory and short-lived. Impacts to birds can be expected to vary as some species, such as Bobwhite Quail and Wild Turkey are well-suited to switchgrass plantings, while some grassland birds are less likely to use such areas, although switchgrass plantings in Iowa, as a replacement for row crops, have shown an increase in grassland bird species.

Depending on the overall diversity of vegetative cover and wildlife, the impacts to recreation could be positive or negative at the local area, but based on the small amount of acreage that might be converted, impacts to recreation are expected to be minimal at the regional or national level.

4.7.3.2 Indirect Impacts

Changes in habitat for wildlife can result in a reduction (or increase) in the amount of hunting and wildlife viewing, causing a reduction *(*or increase*)* in national and regional spending for dedicated trips for these activities. Because the changes in habitat acreage would be limited, the impacts on hunting and wildlife viewing are expected to be small, although there could be local impacts.

4.7.3.3 Mitigation Measures

None needed.

4.7.4 Alternative 2

4.7.4.1 Direct Impacts

Nationally, the amount of land shifted to dedicated energy crops is expected to be small and the impacts are expected to be small on a national level. Locally, the impacts could include a substantial number of acres, remove habitat suitable for wildlife, and increase monocultures of vegetation, depending upon the land use shifts. This could have a negative effect on recreation by reducing wildlife populations suitable for hunting and potentially limiting the areas for wildlife viewing. Site specific analyses would need to be performed.

4.7.4.2 Indirect Impacts

Changes in habitat for wildlife can result in a reduction *(*or increase*)* in the amount of hunting and wildlife viewing, causing a reduction *(or increase)* in national and regional spending for dedicated trips for these activities. Because the *national* changes in habitat acreage would be limited, the impacts on hunting and wildlife viewing are expected to be small*, although there could be local impacts*.

4.7.4.3 Mitigation Measures

None needed.

4.7.5 No Action Alternative

4.7.5.1 Direct Impacts

Section 4.3.5 discussed the impacts of the BCAP to vegetation and wildlife under the No Action Alternative. Under this alternative, no additional BCFs would be constructed as a result of the BCAP. Section 4.3.5 concluded that the effects of the No Action Alternative upon biological resources are likely to be minimal. If there are no impacts on wildlife habitat or wildlife, then the impacts on recreation involving wildlife are likely to be minimal.

Under the No Action Alternative, the BCAP would not be implemented and there would be no change in croplands or NIPF from current usage. There would be no impacts to recreation under the No Action Alternative.

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5.0 CUMULATIVE IMPACTS ASSESSMENT

5.1 DEFINITION

Council on Environmental Quality regulations stipulate that cumulative effects analysis consider the potential environmental impacts resulting from “the incremental impacts of the action when added to other past, present and reasonably foreseeable actions regardless of what agency or person undertakes such other actions.” Cumulative effects most likely arise when a relationship exists between a proposed action and other actions expected to occur in a similar location or during a similar time period. Actions overlapping with or in proximity to the proposed action would be expected to have more potential for a relationship than those more geographically separated. Similarly, actions that coincide, even partially, in time tend to have potential for cumulative effects.

The BCAP is designed to encourage the production of feedstocks for cellulosic ethanol and other energy production by providing multi-year contracts for crop and forest producers to grow dedicated energy crops. The program scale is national and includes U.S. territories. For purposes of this analysis, other State, USDA, and Federal programs that focus on bioenergy are the primary sources of information used in identifying past, present, and reasonably foreseeable future actions.

5.2 RECENT LEGISLATION AND LEGISLATIVE PROGRAMS

Alternative energy sources to petroleum and other carbon-based energy sources began to migrate into mainstream conscience during the energy crisis of the 1970s. Until recently, the primary alternative energy sources have been solar, geo-thermal, wind, and corn-based ethanol. On the horizon had been energy crops; non-food crops grown specifically for the production of energy to reduce dependence on traditional carbon-based energy sources (i.e., oil, gasoline, natural gas, and coal). The Congressional Research Service (CRS) in RL33831 analyzed the number of energy efficiency and renewable energy bills that were introduced in 110th Congress (Sissine *et al.* 2008). As of 13 November 2008, more than 460 bills associated with energy efficiency and renewable energy were introduced; of those approximately one-third were for renewable fuels and one-third were for tax incentives for investment, energy productions, fuel use, or fuel reduction. Numerous other measures have been introduced in Congress, including as an example, the establishment of a Green Bank to provide alternative financing for clean energy projects and energy efficiency projects.

5.2.1 Energy Independence and Security Act of 2007 and Renewable Fuel Standards

The EISA of 2007 established guidelines for developing 25 percent of our energy needs from renewable sources by the year 2025. This initiative is followed closely by non-governmental agencies, special interest groups, and congressional endorsements for the 25x’25 organization. EISA also called for renewable fuel standards that (1) compare the GHG emissions of renewable based fuels to standard petroleum fuels with a goal of a 60 percent reduction in GHG emissions and (2) set a time table for inclusion of renewable fuel components in standard automobile fuels to reach 36 billion gallons by 2022; for 2009 that level has been set at 10.21 percent or approximately 11.1 billion gallons of renewable fuel components to be blended into automobile fuels.

The EPA has recently issued (March 2010) a final rule (75 FR 14670) for the second version of the National Renewable Fuel Standards (RFS2) for 2010 and beyond under EISA. The EPA has included calculations for life-cycle analysis (LCA) of renewable fuels to determine their direct and indirect effects to GHG emissions. The direct effects include the integrated production cycle from farm level (biomass production) to facility (fuel production) to vehicle (fuel consumption), while the indirect effects include indirect land use changes at a global scale to account to changes in exports/imports of agricultural commodities (e.g., corn and soybeans).The RFS2 sets the baselines for what will be considered renewable fuel, advanced biofuel, biomass-based diesel, and cellulosic biofuel. In order to qualify for the RFS2, the liquid vehicle biofuels manufactured using any feedstocks grown as a result of the BCAP must meet the GHG tests of EISA and the feedstock eligibility requirement of RFS2 – by default, per the conditions of the preferred alternative, Alternative 1.

5.2.2 American Recovery and Reinvestment Act of 2009 Funding

The *American Recovery and Reinvestment Act of 2009* (ARRA) included numerous renewable energy and energy efficiency provisions. These included extension of production tax credits for wind derived energy (facilities built and functional by 31 December 2012) and for geothermal, biomass, hydropower, landfill gas, waste-to-energy, and marine facilities (facilities built and functional by 31 December 2013) or the conversion of those tax credits to (1) investment tax credits or (2) grant program in lieu of tax credits; advanced energy manufacturing credits; state energy programs; DOE demonstration project funding through the Office of Energy Efficiency and Renewable Energy (EERE); DOE energy efficiency and conservation block grants; Clean Energy Renewable Bonds; and Renewable Energy Loan Guarantee Program. The DOE has partitioned their ARRA funds into $480 million for integrated pilot and demonstration scale biorefineries (10 to 20 awards ranging from $25 million to $50 million); $176.5 million for commercial-scale biorefinery projects (two or more projects); $110 million for fundamental research in biomass program; and $20 million for ethanol research.

5.2.3 Food, Conservation, and Energy Act of 2008 Titles

The 2008 Farm Bill authorized numerous programs benefiting energy efficiency and renewable energy production. The following (short) Titles have some components that relate to renewable energy production or use of biomass for the production of energy.

- Biorefinery Assistance (Title IX – Section 9003) - to assist in the development of new and emerging technologies for the development of advanced biofuels.

- Repowering Assistance (Title IX – Section 9004) - to encourage biorefineries in existence on the date of enactment… to replace fossil fuels used to produce heat or power to operate the biorefineries.
- Bioenergy Program for Advanced Biofuels (Title IX – Section 9005) - the Secretary shall make payments to eligible producers to support and ensure an expanding production of advanced biofuels.
- Biomass Research & Development (Title IX – Section 9008) - Secretary of Agriculture and the Secretary of Energy shall coordinate policies and procedures that promote research and development regarding the production of biofuels and biobased products.
- Forest Biomass for Energy (Title IX – Section 9012) - the Secretary, acting through the Forest Service, shall conduct a competitive research and development program to encourage use of forest biomass for energy.
- Community Wood Energy Program (Title IX – Section 9013) - the Secretary, acting through the Chief of the Forest Service, shall establish a program… to provide grants to State and local governments to develop community wood energy plans and competitive grants to State and local governments to acquire or upgrade community wood energy systems.
- Tax Credit for Production of Cellulosic Biofuel (Title XV – Section 15321) – a cellulosic biofuel producer credit of any taxpayer is an amount equal to the applicable amount for each gallon of qualified cellulosic biofuel production.
- Feedstock Flexibility Program for Bioenergy Producers (Title IX-Section 9010) - subsidizes the use of sugar for the production of biofuels through federal purchases of surplus sugar for sale to bioenergy producers.

5.2.4 Oregon Biomass Producer or Collector Tax Credits

In 2007, the Oregon Legislature passed the Oregon Biomass Producer or Collector Tax Credits (House Bill 2210) for applicable businesses, such as agricultural producers. The tax credits are for the in-state production and collection of biomass or energy crops used for the production of bioenergy within the State of Oregon. The detailed tax credits include:

- oil seed crops, $0.05 per pound;
- grain crops, including but not limited to wheat, barley and triticale, $0.90 per bushel; grains do not include corn, and wheat is eligible only after 1 January 2009;
- virgin oil or alcohol from Oregon-based feedstock, $0.10 per gallon;
- used cooking oil or waste grease, $0.10 per gallon;
- wastewater biosolids, $10.00 per wet ton;
- woody biomass collected from nursery, orchard, agricultural, forest or rangeland property in Oregon, including but not limited to prunings, thinning, plantation

rotations, log landing or slash resulting from harvest or forest health stewardship, $10.00 per green ton;

- grass, wheat, straw or other vegetative biomass from agricultural crops, $10.00 per green ton;
- yard debris and municipally generated food waste, $5.00 per wet ton; and
- animal manure or rendering offal, $5.00 per wet ton.

5.2.5 State Incentives for Alternative Energy Production, Including Biomass

Many states throughout the country offer state incentives programs to develop and produce alternative fuels. Currently 27 states offer some kind of incentive program for the development of alternative fuels (Table 5.2-1). Washington and Iowa offer the highest amount of state incentives. Based on DOE information, 14 states offer a production tax credits including tax exemptions or deductions for facilities that produce alternative fuels. The states of Oregon, Montana, and Michigan also offer property tax exemptions for facilities that produce alternative fuels. Washington, North Dakota, Texas, Iowa, Illinois and Virginia offer an alternative fuel loan or grant for alternative fuel production facilities. Also, there are eight per gallon incentive programs for alternative fuel production and five incentives for construction or improvement of an alternative fuel facility.

According to the EERE, as of May 2009 24 states and the District of Columbia have instituted Renewable Portfolio Standards (RPS) that require electricity providers to obtain a minimum percentage of electricity from renewable energy sources, including biomass. Five other states have non-binding goals for the use of renewable energy sources.

5.3 MATCHING PAYMENT PROGRAM PROVISIONS

The BCAP proposed rule detailed the components of the Matching Payment Program. The components include: land types and categories from where eligible materials may and may not be harvested/collected; which components matching payments are not authorized; the application process for eligible material owners; the application process for receiving matching payments; matching payment provisions; and the qualified BCF requirement.

1. The eligible material must be listed as eligible on the official BCAP Eligible and Ineligible Materials List that will be maintained on the FSA BCAP website. Eligible materials must be harvested or collected from sites within the U.S. or U.S. territories. Eligible materials may be harvested/collected from:

    - National Forest System lands or BLM public lands accomplished according to all laws and regulations that apply to the USFS or BLM;

Table 5.3-1. States with RPS, Amount, and Year

State	Percentage of Electricity from Renewable Sources	Full Implementation by Year
Arizona	15%	2025
California	33%	2030
Colorado	20%	2020
Connecticut	23%	2020
District of Columbia	20%	2020
Delaware	20%	2019
Hawaii	20%	2020
Iowa	105 MW	
Illinois	25%	2025
Massachusetts	15%	2020
Maryland	20%	2022
Maine	40%	2017
Michigan	10%	2015
Minnesota	25%	2025
Missouri	15%	2021
Montana	15%	2015
New Hampshire	23.80%	2025
New Jersey	22.50%	2021
New Mexico	20%	2020
Nevada	20%	2015
New York	24%	2013
North Carolina	12.50%	2021
North Dakota*	10%	2015
Oregon	25%	2025
Pennsylvania	8%	2020
Rhode Island	16%	2019
South Dakota*	10%	2015
Texas	5,880 MW	2015
Utah*	20%	2025
Vermont*	10%	2013
Virginia*	12%	2022
Washington	15%	2020
Wisconsin	10%	2015

*States with non-binding goals

Source: EERE 2009

    - Certain National Forest System lands designated as components of the Wilderness Preservation System, the Wild and Scenic River System, as a National Monument, or composed of inventoried roadless areas are excluded; except for biomass CHST conducted by an eligible material owner who has an existing contract or grant issued by the USFS for the sale or removal of the material; and are subject to all laws and regulations that apply to the USFS including the Endangered Species Act and environmental analysis and approval as required by NEPA.

