APPENDIX A

Watershed Analysis

Watershed analysis (Ziemer 1997, this volume) provides a basis for developing restoration plans and priorities. Watershed analysis is a procedure used to characterize the human, aquatic, riparian, and terrestrial features, conditions, processes, and interactions (collectively referred to as "ecosystem elements") within a watershed. It provides a systematic way to understand and organize ecosystem information. In so doing, watershed analysis enhances our ability to estimate direct, indirect, and cumulative effects of our management activities and guide the general type, location, and sequence of appropriate management activities within a watershed.

The understanding gained through watershed analysis is critical to sustaining the health and productivity of natural resources. Healthy ecological functions are essential to maintaining and creating current and future social and economic opportunities.

Federal agencies are conducting watershed analyses to shift their focus from species and sites to the ecosystems that support them in order to understand the consequences of management actions before implementation. The watershed scale was selected because every watershed is a well-defined land area having a set of unique features, a system of recurring processes, and a collection of dependent plants and animals.

Watershed analyses are conducted by teams of journey-level specialists who follow a standard, interagency six-step process. The process is issue-driven. Rather than attempting to identify and address everything in the ecosystem, teams focus on seven core analysis topics along with watershed-specific problems or concerns. These problems or concerns may be known or suspected before undertaking the analysis or may be discovered during the analysis. Analysis teams identify and describe ecological processes of greatest concern, establish how well or poorly those processes are functioning, and determine the conditions under which management activities, including restoration, should or should not take place. The process is also incremental. New information from surveys and inventories, monitoring reports, or other analyses can be added at any time.

Watershed analysis is not a decision-making process. Rather it is a stage-setting process. The results of watershed analyses establish the context for subsequent decision-making processes, including planning, project development, and regulatory compliance.

The results of watershed analysis can be used to:

- Assist in developing ecologically sustainable programs to produce water, timber, recreation, and other commodities.
- Facilitate program and budget development by identifying and setting priorities for social, economic, and ecological needs within and among watersheds.
- Establish a consistent, watershed-wide context for project-level National Environmental Policy Act (NEPA) analyses.
- Establish a watershed context for evaluating management activity and project consistency given existing plan objectives (e.g., Aquatic Conservation Strategy objectives).
- Establish a consistent, watershed-wide context for implementing the Endangered Species Act, including conferencing and consulting under Section 7.
- Establish a consistent, watershed-wide context for local government water quality efforts, and for the protection of beneficial uses identified by the States and tribes in their water quality standards under the Federal Clean Water Act.

Summary of the Six-Step Process

The process for conducting watershed analysis or ecosystem analysis at the watershed scale has six steps:

1. Characterization of the watershed

The (purpose) objective of step 1 is to identify the dominant physical, biological, and human processes or features of the watershed that regulate ecosystem function or condition and to relate these features and processes to those occurring in the river basin. Characterization establishes the relative importance of each of the core topics, as well as other analysis topics unique or relevant to the watershed. This step provides a broad watershed context useful in subsequent steps to identify the primary ecosystem elements that should be carried into the analysis.

Characterization uses known information about the watershed to provide new information for the analysis through synthesis of the core topics. Teams may find that they need to return to step 1 and update the watershed characterization after completing subsequent steps of the analysis.

Core Topics and Questions

Erosion Processes

- What erosion processes are dominant within the watershed (e.g., surface erosion processes, mass wasting)? Where have they occurred or are they likely to occur?

Hydrology

- What are the dominant hydrologic characteristics (e.g., total discharge, peak flows, minimum flows) and other notable hydrologic features and processes in the watershed (e.g., cold water seeps, ground-water recharge areas)?

Vegetation

- What is the array and landscape pattern of plant communities and seral stages in the watershed (riparian and nonriparian)? What processes cause these patterns (e.g., fire, wind, mass wasting)?

Stream Channel

- What are the basic morphological characteristics of stream valleys and segments and the general sediment transport and deposition processes in the watershed (e.g., stratification using accepted classification systems)?

Water Quality

- What beneficial uses dependent on aquatic resources occur in the watershed? Which water quality parameters are critical to these uses?

Species and Habitats

- What is the relative abundance and distribution of species of concern that are important in the watershed (e.g., threatened or endangered species, special status species, species emphasized in other plans)? What is the distribution and character of their habitats?

