April 9, 2007

How Sustainable are Current Biofuels Efforts?
NCR-SARE Administrative Council
April 2007

Background: In 2006, excitement about bioenergy raced through U.S. agriculture like a runaway train. Today that train continues to gain momentum. Politicians, farmers, and investors across the U.S. are enthusiastic about potential economic benefits and use of energy crops to revitalize the rural landscape. Rapidly expanding, highly visible and potentially polarizing investments and decisions are being made in an often chaotic manner that is not consistent with value-based and data-based information. Frequently, there has been little or no long-range planning or perspectives and no visible efforts to consider the externalities (i.e., natural resource and community impacts) that will occur as a result of these activities.

Current investments are ignoring the basic principles of sustainability and as such will not be profitable for producers, beneficial to the environment, or long-term assets to the community as a whole. Critical questions must be addressed.

- What are the effects of increased removal of crop residues, monoculture, continuous cropping, and increased nutrient and pesticide inputs on environmental sustainability, especially soil erosion, soil organic matter, and water quality?
- What are the effects on food and feed costs throughout the world?
- How will small local communities deal with increased transportation and other infrastructure requirements, and environmental damage done to community air or water?
- Will investments really create wealth for local communities or will they enhance the current extractive economy in which wealth derived from local natural resources is removed from rural America?

An important role for NCR-SARE, consistent with the organization's core values, is to ask: (1) How sustainable are current biofuels efforts? And (2) How can SARE contribute to the vision and development of a truly sustainable bioenergy future?

Strategies: The North Central Region Sustainable Agricultural Research and Education (NCR-SARE) Administrative Council (AC) will vigorously support energy-use-efficiency (including all aspects of energy conservation), strive to help identify bioenergy ideas and technologies that are truly sustainable, and actively participate in balanced discussions regarding the sustainability of current bioenergy investments. We need to begin immediately with a strong focus on data-based synthesis and education. We need to create partnerships to leverage the small amount of fiscal and human resources available through NCR-SARE. We will direct efforts through the Professional Development Program (PDP), Research & Education (R&E) grants, and other education and outreach activities to be sure that all relevant data are examined, all aspects of sustainability are being debated, and that all issues of sustainability are included in the decision-making process. Partnerships with other SARE regions, agencies (e.g., DOE, NRCS, and ARS), institutions (Land Grant and other colleges and universities), non-governmental organizations (NGOs), and state agriculture and natural resource departments must be investigated to ensure issues of sustainability (e.g., clean water, soil and air quality, and rural communities) are being fully considered. Time is of the essence so action should commence immediately, but in a coordinated and focused manner initially emphasizing investments in education.

NCR-SARE must ask questions that may be overlooked or even discounted in the rush to develop new technologies and management strategies to support renewable bioenergy production. For example, how can farmers and ranchers:

- Develop agricultural resources for energy production in a sustainable manner?
- Capitalize on bioenergy opportunities while protecting soil and water quality?
- Partner with local businesses to ensure that rural communities realize benefits from energy development projects?

To respond to these and similar questions, NCR-SARE has identified several research and education themes for future CFPs (Calls for Preproposals or Calls for Proposals). These include:

1. Energy Conservation and Efficiency
    a. Strategies for energy conservation by machinery and equipment
        i. What's limiting adoption and use of more efficient engines, fluorescent lighting, fans, tractor maintenance and ballasting, variable speed vacuum pumps in dairy/frequency drives, plate coolers for milk pre-cooling, scroll compressors, heat recovery systems on milk coolers, or low-pressure irrigation systems?
    b. Strategies for energy conservation in buildings

        i. How can building design, site selection and orientation, insulation, energy efficient ventilation systems, controllers for lights, heaters and fans be improved?

    c. Strategies for educational methods – to increase overall commitment to sustainable agriculture, there is a need to:
        i. Design course units and curricula to address energy conservation and efficiency associated with agriculture
        ii. Design course units and curricula to address bioenergy production and bioeconomy that includes energy conservation and efficiency.

2. Energy Efficient Production Practices
    a. Conservation tillage – farmers can save about 3 to 4 gallons of fuel per acre by switching from conventional tillage to reduced tillage systems. Conservation tillage systems are also thought to help sequester carbon – a component of a primary greenhouse gas.
        i. What factors limit adoption of conservation tillage?
        ii. How can farmers be encouraged to reduce tillage?
    b. Diversified cropping systems – approximately 30% of energy used nationally in agriculture is for fertilizer manufacturing. Cover crops and/or nutrient cycling through organic materials such as legumes and animal manures reduce on-farm energy use. Application uniformity of commercial or organic fertilizer can be improved with proper equipment techniques.
        i. What types of incentives, educational programs, or demonstration projects are needed to increase adoption and use of nutrient management plans, site-specific management practices, and innovative application techniques that result in an overall reduction in off-farm energy used to sustain soil fertility?
    c. Integrated livestock systems – moving from concentrated animal feeding operations (CAFOs) to rotational grazing systems can improve herd health and save energy currently used for transportation and feed production. Pasture-based systems and innovative livestock housing such as deep-straw barns significantly reduce heating and electricity requirements.
        i. Do these strategies negatively impact production?
        ii. What limits their adoption?

3. Non-biomass Renewable Energy Sources
    a. Solar energy and wind power – the price of wind power has recently dropped enough to drive a new market for on-farm turbines. Solar can be used either in the field for remote pumps in grazing systems, for electric fences, or to power operations in the barn or in the house.
        i. What improvements, incentives, or strategies are needed to encourage greater adoption of these energy sources?

4. Alternative Biomass Feed Stock Production Systems
    a. What types of diverse, and sustainable cropping systems should be developed for bioenergy production?
    b. What systems could meet the multiple needs of soil, water and air quality while also providing wildlife habitat?
    c. What are the adoption gaps?

5. Environmental Impact of Bioenergy Production
    a. How can the environmental need for diversity be balanced with the industrial need for uniformity of bioenergy feed stock sources?

6. Community and Rural Development Impacts of Bioenergy Production
    a. What is the best landscape design for sustainable bioenergy production?
    b. What size/scale yields the best efficiency and community development?
    c. How will small and mid-size farms be affected?

7. Local and Regional Economic Impact of Biofuel Production
    a. What ownership models are most appropriate for bioenergy production enterprises?
    b. Significant potential exists to reduce feedstocks and ultimately livestock production, particularly non-ruminant animals such as swine and poultry. What are the local/regional tradeoffs in jobs between bioenergy and livestock?

8. Whole farm integrated energy systems
    a. What models can be developed that use multiple aspects of a landscape and/or farm's resources to provide a closed loop energy system?
    b. Fertilizer nutrients can be recycled in a sustainable, balanced manner through on-farm crop/livestock production system. As crop acres are diverted to bioenergy, what are the implications for the sustainability of fertilizer nutrient re-cycling? Can strategies be developed and encouraged for recycling plant nutrients?

Through this vision, NCR-SARE hopes to more clearly articulate the need to use a systems approach to identify critical questions, develop innovative solutions, and solve both on-site and off-site problems that might limit sustainable development of bioenergy production. For more information, please contact Dr. Bill Wilcke at ncrsare@umn.edu or (612-625-8205).

Finally, for additional information from the SARE national energy webpage, please see http://www.sare.org/coreinfo/energy.htm.

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