- Tribal, State, and other government locally owned land when performed in accordance with all applicable laws, regulations, ordinances, and permits;
- Privately owned land, including cropland, pastureland, rangeland, and forest land when performed to all applicable laws, regulations, ordinances, and permits.
- If collected or harvested from cropland, it must be consistent with the Conservation Plans required for HEL provisions of Title VII of the Food Security Act of 1985, as amended;
- NIPF in accordance with applicable Forest Stewardship Plans or the equivalent;
- If removed from CRP contract acreage, the material must be harvested or collected under the managed haying and grazing provisions of 2-CRP, Part 13;
- If removed from other lands enrolled in Federal, State, or local private land programs, the eligible material must be harvested or collected in accordance with the program's rules and requirements; and
- All eligible material must be collected and harvested in compliance with EO 13112 (Invasive Species), February 3, 1999 (64 FR 25).

2. Matching payments are not authorized for (1) eligible material delivered to a qualified BCF prior to the publication of the final rule in the Federal Register; (2) eligible material delivered before the initial application for matching payments has been received and approved by FSA; and (3) eligible material delivered to a facility that is not a qualified BCF; (5) material not originating from the U.S. or U.S. territories, including the source material used by intermediate factories/facilities; (5) materials removed from Federal lands other than National Forest System lands or BLM public lands; and (6) for any material for which a payment has already been applied, approved, earned or is subject to a scheme or device used to circumvent the rule and related program requirements.
3. An eligible material owner must complete an application with the FSA to determine eligibility and the amount of eligible materials that an applicant can receive matching payments toward. An eligible material owner may make

deliveries to multiple qualified BCFs; however, a separate application must be completed for delivery to each qualified BCF. The details of the application process are included in the proposed rule.

4. After the application has been approved, the eligible material owner will need to provide evidence of delivery and payment by a qualified BCF to request payment of the matching funds. The details of the payment request process are included in proposed rule.
5. Matching payments will be made to approved eligible materials owners at a rate of $1 for each $1 received from the BCF at a maximum of no more than $45 per ton based on one of the three options described in the proposed rule. Payments will be made for a period not to exceed 24 months from the date of the first matching payment. Only one owner will receive matching payments for any eligible materials. The program will be administered according to all applicable laws, regulations, and USDA guidance.
6. A BCF must enter into an agreement with the CCC and meet all the requirements set forth in the proposed rule to be considered a qualified BCF.

5.3.1 Status Qualified Biomass Conversion Facilities

There are currently 40 states that have qualified BCFs according to the FSA (See Figure 1.3-1). California currently has 38 qualified BCFs, Oregon (31), Georgia (27), Maine (26) and Louisiana (25). Both California and Maine offer a state biomass production tax incentive. The highest amount of production incentives is offered in Washington which currently has 18 qualified BCFs. Of the 24 states that offer no state tax incentives or credits, 16 of them have at least one qualified BCF.

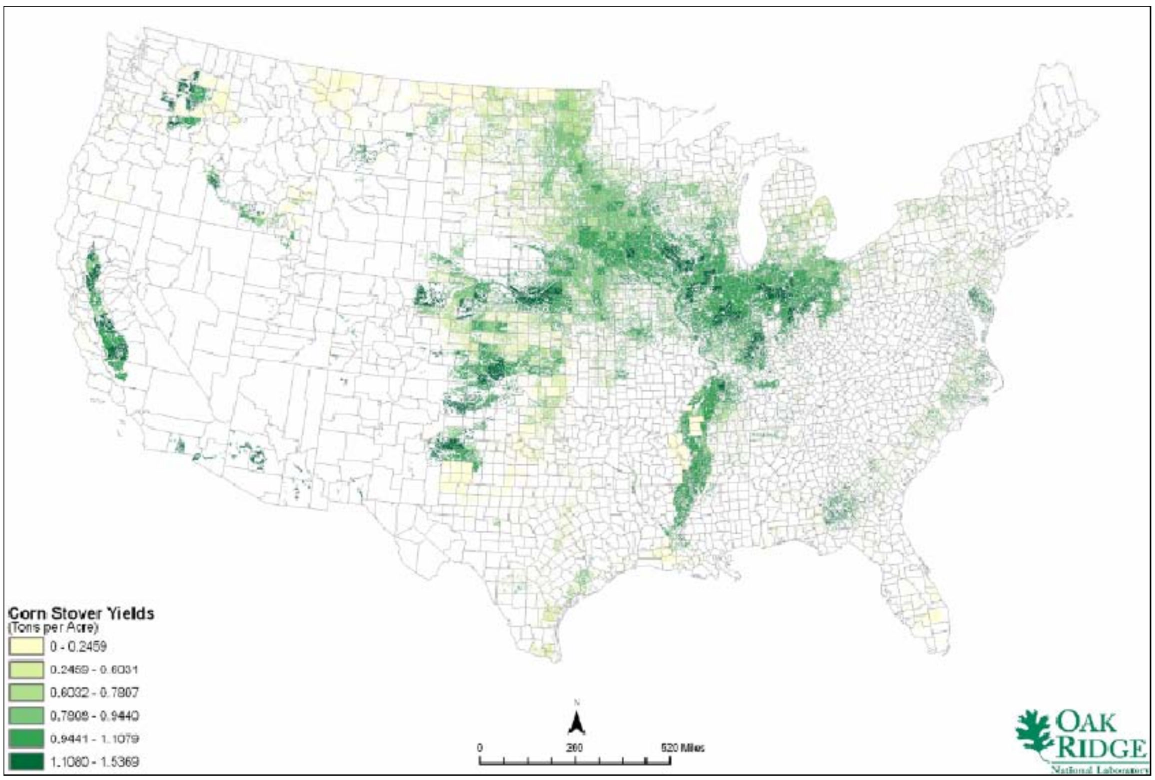
Of the BCFs, 90 facilities were biomass conversion plants, 112 were plant products including pulp, paper and packaging products, 106 were wood and timber products, 54 were wood fuel pellet producers, 15 were sugar cane processors, and 10 were biofuel producers.

5.3.2 Status of Eligible Materials

Second generation biofuels will be produced using crop and forestry harvest residues as biomass feedstocks (Biomass Research and Development Board 2008). Harvesting residues can lead to variable impacts on soil and water quality depending on climate, soil, crop grown, and the extent which aboveground biomass is removed. The environments most likely to be impacted by use of crop residues as biomass and the intensity of the impacts are thus related to the geography of crop production. While any land planted to a Title I crop could potentially be a source of biomass, it is most likely that BCFs and other consumers of biomass will be located in areas where feedstocks are readily abundant. The low bulk density of crop residues and the consequent high transportation cost will preclude their shipment over long distances. Therefore, it is reasonable to anticipate that markets will develop in areas where feedstocks are produced in high quantities.

5.3.2.1 Crop Residues

Agricultural crop residues are the biomass that remains in the field after harvest. The eight leading U.S. crops can produce more than 450 million tons of residues each year (Perlack *et al.* 2005). A sizeable portion of this is corn stover (Figure 5.3-1). Corn stover refers to the stalks, leaves and cobs that remain in corn fields after the grain harvest. Farmers leave it on their fields to revitalize the soil and prevent erosion. Crop residues can be found throughout the U.S., but are primarily in the Midwest because of corn stover preeminence.



Source: ORNL 2009b

Figure 5.3-1. Estimated Availability of Corn Stover Residue, 2007

PRIMARY CROP RESIDUE LAND RESOURCES REGIONS

Because of a preponderance of corn and other agronomic crops in the North Central Region, these areas are more suitable, at present, as areas where crop residue removal as biomass for bioenergy conversion could be most prevalent (De La Torre Ugarte *et al.* 2007, English *et al.* 2006). Most of the area suitable for residue removal under unirrigated conditions is in Region M. Under irrigated conditions it could include Regions F, G, and H. In these areas removal of wheat residue for biomass could be common.

The NREL published a study on biomass resource availability related to crop geography (Milbrandt 2005). The study defines potential biomass resource availability for a number of crops for which the residues remaining after harvest could be collected for biomass. It is reasonable to assume that areas most likely to be affected by the BCAP will be those with the highest density of residues available. In general, the region with the highest concentration of available residues is located in the Upper Midwest (Figure 5.3-2).

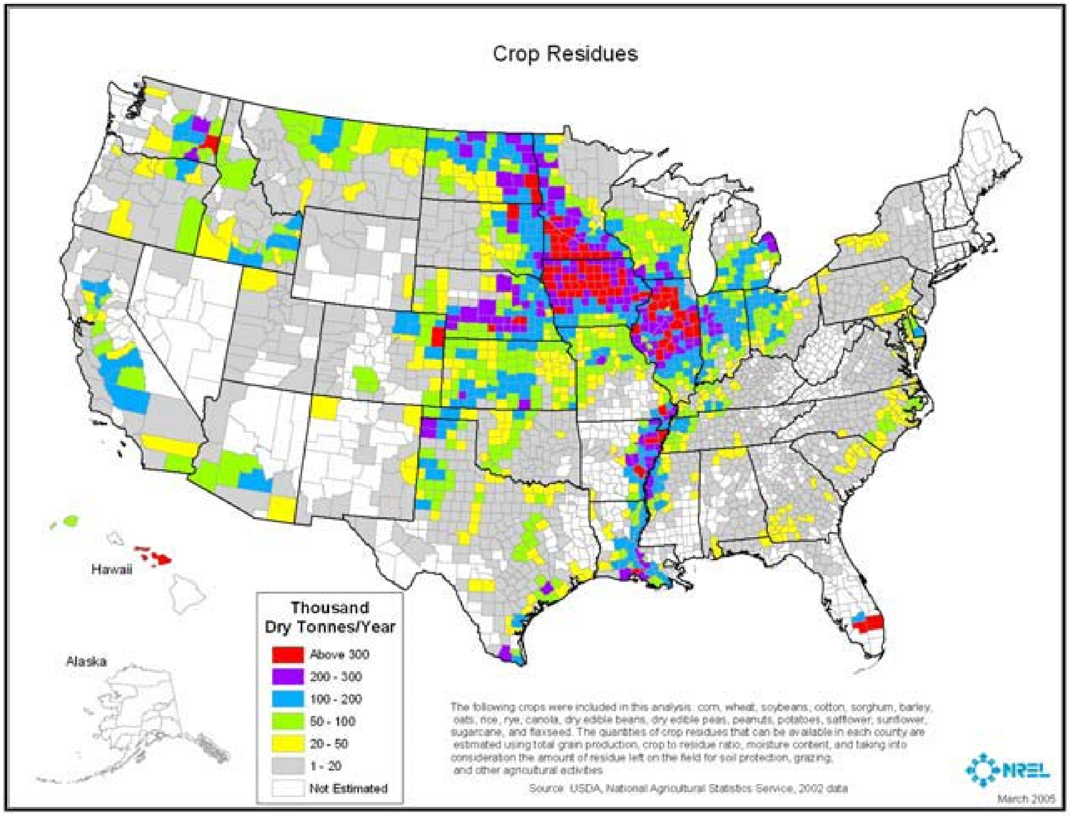


Figure 5.3-2. Primary Crop Residue Areas within the U.S.

Of the Title I crops, residues of corn, sorghum, soybean, and wheat represent the largest potential sources of biomass. Using 2001 as a baseline, the USDA and DOE reported that these four crops produce 225.0, 12.4, 80.2, and 115.8 million dry tons of residues per year (Perlack *et al.* 2005). However, of these four crops, only corn and wheat produced large amounts of biomass that could be harvested sustainably under present production practices. Changes in production practices for these crops such as reduced tillage and use of cover crops could significantly increase residues available for use as biomass. Of these crops, corn stover represented by far the largest potential source of crop residue derived biomass under any scenario studied.

Corn production is largely centered in the upper Midwest with Iowa, Illinois, Nebraska, Minnesota, and Indiana representing the top five corn producing states corresponding to Region M. Of these five states, Nebraska (Region G) is the only one with a significant acreage of irrigated corn. The other four states are located in the humid temperate region and generally receive ample precipitation for dryland corn production. Wheat production is most concentrated in the Central and Northern Great Plains. Kansas, North and South Dakota, Montana, and Oklahoma are the top five wheat producing states corresponding to Regions H and F. Sorghum production is largely centered in Region H. Sorghum is more tolerant of moisture stress than corn so it is generally grown further west than corn, but a significant proportion of sorghum is grown under irrigation. The top five sorghum producing states are Kansas, Texas, Oklahoma, Nebraska, and Colorado. The distribution of soybean production is similar to that of corn (Region M) but extends further south into the Mississippi delta corresponding to Region O (USDA 2009d, e).

The West Coast Regions consist of Regions A and B. Excessive crop residue removal can have negative effects on soil organic matter storage and potentially increase water and wind erosion. These would have detrimental effects on soil in these regions and also impact surface water from sediment or nutrient movement into water bodies. Increased irrigation in these areas for more acreage of row crops and subsequent crop residue removal could impact groundwater supplies and enhance salt accumulation problems from irrigation.

The East Coast Region consists of Regions N; P, and O. Clearly, regions somewhat west and southwest of these regions and north of these regions and some coastal areas adjoining Region P may be suitable for some production of biomass crops, forest residues, and others. There are a diverse array of crops grown across this region including corn, cotton, soybeans, grain sorghum, winter wheat, and some rice and sugarcane. The amount of land area in each crop is variable from year to year in the areas as a response to weather, crop price, etc. Most of the crop acreage before about 30 years ago was in tilled scenarios, which left the soil bare for extended periods, with resulting severe water erosion and loss of soil organic matter and crop productivity (Tyler *et al.* 1994).

CROP RESIDUE REMOVAL ENVIRONMENTAL CONCERNS

Crop residue removals are of concern due to the potential loss of soil organic matter input should excess residue be removed from croplands. Johnson *et al.* (2007) summarizes the existing knowledge of the use of corn stover as a bioenergy feedstock in terms of potential effects to soil organic matter contribution and soil carbon deposition. Their review indicates that tillage treatment does impact soil carbon evidenced by the minor differences in the soil carbon from moldboard plowing activities whether corn stover was removed versus not removed; however, there was a clear increase in soil carbon from no-till treatment in association with stover return (*Ibid*). They further indicate that crop residue effects on soil carbon and soil quality would be regional or even site-specific due to local conditions (*Ibid*). In some areas, a certain percentage of crop residues may be removed and still create soil carbon deposition, while in other areas the removal of crop residue would not be recommended.

Additional concerns associated with the use of crop residue include (1) increased nitrogen runoff from increased fertilizer use and (2) increased soil erosion due to less organic cover of the soil surface. Both could increase total suspended solids and nutrients transported off croplands into nearby waterways (Malcolm *et al.* 2009). Mullen *et al.* (2009) have indicated that farm-scale production of the intermediate high density bio-oil for later gasification into bioenergy results in the production of bio-char, which can be used to supplement the soil, similar to leaving crop residues in place. In addition to the soil nutrient benefits associated with bio-char, it would also act to trap carbon back into the soil, making the overall farm-scale process potentially carbon negative for the environment (Mullen *et al.* 2009).

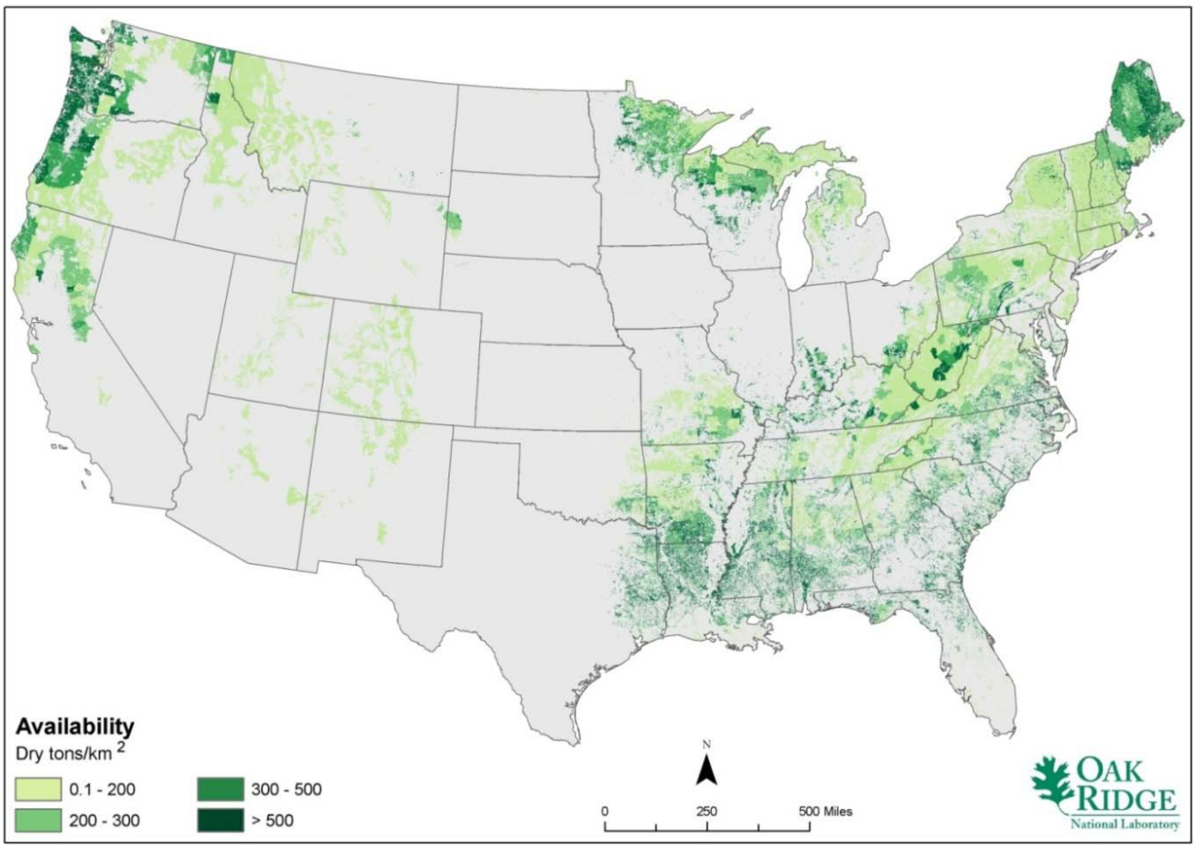
CROP RESIDUE REMOVAL MITIGATION MEASURES

More short-term methods to increase the environmental sustainability of the use of crop residues would be implementing conservation plans that set a sustainable limit of residue removal based on site specific conditions. Additional changes in tillage techniques, for example, that minimize soil disturbance over traditional practices, could also positively affect soil organic matter levels and nutrient retention. A projected increase in acres using conservation tillage based on increased demand for biomass could result in a net reduction in soil erosion, while still requiring soil nutrient enhancement for lost soil organic matter (Malcolm *et al.* 2009). The Natural Resources Conservation Service (2006c) recommends that if crop residue is to be removed, then certain mitigative measures should be in place such as (1) site specific residue removal rates, as determined through the use of tools such as RUSLE, WEQ, and Soil Conditioning Index; (2) additional conservation practices be put in place, such as contour cropping and/or conservation tillage; (3) the use of a crop alternative; and (4) periodic monitoring and assessment to allow for adjustments to the amount or method of crop residue collection and tillage.

5.3.2.2 Woody Biomass Residues

The FAO has recognized that wood has been an important source of bioenergy since the discovery of fire for cooking and heating (2005). These resources are also commercially used for fish drying, tobacco curing, and brick baking, as a few examples, in developing countries. Industrially, in the global forestry sector wood residues and indirect byproducts (e.g., black liquor) have been used for energy generation needs (FAO 2005). The FAO summarized differing bioenergy production techniques for wood fuels including steam-turbine power boiler, CHP facilities, and small-scale gasification. Energy efficiency of these processes varies from 40 percent (steam-turbine) to theoretically, up to 70 to 80 percent for CHP with recent technological improvements (e.g., flue-gas recovery and recycling) and integrated gasification (2008). Integrated gasification technologies are being examined for small-scale, localized power generation (i.e., on-farm, village, etc.) to replace fossil fuel generators; however, limitations of the technology include consistent supply for fuel feedstock. One of the most efficient wood fuel products at a small-scale is wood pellets, originally produced from wood wastes.

Woody biomass are the trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management (Figures 5.3-3 and 5.4-4). Forest residues from either SRWC, fast growing tree species harvested every five to seven years specifically for biomass, wood residues after timber operations and other forest resource possibilities are summarized by Perlack *et al.* (2005). The conversion of these lands to biomass crops, especially perennial crops and the increased utilization of forest residues, could have large effects on the environment. Carbon sequestration could be affected, as well as overall soil quality and water quality. The use of wood residues from forestry management activities (e.g., fuel treatment thinning, on-site logging residues) could negatively impact soil and water quality in local forest conditions depending upon the amount and frequency of forestry residue removal. Sound forestry management techniques detailed in a forestry stewardship plan (or the equivalent) would minimize impacts associated with loss of soil organic matter from forestry residues.



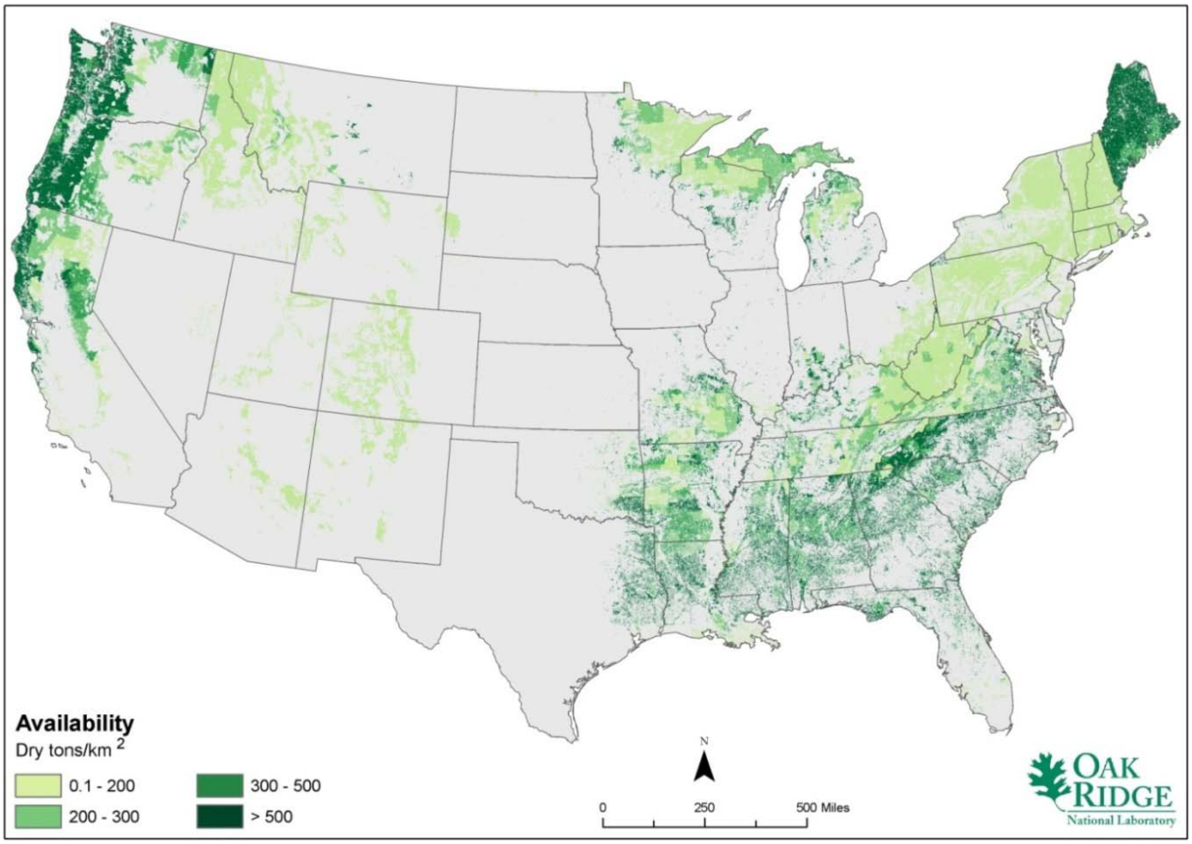
Source: ORNL 2009b

Figure 5.3-3. Estimated Availability of Logging Residues from All Timber Lands, 2007

FOREST RESOURCES OWNERSHIP

About 56 percent (423 million acres) of the Nation's forests are held by private ownership while about 328 million of acres (43.7 percent) are held by public ownership

(Table 5.3-1). In 2007, of the 423 million acres in private ownership, 67.3 percent are private non-corporate ownerships, which include individuals, Native American lands, unincorporated partnerships, clubs, and lands leased by corporate interests. Of the total forest land ownership, 33 percent (248 million acres) are held by public federal ownership. The USFS National Forest System governs the largest segment of public forest land, 147 million acres, or 59.2 percent of the total public federal forest land.



Source: ORNL 2009b

Figure 5.3-4. Estimated Availability of Fuel Treatment Thinnings from All Timber Lands, 2007

In 2007, there were a total of 514 million acres of timber land, 69.3 percent of which is held by private ownership with the reminding 30.7 percent owned by Federal, State, and other public owners. Private corporate timber land holdings in the United States totaled 106 million acres in 2007. These acres are owned by organizations that are legally incorporated. The remaining 250 million acres are owned by private non-corporate ownership including individuals, partnerships, clubs, and Native Americans. This group accounts for 48.6 percent of total timber land. National Forest timber land in the United States totals 99 million acres or 19.3 percent of all timber land. The remainder of public land is owned by BLM and other Federal agencies and by State, County, and Municipal authorities.

About 10 percent of forest land is permanently reserved from wood production as reserved forest land or roadless areas. Reserved forest land is defined as those forested areas that are withdrawn from wood production by legal statute. Reserved forest lands include national parks, National Forest System wilderness areas, and State parks. There are about 41.5 million acres of reserved forest land in the United States (excluding Alaska) with about 31.7 million acres (76.4 percent) located in the West. These lands are excluded from commercial timber harvest activities: as such, they are not eligible lands for either eligible BCAP crops or materials. Roadless areas are lands that prohibit road construction, road reconstruction, and timber harvesting in inventoried roadless areas on National Forest System lands. Roadless areas on National Forest lands accounts for about 42 million acres of combined forest and non-forest land (excluding Alaska). Alaska contains about 15 million acres of roadless areas. Aside from Alaska, Idaho and Montana have the greatest amount of roadless areas. The reserved forest lands and roadless areas are less intensely managed than other forest areas, thus there are differences in stand age and fuels accumulation. On reserved forest land, stand ages are older than on non-reserved forest land, with 48 percent of reserved forests more than 100 years old, as compared with 16 percent for non-reserved forests. Roadless areas follow similar stand age patterns as reserved forest lands.

TIMBER PROCESSING RESIDUES

During 2006, timber-processing facilities in the U.S. produced 86.8 million dry tons of wood residues. These residues are used for wood products including pulp, paper, particle board, biomass energy, fuel pellets, firewood and others. Only about 1.5 percent (1.3 million tons) of that residue was not utilized for a product (Table 5.3-2). About 36.7 million tons (42.3 percent) of wood residue were used for fuel, 35.4 million tons (40.8 percent) for fiber products, and 13.3 million tons (15.3 percent) for other products. The South region produced 61.1 percent of the wood residues, with less than one percent of the residues not utilized. The Pacific Coast region produced 19.1 percent, the North region produced 14.5 percent, and the Rocky Mountain region produced 5.3 percent of the wood residues (Table 5.3-3). Overall, timber processing residues or wood mill residues have a generally small availability as a new feedstock for bioenergy facilities. Given the small amount of available materials and the potential incentive created by BCAP matching payments, the proposed rule has excluded mill residues as eligible materials because the residues are used as an intermediary step to create a higher value product.

Table 5.3-2. Forest Land Area and Timber Land Area in the U.S. by Ownership, 2007

Ownership Type			Forest land	Timber land
			Millions of acres	
	All Ownership		751	514
Public		Total Public	328	158
Public	Federal	Total Federal	248	113
Public	Federal	National Forest	147	99
Public	Federal	Bureau of Land Management	48	7
Public	Federal	Other	54	7
Public	State	State	69	35
Public	State	County & Municipal	11	10
Private	Total Private		423	356
Private	Private Corporate		138	106
Private	Private Non-Corporate		285	250

Source: USFS 2009

Table 5.3-3. Wood Residues by Region and Use Type, 2006

Region	Total residue (thousands of dry tons)				
	Fiber products	Fuel	Other uses	Not used	Total
North	2,798	5,010	4,186	622	12,616
South	20,300	25,665	6,534	493	52,992
Pacific Coast	9,631	4,836	1,969	118	16,554
Rocky Mountain	2,713	1,236	594	78	4,621
United States	35,442	36,747	13,283	1,311	86,783

Source: USFS 2009

5.4 CUMULATIVE IMPACTS ANALYSIS

Hoekman (2009) indicated that a mature bioenergy industry would generate both positive and negative effects, both short-term and long-term. Table 5.4-1 illustrates Hoekman's idea of potential benefits and challenges of the biofuels industry. This PEIS has focused on the potential environmental effects from the implementation of the BCAP and from the No Action Alternative, no implementation of the BCAP. Overall, it has been indicated that in general the BCAP would generate many positive effects at the local, regional, and national scale depending upon the size of the program. Table 5.4-2 summarizes the overall anticipated cumulative effects from the BCAP by alternative.

5.4.1 Socioeconomics and Land Use

Depending upon the level of funding available to meet the desired goals associated with BCAP, the cumulative socioeconomic and land use effects of BCAP, when taken into consideration with all of the other Title IX 2008 Farm Bill Programs and state programs that assist with both establishment and CHST, would range from insignificant and negative to significant and positive.

Table 5.4-1. Potential Benefits and Challenges of Bioenergy

Improved Energy Security	Economic Productivity	Environmental Impacts
• Domestic Supply • Distributed Resources • Supply Reliability • Petroleum Reduction	• Price Stability • Increased Rural Development • Reduced Trade Deficit • Improved Global Competitiveness	• Land and Water Use • Criteria Air Pollutants • GHG • Wildlife Habitat • Biodiversity • Carbon Sequestration

Source: Hoekman 2009

Table 5.4-2. Estimated Cumulative Effects by Alternative for BCAP

Resource Area	No Action	Alternative 1	Alternative 2
Socioeconomics and Land Use	I -	I/S +	S +
Vegetation	I	I +	S -/+
Wildlife	I	I +	S -/+
Air Quality	I -	I/S +	I/S -/+
Soil Quality	I/S -	I +	I/S +
Water Quality and Quantity	S -	I/S +	S +
Recreation	I	I	I
Transportation	I -	I -	I/S -

Note:
S = Significant
I = Insignificant
N = No Effect
+ = Positive
- = Negative

With a limited level of BCAP funding that would provide for only two commercial-scale facilities, the range of potential cumulative effects would be broad depending upon the location of the facilities. However, land use changes to dedicated energy crops as feedstock for a new BCF, potentially funded through RD, would not be nationally significant but could create local or regional effects. Under Alternative 1, the limitation of no more than 25 percent of cropland within a county would further limit the potential effects from land use changes. Under Alternative 1, the limited funding would not induce national changes in agricultural related prices, given the limited land use changes to dedicated energy crops.

Under Alternative 2, the unlimited funding of the BCAP to support all scales of BCFs could lead to national level price changes in Title I commodities specifically related to BCAP implementation; however, changes are dependent on the total level of activities. These price changes would induce downstream economic effects, which would generate additional employment positions and increased earnings. Additionally, implementing Alternative 2 would provide greater regionalization potential to take advantage of regionally significant feedstocks (i.e., SRWC, woody biomass, energycane, forage sorghum). Having the ability to take advantage of regionally competitive species could induce land use changes toward dedicated energy crops in those areas that currently would not support Title I crops or are only marginally productive for Title I crops.

The combination of the USFS provisions for the utilization of woody biomass for bioenergy and the Matching Payment provisions of BCAP would likely contribute to a greater use of forestry residues in BCFs. This would be the most likely path for short term increases in the utilization of biomass for bioenergy due to the availability of this feedstock and the proximity and wide definition of qualified BCFs under the Matching Payments Program. USFS NEPA requirements for materials taken from National Forest System Lands would limit the cumulative effects from the use of forestry residues, as each removal application would be required to follow all applicable Federal, State, and local environmental regulations and mitigation measures.

5.4.2 Biological Resources

The potential cumulative effects on vegetation would impact native fish and wildlife as habitats are fragmented, degraded, or destroyed from crop establishment. Not all species are harmed by conversion of land to more intensive uses, and so the cumulative effects will be localized and site-specific. While the footprints of the areas considered under conversion are relatively small (less than one percent of the area inside the 50 mile buffer), it is possible that in the right set of circumstances the spatial configuration and relative location of converted areas combined with existing habitat fragmentation patterns could have a multiplicative effect on the overall regional habitat fragmentation values. The establishment of new crops in areas previously fallow or cropped for a different style of agriculture may itself cause some direct mortality and range shifting at the local scale of wildlife. The use of BMPs and environmental assessments should help to prevent and minimize any significant impacts; however, fragmentation is unavoidable.

Cumulative impacts to vegetation would occur from the conversion of large amounts of agricultural land from traditional crops to dedicated energy crops. The cap on the amount of acreage that may be used for dedicated energy crops under Action Alternative 1 (i.e. 25 percent in any single county within the 50-mile radius) also is designed to reduce these impacts. Similarly, because of the limited funding that would only provide for two to five qualified BCFs, the amount of agricultural land that potentially would be converted is negligible.

There are no quantitative studies of the impacts to wildlife directly related to biofuel crops. Direct effects on wildlife occur from conflicts with haying machinery or trampling by grazing livestock that may result in mortality. Under Alternative 1, direct impacts are expected to occur during the establishment and harvest stages of BCAP crops; yet, these impacts are expected to be short-term and localized. Indirect impacts would be the result of habitat change as cropland use is shifted from traditional crops to dedicated energy crops, and are expected to be positive and negative but not significant. These habitat changes would impact such aspects as food availability, type and quantity of cover for escape and breeding, and the availability of adequate nesting sites. Wildlife in lands adjacent to the dedicated energy cropland may either be positively or negatively impacted depending on the habitat quality provided by the biofuel crops.

The broad implementation of Alternative 2 would lead to direct and indirect impacts to vegetation and wildlife at a regional scale. As with Alternative 1, direct impacts are not expected to impact wildlife at a population level. However, the significance of indirect impacts are dependent on potential land use changes; the quantity and habitat quality of any land converted from native grasses, forest land or pastureland for dedicated energy crops will determine the level of cumulative impacts. Under Alternative 2, depending upon the level of land use changes, the cumulative impacts to vegetation and wildlife could be significant.

Under the No Action Alternative, the BCAP Project Areas Program would not be implemented and financial assistance would not be provided for the conversion of cropland and potentially non-agricultural land to dedicated energy crops. Both the positive and negative impacts to vegetation and wildlife as described above would not occur.

5.4.3 Air Quality

In general, the maturation of the biofuels and bioenergy industries should result in significantly positive energy balance in relation to first generation biofuels and bioenergy supported by grain feedstocks and fossil fuels. Substantial effort has been made on determining the potential value of biofuels and bioenergy at localized, regional or state, national, and global levels.

Depending upon the level of funding available to meet the desired goals associated with BCAP, the cumulative air quality effects of BCAP, when taken into consideration with all of the other Title IX 2008 Farm Bill Programs and state programs that assist with both establishment and CHST, would range from insignificant and negative to significant and positive with some potential for significant and negative.

With a limited level of BCAP funding that would provide for only two commercial-scale facilities, the range of potential cumulative effects would be broad depending upon the location of the facilities. However, it was estimated that the BCAP program would generate net energy savings and greater soil carbon sequestration as lands are converted to dedicated energy crops. The effects were estimated to only be locally or regionally significant and not nationally significant.

Under Alternative 2, the unlimited funding of the BCAP to support all scales of BCFs could lead to national level effects, such as a decline in soils carbon sequestration, due to an increased use of crop residues to meet the EISA volume requirements. It was estimated that there would be benefits from the conversion of lands associated with total carbon flux and overall energy use, but there would also be negative effects from the greater use of residues, which would generate additional GHG emissions and reduce soil carbon sequestration. In the longer term, as more acreage is planted to dedicated energy crops and regionally competitive crops (i.e., SRWC), there would be some off-set from the anticipated soil carbon losses associated with residue removal and use.

5.4.4 Soil Quality

The implementation of BCAP would generate positive effects from a reduction in soil erosion and increased soil carbon sequestration from the conversion of Title I crops to perennial dedicated energy crops. The conversion to a perennial dedicated energy crop provides greater soil retention due to anticipated cropping practices and the plant structure holding soil in place. Under Alternative 1, with the limited BCAP funding, the benefits associated with reduced soil erosion would be only locally significant and would provide for positive changes to water quality, soil organisms biodiversity and overall biological diversity. Under Alternative 2, depending upon the level of crop residue use, the effects could be either insignificant or significant, cumulatively. When combined with the USFS measures to increase woody biomass utilization for bioenergy, there may be short term increases in soil erosion from forest lands in some regions; however, these should be minimal if harvest and management BMPs are implemented per the Forest Stewardship Plan or the equivalent, and all applicable Federal, State, and local harvest regulations. Also, in some regions, soil erosion on forest lands would be insignificant due to the species and understory cover provided. The increased use of crop residues is anticipated to lead to changes in cropping practices, which should provide greater soil cover by standing crop residues and reduced tillage practices to promote residue use.

5.4.5 Water Quality and Quantity

The National Research Council Committee on Water Implications of Biofuels Production in the United States (NRC-CWIBP) in 2008 published an overview entitled "Water Implications of Biofuels Production in the United States." Their analysis of existing data indicated that water use by ethanol production facilities averaged approximately four gallons of water use per gallon of ethanol created (National Academy of Sciences 2007). They also point out that for petroleum refining, water use is approximately 1.5 gallons for every gallon of product, while initial estimates for cellulosic ethanol appear to be approximately 9.5 gallons of water to every gallon of product (*Ibid*). However, the NRC-CWIBP do indicate that water use for ethanol production is likely to continue decreasing as more efficient processes are developed with an estimated range between two to six gallons of water per gallon of product.

Water consumption to generate the feedstock for corn ethanol varies depending upon source with NRC-CWIBP (2008) indicating as much as 780 gallons per water per gallon of ethanol and Wu (2008) indicating a range depending upon farm production region from 7.0 to 320.6 gallons per gallon of ethanol. The range of values is more indicative of the true water consumption at the crop level due to differing irrigation requirements throughout the productive cropland of the United States. Additionally, new data associated with the 2007 Agricultural Census – Farm and Ranch Irrigation Survey (2009a), indicate that since the last irrigation survey, water use per acre for irrigated corn for grain (average acre-feet applied per acre) has declined from an average of 1.2 acre-feet to 1.0 acre-feet, while average yield increased from 178 bushels per acre to 181 bushels per acre, which indicates an average water consumption on irrigated acres of corn at approximately 1,800 gallons per bushel (*Ibid*). This decline was identified both for pressure systems and for gravity systems. This, on average, would reduce the consumption of water to between 641 gallons to 660 gallons per gallon of ethanol, using Wu (2008) average gallons of ethanol produced per bushel of corn for both dry mill (2.81 gallons) and wet mill (2.74 gallons) procedures.

Figures 5.4-1 through 5.4-3 illustrate the existing and planned expansion of ethanol production capacity in relation to the ratio of irrigated harvested corn to total harvested corn acres; total irrigated harvested acres to total harvested acres; and total harvested irrigated acres to total harvested acres in relation to the potential BCAP project area by species type (i.e., perennial herbaceous species, annual herbaceous species, and SRWC). A visual analysis of corn acres indicates that the majority of existing ethanol production capacity is within areas that have a relatively low ratio of irrigated harvested corn acres compared to total harvested corn acres. This also appears to hold for total irrigated harvested acres with higher ratio of irrigation in the more arid west and Nebraska and Kansas. When the potential BCAP project areas are illustrated with the total irrigated harvested acres, some of these project areas seem to occur in regions with high irrigation ratios (0.75 – 1). The establishment of perennial herbaceous crops within these high irrigation regions could provide a mechanism to reduce overall irrigation within those areas, after initial establishment of those crops, if establishment and maintenance of those species was cost-effective compared to current uses. Wu (2008) further the analysis by looking at the water consumption across exploration and production activities for petroleum and then oil refining activities into gasoline to make a comparison of total water consumption for ethanol versus gasoline. Table 5.4-3 is adapted from Wu (2008) showing the total water consumption range from ethanol and gasoline given different feedstocks. This indicates that at current technology corn ethanol production consumes significantly more water per gallon than the production of gasoline; however, depending upon production technologies for cellulosic ethanol, water consumption could be near or below the water consumed to produce gasoline.

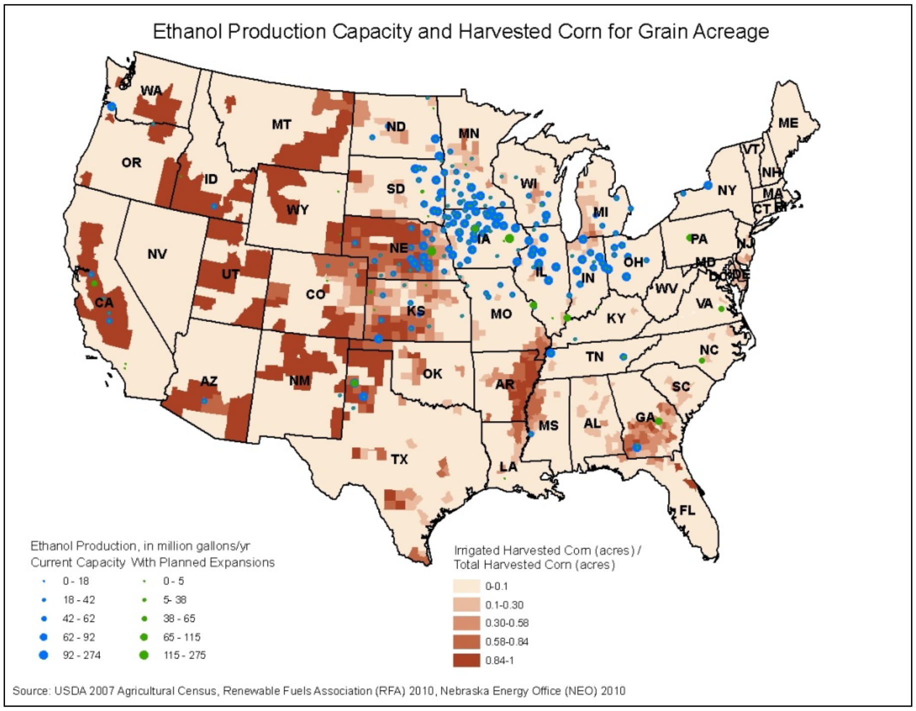


Figure 5.4-1. Existing Ethanol Capacity and Ratio of 2007 Irrigated Harvested Corn Acres to Total Harvested Corn Acres

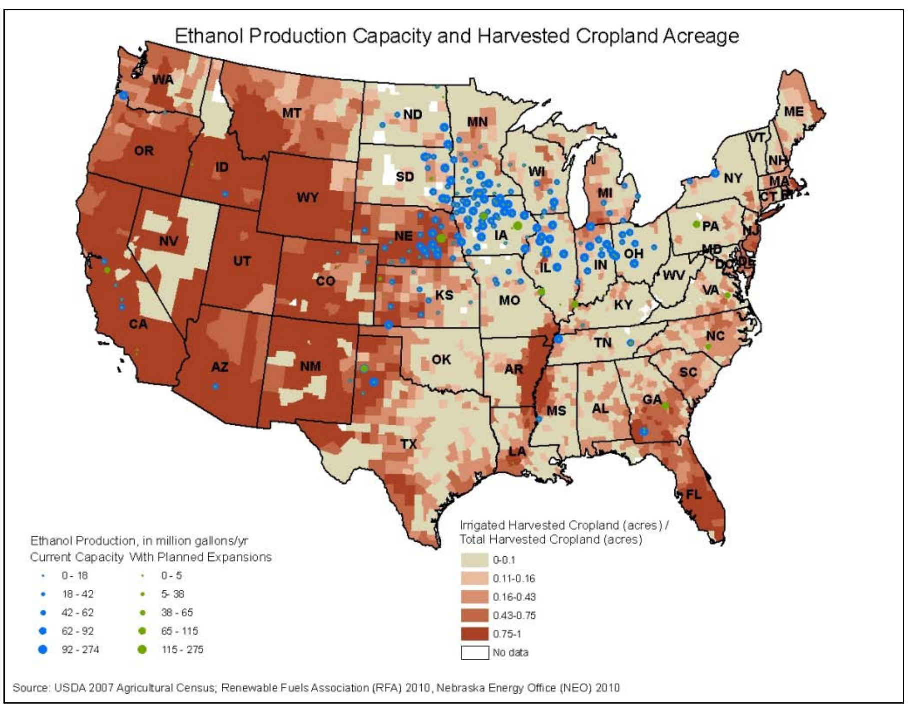


Figure 5.4-2. Existing Ethanol Production Capacity and 2007 Ratio of Irrigated Harvested Cropland to Total Harvested Cropland

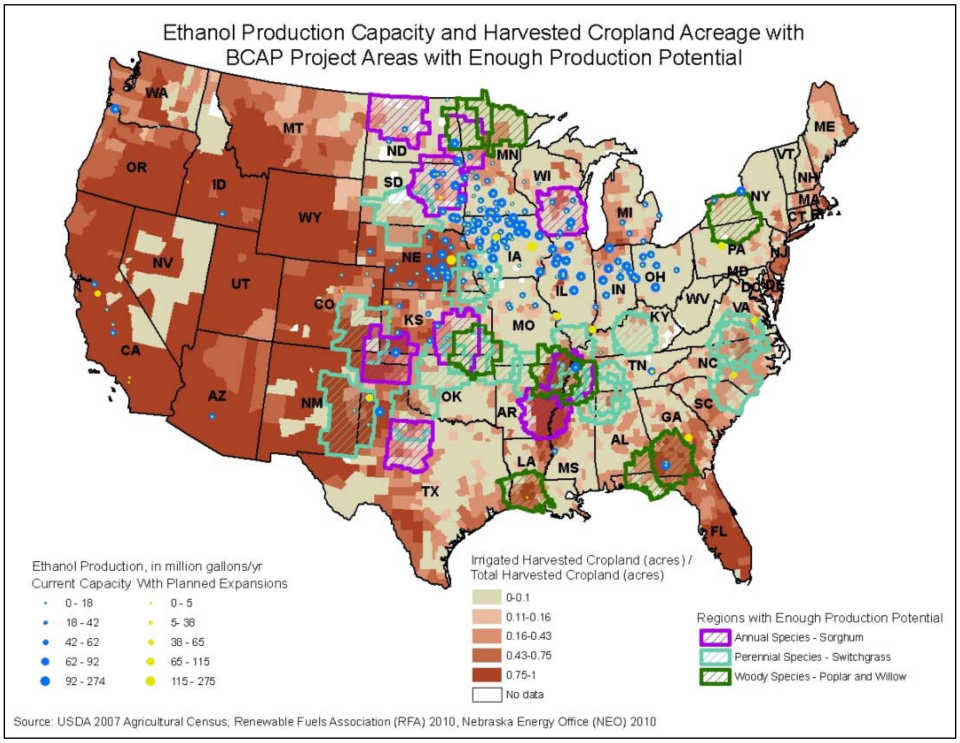


Figure 5.4-3. Existing Ethanol Production Capacity with Irrigated Harvested Acres Ratio and All Potential BCAP Project Areas

Table 5.4-3. Comparison of Water Consumption for Ethanol and Gasoline by Feedstock

Feedstock	Net Water Consumed/Gallon of Product	Major Factors Affecting Water Use
Corn ethanol	10-324 gallons/gallon ethanol	Regional variation caused by irrigation requirements due to climate and soil type
Switchgrass ethanol	1.9-9.8 gallons/gallon ethanol	Production technology
Gasoline (US conventional crude)	3.4-6.6 gallons/gallon gasoline	Age of oil well, production technology, and degree of produced water
Gasoline (Saudi conventional crude)	2.8-5.8 gallons/gallon gasoline	Age of oil well, production technology, and degree of produced water
Gasoline (Canadian oil sands)	2.6-6.2 gallons/gallon gasoline	Geologic formation, production technology

Source: Wu 2008 Table S-2

The implementation of BCAP would generate positive effects from (1) a potential reduction of irrigated cropland acres, (2) greater water use efficiency on non-irrigated and irrigated acreage, and (3) a general reduction in agricultural chemical use from the conversion of Title I crops to perennial dedicated energy crops. As shown previously, the majority of water consumption associated with corn-based ethanol is from irrigation to grow the crop. A potential reduction in the amount of irrigated acres would reduce the total water consumption to produce ethanol. Additionally, some studies (Campbell *et al.* 2009; Cherubini *et al.* 2009; Grahn *et al.* 2007) have indicated that conversion of biomass at co-generation or CHP power plants for electricity is more efficient in the reduction than conversion into transportation fuels. However, water consumption for this use should also be considered. Younos *et al.* (2009) indicate that traditional liquid biofuels used as a fuel source for power generation are the most water inefficient (2,510 – 29,100 gallons of water per million British thermal units [MBtu]) when compared to traditional fuels, such as natural gas, which was the most water efficient (3 gallons per MBtu).

The conversion to a perennial dedicated energy crop provides greater water use efficiency than traditional row crops such as corn. This conversion would be anticipated to limit runoff from agricultural fields and potential need for irrigation past the initial establishment period. Under Alternative 1, with the limited BCAP funding, the benefits associated with increased water quality and decreased water quantity would be only locally significant and would provide for positive changes. Under Alternative 2, depending upon the level of crop residue use, the effects could be either insignificant or significant, cumulatively.

5.4.6 Recreation

Impacts to recreation could be positive or negative based on the locality for BCAP project regions. However, they would be small regionally and nationally under either alternative and would not substantively or cumulatively change the recreational aspects of participation in wildlife activities.

5.4.7 Transportation

The transportation system's capacity to move biomass and co-location products derived from processing biomass/biofuel production would increase proportionately as production increases. However, biomass use for fuel is likely to have a mixed impact on rail, truck, and barge transportation. For example, trucks are used to ship most of the biomass used by BCFs today.

The cost of transporting biomass goods is highly dependent on the scale of the project. A recent study by Brechbill and Tyner (2008) showed that the total per ton costs for producing and transporting biomass within a 30 mile range varies between $39 and $46 for corn stover and $57 and $63 for switchgrass. The difference in transportation costs between per ton owned for corn stover and switchgrass is due to the capital transportation costs being spread over more tons in the case of switchgrass. It is reported that this difference also exists between corn stover and switchgrass due to differences in yields of these crops per acreage (Brechbill and Tyner 2008).

When considered cumulatively, BCAP has the potential to provide positive benefits associated with the transportation sector and negative effects associated with increased use of primarily truck transportation during the short term. Under Alternative 1, provided the limited funding of BCAP for the support of only two commercial-scale facilities, transportation efforts would be centered on the available modes to move dedicated energy crops to the BCF and move equipment to the field to establish the dedicated energy crop. Primarily, the transportation mode would be heavy trucks with the ability to transport bales of biomass. For establishment, the transportation network would use heavy trucks to move machinery very similar to the machinery currently in use or readily available from commercial producers. Related transportation effects would be through noise, fugitive dust, and level of service aspects on rural roadways. Under Alternative 1, with the limitation of new dedicated energy crops, conversion of existing cropland, which is currently in production, would be the key factor to determine the overall level of effects. Site specific traffic analysis would be required by RD, if the new BCF were to receive funding under its Title IX program, which would address and mitigate potential effects directly related to the BCF and the transportation of feedstock to the facility.

Under Alternative 2, to meet the EISA volume requirements, in the short term, there would be a heavy reliance on the use of crop residues and woody biomass. These feedstocks would be transported over existing road networks using existing equipment, but potentially at a higher volume. If, under Alternative 2, there is a larger scale expansion of BCFs, then there would be the potential for greater investment in the transportation system, which would have the potential to bring new jobs to the rural areas through construction and maintenance. The development of infrastructure can bring increased traffic to existing business and industries, all which in turn would potentially create utility surplus in rural economies.

Because of heavy reliance on trucking systems, the interstate and highway systems (including bridge systems, etc.) would experience greater levels of use as the need for feedstocks increase over the longer term. Semi-trailers and other forms of heavy traffic accelerate the rate of deterioration on the road networks and bridge systems, thereby increasing the expenses for state and local governments. Overall, transportation effects from the implementation of BCAP would generate both positive benefits and negative effects at local and regional areas associated with a BCF.

5.5 IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effect that the use of these resources has on future generations. Irreversible effects primarily result from the use or destruction of a specific resource that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action. For the proposed action, the use of gasoline for operating heavy equipment would be the only irreversible or irretrievable resource commitment expected from the implementation of the proposed action.

6.0 MITIGATION

6.1 INTRODUCTION

The purpose of mitigation is to avoid, minimize, or eliminate negative impacts on affected resources to some degree. CEQ Regulations (40 CFR 1508.20) state that mitigation includes:

- Avoiding the impact altogether by not taking a certain action or parts of an action;
- Minimizing impacts by limiting the degree or magnitude of the action and its implementation;
- Rectifying the impact by repairing, rehabilitating, or restoring the affected environment;
- Reducing or eliminating the impact over time by preservation and maintenance operations during the life of the action; and
- Compensating for the impact by replacing or providing substitute resources or environments.

6.2 ROLES AND RESPONSIBILITIES

Regulations established by CEQ state that all relevant reasonable mitigation measures that could alleviate the environmental effects of a Proposed Action must be identified, even if they are outside the jurisdiction of the lead agency or the cooperating agencies. This serves to alert agencies or officials who can implement these extra measures, and would encourage them to do so. The lead agency for the alternatives analyzed is FSA.

6.3 MITIGATION RECOMMENDATIONS

Mitigation refers to taking additional measures to reduce or eliminate the potential effects from implementing the proposed action. Because BCAP is a national program, it is very difficult to accurately define site-specific mitigation measures at the programmatic level. FSA is proposing the use of general mitigation measures during the development of the forest stewardship plan or conservation plan, and could include

- Avoiding the impact by not taking a certain action or parts of an action.
- Limiting the timing or geographic extent of an action.
- Repairing, rehabilitating, or restoring the affected environment.
- Performing additional studies or surveys to ensure protected resources are not present on the site.
- Implementing various preservation and maintenance operations during the life of the action.
- Replacing or providing substitute resources or environments.
- Monitoring the affected environment for an established period of time.

Additionally, proposed resource specific mitigation measures for a specific Alternative are outlined in Chapter 4, *Environmental Consequences* section, of this document. Monitoring is still under development but should be discussed when the final rule is published.

The negative impacts associated with the implementation of the action alternatives discussed are expected to be temporary in nature, mainly occurring during the conversion of both traditional crop and non-crop land to dedicated energy crops. The negative impacts have the potential to range from localized to broad in scope, depending on the action alternative chosen. Site-specific evaluations are needed to identify the particular negative impacts associated with each conversion to dedicated energy crops. When sensitive resources, protected species or cultural resources are present or in the vicinity of the proposed biomass crop production site, consultation with the appropriate regulatory agency would occur. Specific mitigation measures necessary to reduce or eliminate the potential localized negative impacts to those sensitive resources would be identified. If the environmental evaluation recognizes that species or critical habitat protected under the ESA are potentially present, and the proposed agricultural activity on the land is determined to have negative impacts, it is not likely the site would be approved for production of eligible biomass crops. Activities may result in temporary localized impacts to biological, soil, and water resources; as well as air quality during preparation of the land for installing a biomass crop; however, they may be mitigated through the implementation of BMPs like the installation of silt fencing, temporary covers, vegetative filter strips, or retention basins.

In accordance with current environmental rules and regulations, as administered through similar FSA programs, such as CRP and in addition to site-specific evaluations, producers must provide current Conservation or Forest Stewardship Plans or equivalent and a completed BCAP Environmental Screening worksheet, all of which are needed for final BCAP contract approval. These BCAP Conservation Plans or Forest Stewardship Plans or equivalent (see Section 2.1.3.1) are developed, respectively, by, and NRCS/NRCS certified Technical Service Providers, State Foresters, or other technical service providers under a recognized certification program to the standards established by the USFS and States under existing technical assistance programs and in conjunction with the landowners. These plans should contain all resource information necessary to comply with local, state and Federal regulations. These plans and any required Environmental Evaluations are provided to FSA, which has the ultimate responsibility for ensuring compliance with NEPA and other applicable Federal laws and regulations. If it has been determined, after completion of these plans, that there are potential negative environmental effects from BCAP activities, additional environmental analyses would be performed in accordance to the applicable standards developed for BCAP or by the FSA. The additional level of analysis could range from a site specific EA at the producer level to a project area programmatic EA. If the EA determines that the activity could have significant impacts, then an EIS would be necessary. The ultimate goal of the BCAP Conservation Plans or Forest Stewardship Plans or equivalent should be to develop a site specific BCAP program with methods or activities that would mitigate any potential negative impacts, while meeting the overall goals of BCAP. The negative impacts associated with the conversion of land under BCAP may be reduced through the use of site-specific sustainable agriculture practices and adherence to definitive NRCS Conservation Practice Standards. In addition, after implementation of BCAP, FSA intends to monitor data from BCAP activities to determine, as appropriate, what additional mitigation measures or criteria may be needed as the program progresses.

6.3.1 Biological Resources:

Development of a BCAP Conservation Plan or Forest Stewardship Plan or equivalent that includes NRCS Conservation Practice Standards and sustainable agriculture practices results in a conservation system that reduces the negative impacts to biological resources. The goal of sustainable agriculture is to create an agroecosystem that maintains a natural resource base, has little dependence on artificial inputs from outside the farm system, manages pests and diseases through internal regulation mechanisms, and can naturally recover from the disturbances caused by cultivation and harvests. (Gliessman 2004). BCAP site specific Conservation Plans and Forest Stewardship Plans or equivalent tailored to local environments can reduce negative impacts to grassland birds such as the grasshopper sparrow and northern bobwhite or small mammals. One example of this is adapting dedicated energy crops to the local conditions of the farm and surrounding areas. Choosing energy crops based on local ecosystems will minimize potential disturbance to native wildlife species and vegetation by providing habitats comparable to those found in natural habitats; heterogeneous habitats such as these are proven to benefit native wildlife (Nocera and Dawe 2008).

Other sustainable agricultural techniques used to reduce negative impacts to biological resources include incorporation of conservation buffers into and along the borders of currently producing agricultural fields. Buffers provide multiple benefits to ecosystems, including the conservation and continuity of natural habitats, increased habitat areas, the protection of sensitive habitats such as watersheds and an increased access to local natural resources. Buffers can be designed and tailored towards local ecosystems and site-specific conservation needs.

Additionally, specific county NRCS Conservation Practice Standards, as well as State or county specific technical notes and specific guidance on mitigation measures must be incorporated in the Conservation Plan and Forest Stewardship Plan or equivalent. Practice Standards such as NRCS Conservation Practice 645 Upland Wildlife Habitat Management are targeted specifically for lands where conserving wildlife species is an objective of the landowner or Forest Stewardship Plan. NRCS Conservation Practice 511 Forage Harvest Management is designed to optimize yields and quality of harvests, while promoting plant re-growth, extending stand life, maintaining desired wildlife species and habitat, and controlling insects, diseases and weeds.

Algae production, due to the specialized nature of the demonstration practices currently in effect, should move to minimize the use of potable water supplies where feasible and ensure that ponded areas do not become inadvertent wildlife hazardous due to trapping and drowning.

6.3.2 Water Resources

Some temporary disturbance may occur during activities for the installation of dedicated energy crops, such as the removal of trees and stumps, brush and other vegetation. In order to minimize the potential for soil erosion and sedimentation of water bodies the guidance contained in Conservation Practice Standard 460 should be followed (NRCS 2003). Land within 50 feet of a wetland, water body or perennial stream should be left undisturbed, and a temporary cover should be established to stabilize the soil and prevent sheet and rill and/or wind erosion until the planned crop is established.

One of the greatest threats to water quality would be removing established conservation cover and placing land back into production. The potential negative impacts include deposition of nutrients and pesticides, and/or sedimentation of surface and groundwater, as well as rivers and streams, including those that drain into coastal waters. There are several approaches available to manage water quality within a planning area, which include both management measures and management practices (EPA 2009c). Management practices are specific, usually site-based approaches for controlling pollutant sources; whereas management measures are groups or categories of practices implemented to achieve comprehensive goals. Management practices can be categorized as either structural (constructed facilities capture, treat, and/or discharge treated runoff), or nonstructural (changes in activities or behavior to control the pollution at its source) (Table 6.3-1). Structural practices are the physical control of pollutants; while nonstructural practices (such as sustainable agriculture methods) prevent or reduce problems by reducing the generation of pollutants and managing them at the source.

Table 6.3-1. Examples of Structural and Nonstructural Agricultural and Forestry Management Practices

Structural Practices	Nonstructural Practices
Agricultural Management Practices	
• Contour buffer strips • Grassed waterway • Constructed wetlands • Restored wetlands • Grassed filters • Riparian buffers • Herbaceous wind barriers • Mulch • Live staking • Livestock exclusion fence (prevents livestock from wading into streams) • Sediment basins • Terraces	• Brush management • Conservation coverage • Conservation tillage • Educational materials • Erosion and sediment control plan • Nutrient management plan • Pesticide management • Prescribed grazing • Residue management • Requirement for minimum riparian buffer • Rotational grazing • Workshops/training for developing nutrient management plans
Forestry Management Practices	
• Broad-based dips • Culverts • Establishment of riparian buffer • Mulch • Revegetation of fire lines with adapted herbaceous species • Temporary cover crops • Windrows	• Education campaign on forestry-related nonpoint source controls • Erosion and sediment control plans • Forest chemical management • Fire management • Operation of planting machines along the contour to avoid ditch formation • Planning and proper road layout and design • Preharvest planning • Training loggers and landowners about forest management practices, forest ecology, and silviculture

Source: Adapted from EPA 2009c

The use of conservation tillage is an effective method for reducing this potential impact (Fawcett No Date). Using conservation tillage, the crop residue left on the soil surface protects soil from both rainfall and wind erosion, slows runoff and prevents sealing of the soil surface, and improves water infiltration (Fawcett and Caruana 2001). There are also other erosion control practices such as contour planting, terracing, tile outlet terraces, and sediment basins that reduce runoff of nutrients (Fawcett No Date, Schepers *et al.* 1985). National Conservation Practice Standards exist for these practices, except tile outlet terracing, and are available through NRCS, with State and county specific guidance available at State NRCS offices. The use of crop rotation also has multiple beneficial impacts such as increasing soil fertility and SOC, which reduces future need for nutrient application (Baldwin 2006). Conservation practices such as buffer strips, filter strips, and grassed waterways reduce sediments and nutrients from agricultural runoff. However, reducing nutrient losses depends on many other factors beyond physical control and includes methods and timing of nutrient application, local soil conditions, topography, hydrology, and climate (Fawcett No Date). Specific guidance for timing, application rates and methods, and testing and monitoring are contained in NRCS Conservation Practice Standard 590 (NRCS 2006d), with State-and county-specific guidance available at State NRCS offices. Coordination between local FSA, NRCS, and EPA on watershed and catchment initiatives and conservation planning would further minimize the potential for sedimentation, and nutrient and agricultural chemical deposition into water bodies.

Construction operations during activities to restore hydrology (i.e., the construction of dams and levees) may temporarily increase the potential for erosion and sedimentation of adjacent water bodies, as well as flooding during periods of peak flow. In order to mitigate these potential impacts, planning should consider both water quantity and water quality (NRCS 1978). A runoff management system must be designed that complies with local jurisdiction requirements and regulations for controlling sediment, erosion and runoff, and that regulate storm discharges from the site to a safe and adequate outlet. Systems should be designed to ensure soluble pollutants and salts do not enter local water supplies. Design criteria are contained within NRCS Conservation Practice Standard 570 Runoff Management System. Similarly, State NRCS offices would also have specific State and county guidance, including applicable technical notes related to erosion and runoff control on construction sites.

Proper maintenance of heavy machinery to be used during establishment, maintenance, harvest and transport of the dedicated energy crops would limit the possibility of oil and gas leaks which may degrade surface water quality and wetlands. Implementing BMPs during the establishment of access roads would reduce or eliminate impacts to surface water quality and wetlands.

6.3.3 Soil Resources

Some of the same erosion control practices discussed in 6.3.2 (e.g., land clearing mitigation, conservation tillage, contour planting and terracing) also apply to soil resources. Other measures include cover crops, no till practices, cross wind trap strips, and wind barriers to reduce soil loss from sheet and rill, and/or water erosion. Additional erosion control practices, such as the ones described below, would be considered appropriate on a site-specific basis when implementing the practices, especially on lands designated as HEL. Additionally, a site-specific environmental evaluation to determine erodibility potential, and to ensure HEL compliance requirements are met, would be done.

Erosion control measures that may be utilized on a site-specific basis are:

- Shorten the length of exposure of the erosive surface and prevent sediment from moving offsite by utilizing mulch, silt fences, gravel bags and vegetative barriers that trap sediment
- Clear smaller areas of vegetation at different intervals
- Schedule excavation during low-rainfall periods
- Cover disturbed soils with mulch or vegetation
- Control concentrated water flows that form rills and gullies
- Minimize the length and gradient of slopes
- Inspect and maintain all structural control measures
- Avoid soil compaction by restricting the use of heavy equipment and vehicles to limited areas
- Break up or till compacted soils prior to vegetating

Soil compaction, when soil particles are pressed together reducing pore space, occurs in response to the weight of machinery and grazing animals. Compaction restricts rooting depth, and decreases soil moisture and soil temperature (NRCS 1996). Compaction can be reduced by decreasing the number of trips across an area, avoiding activities when soils are wet, and maintaining or increasing SOC. Additional measures in forestry activities such as harvesting while the soil is frozen or snow covered will also reduce compaction.

6.3.4 Air Quality

Fugitive dust emissions from activities associated with establishment of BCAP are unlikely to cause an increase in negative impacts to Air Quality, as they are approximately equal to current fugitive dust emissions associated with on-going agricultural traditional crop production (Section 4.3). However, there are several sustainable agriculture techniques that provide opportunities to mitigate these impacts. The use of renewable energy practices such as solar photovoltaic systems, wind turbines, geothermal systems and biodiesel should be considered wherever possible. Development of a BCAP Conservation Plan that not only adheres to NRCS Conservation Practice Standards, but also combines best management practices as discussed above, will also result in a reduction of these negative impacts.

Greater impacts will be felt in the increase of carbon emissions as a result of decreasing SOC levels from the loss of crop residue. However, the greatest opportunities for mitigation of GHG emissions lie in the biological and physical capacity of soils to sequester carbon. Restoration of cultivated organic soils, nutrient management, and tillage/residue management are all practices designed to enhance the soil carbon sequestration properties of the soil. Nitrous oxide emissions from soils can be reduced by precision application of nitrogen fertilizers and use of nitrification inhibitors. Use of renewable energy alternatives and practices will also mitigate the impacts of increased carbon emissions by reducing direct energy consumed. Biodiesel alternatives to traditional machinery, or the use of more fuel-efficient machinery would reduce GHG emissions. Sustainable agriculture techniques that use fertilizer more efficiently, specifically nitrogen fertilizers, would also reduce GHG (N2O) emissions. Fertilizing at specific times, such as the most appropriate period for plant uptake as determined by each crop, fertilizing below the soil surface, and balancing nitrogen fertilizers with other nutrients that can stimulate more efficient uptake are all practices that would mitigate agricultural GHG emissions (Pew 2009). Cover crops can provide a buffer for agricultural systems by preventing water and soil loss and deterring pests, and can therefore reduce the need for chemical inputs and in turn, lessen harmful emissions. Adoption and incorporation of these practices into the BCAP Conservation Plan and Forest Stewardship Plan or equivalent will significantly increase the ability of BCAP lands to sequester carbon. Combining these mitigation techniques, along with those discussed in soil and water quality and biological resources, will have the greatest positive impact on BCAP agricultural lands.

6.3.5 Recreation

Given the site specific nature of the BCAP project areas and the practices best suited to those conditions, the effects on the abundance of wildlife for both consumptive and non-consumptive uses would vary. Practices that encourage more foraging habitat for game species could induce changes in relation to decreased traditional row crop fields; however, changes to pasture of hayland could indicate small adverse effects. As such, operators should be encouraged to comply with the goals for wildlife habitat enhancements associated with the Conservation Plans and Forestry Stewardship Plans, or equivalent, at the recommendation of the technical advisors (i.e., NRCS and USFS).

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Disclosure Statements

As required by federal regulations (40 Code of Federal Regulations 1506.5c), Integrated Environmental Solutions, LLC, and its subcontractors have signed National Environmental Policy Act of 1969 (42 United States Code 4321) disclosure statements in relation to the work they performed on the Biomass Crop Assistance Program PEIS. These statements appear on the following pages.

ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE – ADVISORY AND ASSISTANCE SERVICES (April 2009)

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(4) Integrated Environmental Solutions, LLC, represents that it has no past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the Statement of Work.

(5) Integrated Environmental Solutions, LLC, represents that it has no actual or potential conflict of interest or an unfair competitive advantage with respect to the advisory and assistance services to be provided in connection with the Statement of Work.

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(3) Services to be provided are described in the Statement of Work contained in Contract No. AG-3151-C-09-0003.

(4) Daniel De La Torre Ugarte, PhD. represents that it has no past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the Statement of Work.

(5) Daniel De La Torre Ugarte, PhD. represents that it has no actual or potential conflict of interest or an unfair competitive advantage with respect to the advisory and assistance services to be provided in connection with the Statement of Work.

Daniel De La Torre Ugarte, PhD.
May 2009

ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE – ADVISORY AND ASSISTANCE SERVICES (April 2009)

INTEGRATED ENVIRONMENTAL SOLUTIONS, LLC – Prime
Donald Tyler, PhD. – Independent Consultant

(1) Agency: USDA Farm Services Agency
Contract No.: AG-3151-C-09-0003

(2) Donald Tyler, PhD.
620 Rocky Springs Road
Beech Bluff, TN 38313

(3) Services to be provided are described in the Statement of Work contained in Contract No. AG-3151-C-09-0003.

(4) Donald Tyler, PhD. represents that it has no past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the Statement of Work.

(5) Donald Tyler, PhD. represents that it has no actual or potential conflict of interest or an unfair competitive advantage with respect to the advisory and assistance services to be provided in connection with the Statement of Work.

Donald Tyler

Donald Tyler, PhD.
May 2009

ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE – ADVISORY AND ASSISTANCE SERVICES (April 2009)

INTEGRATED ENVIRONMENTAL SOLUTIONS, LLC – Prime
Ken Moore, PhD. – Independent Consultant

(1) Agency: USDA Farm Services Agency
Contract No.: AG-3151-C-09-0003

(2) Ken Moore, PhD.
2508 Bristol Drive
Ames, IA 50010

(3) Services to be provided are described in the Statement of Work contained in Contract No. AG-3151-C-09-0003.

(4) Ken Moore, PhD. represents that it has no past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the Statement of Work.

(5) Ken Moore, PhD. represents that it has no actual or potential conflict of interest or an unfair competitive advantage with respect to the advisory and assistance services to be provided in connection with the Statement of Work.

Ken Moore

Ken Moore, PhD.
January 2010

ORGANIZATIONAL CONFLICTS OF INTEREST DISCLOSURE – ADVISORY AND ASSISTANCE SERVICES (April 2009)

INTEGRATED ENVIRONMENTAL SOLUTIONS, LLC – Prime
Advanced Natural Resource Services – Independent Consultant

(1) Agency: USDA Farm Services Agency
Contract No.: AG-3151-C-09-0003

(2) Advanced Natural Resource Services
1125 Burning Tree Lane
Knoxville, TN 37923

(3) Services to be provided are described in the Statement of Work contained in Contract No. AG-3151-C-09-0003.

(4) Advanced Natural Resource Services represents that it has no past (within the past twelve months), present, or currently planned financial, contractual, organizational, or other interests relating to the performance of the Statement of Work.

(5) Advanced Natural Resource Services represents that it has no actual or potential conflict of interest or an unfair competitive advantage with respect to the advisory and assistance services to be provided in connection with the Statement of Work.

Jennifer L. Murrow
Co-founder and President, ANRS, Inc.
May 2009

Tristram O. West
May 2009

9.0 PERSONS AND AGENCIES CONTACTED

Name	Organization/Agency
Proponent	
Robert Stephenson	Director, U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division
Mike Linsenbigler	Deputy Director, U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division
Matthew Ponish	National Environmental Compliance Manager , U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division, Washington D.C.
Bennett Horter	Federal Preservation Officer, U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division, Washington D.C.
Paul Harte	U.S. Department of Agriculture, Farm Service Agency, Conservation and Environmental Programs Division
Rich Iovanna	U.S. Department of Agriculture, Farm Service Agency, Economic & Policy Analysis Staff
Korah Abraham	U.S. Department of Agriculture, Rural Development
Neil Hoffman	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
Rebecca Stankiewicz-Gabel	U.S. Department of Agriculture, Animal and Plant Health Inspection Service
Ted Beauvair	U.S. Department of Agriculture, U.S. Forest Service
Matt Harrington	U.S. Department of Agriculture, Natural Resources Conservation Service
Dave Walker	U.S. Fish and Wildlife Service
Brett Butler	U.S. Department of Agriculture, U.S. Forest Service

Name	Organization/Agency
Proponent	
Elizabeth LaPoint	U.S. Department of Agriculture, U.S. Forest Service
Kelly Novak	U.S. Department of Agriculture, Farm Service Agency
Shawn Bucholtz	U.S. Department of Agriculture, Farm Service Agency
Agency Contacted	
U.S. Fish and Wildlife Service *Region 1* *Region 2* *Region 3* *Region 4* *Region 5* *Region 6* *Region 7* *Region 9*	 Portland, OR Albuquerque, NM Fort Snelling, MN Atlanta, GA Hadley, MA Denver, CO Anchorage, AK Washington, D.C.
U.S. Environmental Protection Agency *EIS Filing Section* *Region 1* *Region 2* *Region 3* *Region 4* *Region 5* *Region 6* *Region 7* *Region 8* *Region 9* *Region 10*	 Washington, D.C. Boston, MA New York, NY Philadelphia, PA Atlanta, GA Chicago, IL Dallas, TX Kansas City, KS Denver, CO San Francisco, CA Seattle, WA
U.S. Department of Agriculture	Farm Service Agency, Rural Development, Animal and Plant Health Inspection Service, Natural Resources Conservation Service, Forest Service

10.0 INDEX

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11.0 GLOSSARY

Action Alternative: A suggested alternate action to the Proposed Action that (a) meets basic purpose and need; (b) is achievable within the legislated time constraints for the program; (c) is achievable within the budget appropriated for the program; and (d) does not violate any existing laws.

Administrator: The Administrator of the Environmental Protection Agency

Advisory Committee: The Biomass Research and Development Technical Advisory Committee established by section 9008(d)(1) of Title IX of the 2008 Farm Bill.

Advanced Biofuel: (a) In general: Fuel derived from renewable biomass other than corn kernel starch; (b) Inclusions: (i) biofuel derived from cellulose, hemicelluloses, or lignin; (ii) biofuel derived from sugar and starch (other than ethanol derived from corn kernel starch); (iii) biofuel derived from waste material, including crop residue, other vegetative waste material, animal waste, food waste, and yard waste; (iv) diesel-equivalent fuel derived from renewable biomass, including vegetable oil and animal fat; (v) biogas (including landfill gas and sewage waste treatment gas) produced through the conversion of organic matter from renewable biomass; (vi) butanol or other alcohols produced through the conversion of organic matter from renewable biomoass; and (vii) other fuel derived from cellulosic biomass.

Animal Plant and Health Inspection Service: A USDA agency responsible for protecting U.S. agriculture from pests and diseases under the authority of the Plant Protection Act (PPA), Title IV of the Agricultural Risk Protection Act of 2000 (APHIS 2002).

Arm's-length Transaction: A transaction between ready, willing, and able disinterested parties who are not affiliated with or related to each other and have no security, monetary, or stockholder interest in each other, with the exception that members of either (a) an association of agricultural producers or (b) farmer cooperative organizations, or (c) a farmer cooperative, may deliver and sell at market rates eligible material to such associations, organizations or cooperatives they have a monetary or stockholder interest in and such transaction may be considered arm's length transactions.

BCAP: the Biomass Crop Assistance Program established under Title IX, Section 9011 of the Farm Security and Rural Investment Act of 2008. The program supports the establishment and production of biomass crops for conversion to bio-energy in approved project areas, and provides monetary assistance with collection, harvest, storage, and transportation (CHST) of eligible materials for use in a biomass conversion facility (BCF).

BCAP Project Area: An area that (a) has specified boundaries that are submitted to the Secretary by the project sponsor and subsequently approved by the Secretary; (b) includes producers with contract acreage that will supply a portion of the renewable biomass needed by a biomass conversion facility; and (c) is physically located within an economically practicable distance from the biomass conversion facility.

Bill of Lading: A document issued by a carrier to a shipper, acknowledging that specified goods have been received on board as cargo for conveyance to a named place for delivery to the consignee who is usually identified (also known as a ''BOL'' or ''B/L'').

Biobased Product: A product, determined by the Secretary to be a commercial or industrial product (other than food or feed) that is: (a) composed in whole, or in significant part, of biological products, including renewable domestic agricultural materials and forestry materials; or (b) an intermediate ingredient or feedstock.

Biofuel: A fuel derived from renewable biomass.

Biomass Conversion Facility (BCF): A facility that converts or proposes to convert eligible material into: (a) heat; (b) power; (c) biobased products; or (d) advanced biofuels.

Biorefinery: A facility (including equipment and processes) that (a) converts renewable biomass into biofuels and biobased products; and (b) may produce electricity.

Board: The Biomass Research and Development Board established by section 9008(c) of Title IX of the 2008 Farm Bill.

Carbon sequestration: Storage of carbon in cropping systems involves storage in non-removed crop residues and below ground root systems, as well as carbon being stored in the soil as organic matter in varying stages of decomposition.

CCC: the Commodity Credit Corporation.

CHST: Collection, harvest, storage, and transportation activities, or some combination thereof, for eligible material.

Contract Acreage: Eligible land that is covered by a BCAP contract entered into with the Secretary.

Cooperating Agencies: Any Federal agency other than the lead agency which has jurisdiction by law or special expertise with respect to any environmental impact involved in proposed legislation, a proposed action, or reasonable alternative. Cooperating agencies may include a State or local agency with similar qualifications, at the invitation of the lead Federal agency.

Corn Stover: The stalks, leaves and cobs that remain in corn fields after the grain harvest.

Crop Residue: Plant material remaining after harvesting, including leaves, stalks, roots (OECD 2001).

Cultural Resources: Prehistoric and historic districts, sites, buildings, structures or objects that may be archaeological, architectural or traditional cultural properties.

Deputy Administrator: the FSA Deputy Administrator for Farm Programs, FSA, or a designee.

Direct impacts measure the response of a given industry to a change in final demand for the industry. They include the backward linkages in the economy from the increase (decrease) in economic activities that occur from changes in inter-industry intermediate input demands within the region.

Environmental Impact Statement (EIS): A document providing full and fair discussion of significant environmental impacts for a proposed action and informing decision makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment. A Federal agency must prepare an EIS when a proposed action or program constitutes a major Federal action that may have significant impacts to the natural or human environment.

Eligible Crop: (a) In general: A crop of renewable biomass; (b) Exclusions: (1) any crop that is eligible to receive payments under Title I of the Food, Conservation, and Energy Act of 2008 or an amendment made by that title; or (2) any plant that is invasive or noxious or has the potential to become invasive or noxious, as determined by the Secretary, in consultation with other appropriate Federal or State departments and agencies.

Eligible Land: (a) In general: includes agricultural and nonindustrial private forest lands (as defined in section 5(c) of the Cooperative Forestry Assistance Act of 1978 (16 U.S.C. 2103a(c))); (b) Exclusions: (1) Federal- or State-owned land; (2) land that is native sod, as of the date of enactment of the Food, Conservation, and Energy Act of 2008; (3) land enrolled in the Conservation Reserve Program established under Subchapter B of Chapter 1 of Subtitle D of Title XII of the Food Security Act of 1985 (16 U.S.C. 3831 et seq.); (4) land enrolled in the Wetlands Reserve Program established under Subchapter C of Chapter 1 of Subtitle D of Title XII of that Act (16 U.S.C. 3837 et seq.).

Eligible Material: Renewable biomass with the following exclusions: (a) Harvested grains, fiber, or other commodities eligible to receive payments under Title I of the 2008 Farm Bill; (b) Animal waste and animal waste byproducts including fats, oils, greases, and manure; (c) Food waste and yard waste; or (d) Algae.

Eligible Material Owner: For purposes of the matching payment program, a person having the right to collect or harvest eligible material and that has delivered the eligible material to a qualified biomass conversion facility and including: (a) For eligible material collected from private lands, including cropland, the owner of the land, the operator or producer conducting farming operations on the land, or any other person designated by the owner of the land and; (b) For eligible material collected from public lands, those persons with the right to collect eligible material pursuant to a contract or permit with the U.S. Forest Service or other appropriate Federal agency (e.g., Bureau of Land Management), such as a timber sale contract, stewardship contract or agreement, service contract or permit, or related applicable Federal land permit or contract, and who have submitted the permit or contract authorizing such collection for reproduction by FSA.

EPA: the U.S. Environmental Protection Agency; the overarching environmental enforcement agency in the United States. It provides general guidance to all Federal agencies in the implementation of the NEPA Process and reviews all EIS produced by Federal agencies.

Establishment Payments: BCAP funds that will provide for up to 75 percent of establishment cost for perennial crops and includes cost of seed and/or stock and planting for perennials. In areas of non-industrial forest land, establishment payments will cover the cost of site preparation and tree planting.

Farm Cooperative: A farmer- or rancher-owned and controlled business from which benefits are derived and distributed equitably on the basis of use by each of the farmer or rancher owners.

Farm Price: The season average price received by farmers as they sell their production into the market. The farm price is usually determined by an aggregate market, usually national or global, with local differences created as a result of specific marketing conditions, such as distance to collection or consumption centers, storage availability, transportation, etc.

Farmer Cooperative Organization: A cooperative organization or an entity, not chartered as a cooperative that operates as a cooperative in that it is owned and operated for the benefit of its members, including the manner in which it distributes its dividends and assets.

Final demand: Employment compensation, proprietor income, returns to other property, and indirect business taxes

Fish and Wildlife Service: An agency within the U.S. Department of the Interior responsible for conserving the nature of America.

Floodplains: Defined by the Federal Emergency Management Agency (FEMA) as those low lying areas that are subject to inundation by a 100-year flood, a flood that has a one percent chance of being equaled or exceeded in any given year. They provide for flood and erosion control support that helps maintain water quality and contribute to sustaining groundwater levels. Floodplains also provide habitat for plant and animal species, recreational opportunities and aesthetic benefits.

Food Waste: A material composed primarily of food items, or originating from food items, or compounds from domestic, municipal, food service operations, or commercial sources, including food processing wastes, residues, or scraps.

Forest Lands: Lands at least ten percent of stocked by forest type trees of any size

Forest Service: A USDA agency that manages a portfolio of more than 193 million acres of national forest and grasslands throughout the United States.

FSA: the Farm Service Agency.

Government Payment: Any direct revenue received from the federal treasury as a result of performing agriculture related activities. There are two general types of payments – those linked to the change in prices and or production, and those that are fixed regardless of prices and/or production levels.

Greenhouse Gas Test: A test included in the Energy Independence and Security Act of 2007 that requires advanced biofuels produced by a biomass conversion facility to meet a defined percent of the full life cycle reduction in greenhouse gas gained over the production and use of conventional fuels.

Groundwater: The water that flows underground and is stored in natural geologic formations called aquifers.

Indian Tribe: Any Indian tribe, band, nation, or other organized group or community, including any Alaska Native village or regional or village corporation as defined in or established pursuant to the Alaska Native Claims Settlement Act, which is recognized as eligible for the special programs and services provided by the United States to Indians because of their status as Indians (25 U.S.C. 450b).

Indirect impacts represent the response by all industries in the economy to a change in final demand for a specific industry. As changes in economic activity occur, changes in final demand occur.

Induced impacts represent the response by all industries in the economy to increased expenditures of new household income and inter-institutional transfers generated from the direct and indirect impacts of the change in final demand for a specific industry.

Institution of Higher Education: As defined in Section 102(a) of the Higher Education Act of 1965 (20 U.S.C. 1002(a)), “(a) a proprietary institution of higher education (as defined in subsection (b) of this section); (b) a postsecondary vocational institution (as defined in subsection (c) of this section); and (c) only for the purposes of Part B of Title IV, an institution outside the United States that is comparable to an institution of higher education as defined in Section 101and that has been approved.”

Intermediate Ingredient or Feedstock: An ingredient or compound made in whole or in significant part from biological products, including renewable agricultural materials (including plant, animal, and marine materials), or forestry material that are subsequently used to make a more complex compound or product.

Land use shifts: Indicate the changes in what is planted in a particular area of cropland.

Matching Payments: Those CCC payments provided at a rate of $1 for each $1 per dry ton paid by the qualified biomass conversion facility to the owner for delivery of eligible material to the facility in an amount not to exceed $45 per dry ton pursuant to the BCAP NOFA.

Matching Payment Program: The program established by the BCAP NOFA for the collection, harvest, storage, and transportation of eligible material delivered to a qualified biomass conversion facility.

Native species: A species that, with respect to a particular ecosystem, other than as a result of an introduction, historically occurred or currently occurs in that ecosystem.

Net Farm Income: The difference between total revenue and total expenses, including the gains or losses from the value of farm inventories.

No Action Alternative: A suggested alternative to the Proposed Action that assumes that no Federal program like BCAP is implemented and assesses the potential impacts this could have on the natural and human environment. This alternative does not meet the purpose and need of the proposed program, but is carried forward to provide a baseline against which the impacts of the Proposed Action can be assessed.

Nonindustrial private forest land: Rural lands with existing tree cover, or that are suitable for growing trees, which are owned by any private individual, group, association, corporation, Indian Tribe, or other private legal entity.

Noxious Weed: Any plant or plant product that can directly or indirectly bring harm to agriculture, the public health, navigation, irrigation, natural resources, or the environment.

Prime and Unique Farmland: Prime farmland is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops, and is also available for these uses (the land could be cropland, pastureland, rangeland, forest land, or other land, but not urban built-up land or water). Unique farmland is land other than prime farmland that is used for the production of specific high value food and fiber crops (7 CFR 657.5)

Procuring Agency: (a) Any Federal agency that is using Federal funds for procurement; or (b) a person that is a party to a contract with any Federal agency, with respect to work performed under such a contract

Producer: An owner or operator of contract acreage that is physically located within a BCAP project area

Programmatic Environmental Impact Statement (PEIS): An evaluation of the potential environmental consequences of implementing a new Federal program on a national scale. The BCAP PEIS assesses the potential impacts of the action and the No Action alternatives on potentially affected environmental and socioeconomic resources.

Project Sponsor: (a) a group of producers; or (b) a biomass conversion facility

Protected Species: Those species federally designated as threatened or endangered and protected by the Endangered Species Act (ESA).

Qualified Biomass Conversion Facility: A biomass conversion facility that meets all the requirements for BCAP qualification, and whose facility representatives enter into a BCAP agreement with CCC.

Renewable biomass: Includes the following: (1) Materials, pre-commercial thinnings, or invasive species from National Forest System land and public lands (as defined in Section 103 of the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1702)) that: (a) Are byproducts of preventive treatments that are removed to reduce hazardous fuels, to reduce or contain disease or insect infestation, or to restore ecosystem health; (b) Would not otherwise be used for higher-value products; and (c) Are harvested in accordance with applicable law and land management plans and the requirements for old growth maintenance, restoration, and management direction of section 102 (e)(2), (3), and (4) of the Healthy Forests Restoration Act of 2003 (16 U.S.C. 6512) and large-tree retention of subsection (f); OR (2) Any organic matter that is available on a renewable or recurring basis from non-Federal land or land belonging to an Indian or Indian Tribe that is held in trust by the United States or subject to a restriction against alienation imposed by the United States, including: Renewable plant material (including feed grains, other agricultural commodities, other plants and trees, algae), and waste material (including crop residue, other vegetative waste material (including wood waste and wood residues), animal waste and byproducts (including fats, oils, greases, and manure), food waste, and yard waste).

Renewable Energy: Energy derived from (a) a wind, solar, renewable biomass, ocean (including tidal, wave, current, and thermal), geothermal, or hydroelectric source; or (b) hydrogen derived from renewable biomass or water using an energy source described in subparagraph (A).

Rural Development: An agency of the USDA whose mission is to increase economic opportunity and improve quality of life for all rural Americans. This agency has been delegated authority for five programs relating specifically with rural energy and the advancement of rural energy opportunities.

Scoping: A process used to identify the scope and significance of issues related to a Proposed Action while involving the public and other key stakeholders in developing alternatives and weighing the importance of issues to be analyzed in the PEIS.

Secretary: the Secretary of Agriculture

Short-rotation Woody Crops: Tree crops grown primarily for their fuel value (USFS 2008).

Socially disadvantaged farmer or rancher: Unless other classes of persons are approved by the Deputy Administrator in writing, persons who are: (a) American Indians or Alaska Natives (that is, persons who are members of that class of persons who originally settled Alaska); (b) Asian-Americans; (c) African-Americans; or (d) Hispanic-Americans.

Soil: "The unconsolidated mineral and organic material on the immediate surface of the Earth that serves as a natural medium for the growth of land plants" (Soil Science Society of America [SSSA] 2008).

Surface Water: As defined by the EPA, surface waters are waters of the United States, such as rivers, streams, creeks, lakes, and reservoirs, supporting everyday life through uses such as drinking water and other public uses, irrigation, and industrial uses.

Timber land: is defined forest land that is producing or is capable of producing crops of industrial wood and which has not been withdrawn from timber utilization by statute or administrative regulation.

United States and Territories: Any of the 50 States of the United States, the Commonwealth of Puerto Rico, the District of Columbia, the U.S. Virgin Islands, Guam, American Samoa, the Commonwealth of the Northern Mariana Islands, the Republic of Palau, the Federated States of Micronesia, and the Republic of the Marshall Islands.

Woody Biomass: The trees and woody plants, including limbs, tops, needles, leaves, and other woody parts, grown in a forest, woodland, or rangeland environment, that are the by-products of forest management.

Yard waste: Material composed primarily of yard maintenance, cleanup materials, or debris removal items, originating from residential, municipal or commercial yards, lawns, landscaped areas, or related sites.

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