Human Uses

- What are the major human uses, including tribal uses and treaty rights? Where do they generally occur in the watershed (e.g., map the location of important human uses such as cultural sites, recreation developments, and infrastructure)?

Summary Questions

1. Where is this watershed located in relation to the river basin?
2. What are the distinguishing physical, biological, and human features of the watershed?
3. What are the most important land allocations and management plan objectives that influence the watershed?
4. Do the characteristics of this watershed differ from neighboring watersheds or the river basin in which the watershed is located? Are they unique?
5. What are the ownership and land use patterns in the watershed?
6. What makes this watershed important to people?

2. Identification of issues and key questions

Watershed analyses assemble, organize, interpret, and present information needed to guide future resource management decisions. To meet this intent, step 2 has four phases: (1) identification of issues in the watershed; (2) prioritization of issues to identify the most important or relevant for anticipated management activities within the watershed; (3) identification of indicators most likely to reveal conditions of the core analysis topics; and (4) formulation of key questions about specific processes or conditions based on the issues and indicators. It is important to involve tribes, the public, State and county agencies, and other Federal agencies in step 2 of the analysis.

3. Description of current conditions

The purpose of this step is to develop information (more detailed than the characterization in step 1) relevant to the issues and key questions identified in step 2. The current range, distribution, and condition of the relevant ecosystem elements are documented. In step 3, more detailed analyses will be completed for those core topics and other ecosystem elements identified in step 1 that are relevant to the issues and key questions identified in step 2. The analysis of current conditions in step 3 will develop additional detail over the characterization in step 1, as determined by the analysis team, to answer the key questions. Information germane to these key questions is collected and assembled in the analysis.

The watershed may be stratified, as needed, to accurately describe local conditions and processes. Data should be reported at a scale and resolution commensurate with the scale of the features and processes within the watershed. If conditions or values are averaged over an entire watershed, then data quality and utility may be affected.

4. Description of reference conditions

The purpose of step 4 is to explain how ecological conditions have changed over time as a result of human influence and natural disturbances. A reference is developed for later comparison with current conditions over the period that the system evolved with key management plan objectives.

The intent of step 4 is to describe the known or inferred history of the landscape so that teams understand what existed in the past and what changes have occurred that may affect current capabilities. The reference condition step is based on the premise that ecosystems adapted over extended time periods and that the greatest probability for maintaining future sustainability is through management designed to maintain or reproduce natural components, structures, and processes.

Reference conditions can be used to help define goals or objectives established in management plans. For example, the ACS contains the objective of managing for maintenance of natural sediment regimes. Sediment regimes differ between and within watersheds. Step 4 in watershed analysis can help define what is natural for any specific area or watershed.

The results of step 4 are not goals or desired future conditions (DFCs), but rather clues as to the function of ecological processes over the system's evolution period. No judgment is made on the optimal condition or value of elements. Teams document the range, frequency, and distributions of ecosystem element conditions and processes during the time span for which data are available for comparison with existing conditions and key management plan objectives. The significance of reference conditions with respect to issues from step 2 will be evaluated in step 5 (interpretation).

The conditions and values of ecosystem elements are dynamic in both space and time. The distribution of data values for ecosystem elements over a selected period of time may be termed the "reference variability." Distributions may differ spatially between different landscapes within the watershed, as well as temporally on a given landscape. This reference variability is similar to the concepts of "the natural range of variability" and "the historical range of variability." Because reference variability encompasses the full range of ecosystem conditions, processes, and values within the current climatic period, it includes both presettlement and historical epochs, as well as current conditions.

5. Synthesis and interpretation of information

The purpose of step 5 is to compare existing and reference conditions of specific ecosystem elements and to explain significant differences, similarities, or trends and their causes. The capability of the system to achieve key management plan objectives is also evaluated.

Step 5 is the place to synthesize and interpret information from the previous four steps. The spatial and temporal interaction of biological, physical, and social processes at work in the watershed are explained here. The implications of these interactions for attainment of management plan objectives identified in step 2 will be identified to provide a basis for management recommendations in step 6.

Differences in the range, frequency, and distribution of relevant historical, current, and natural conditions should be explained. Ecosystem processes and causal mechanisms that best explain the differences and how these factors affect the watershed's capability to achieve management objectives also should be identified. Discrepancies among watershed conditions, capabilities, and relevant management plan objectives should be identified. These will enable the team to make general recommendations in step 6 to correct and rectify inconsistencies between resource conditions and management objectives.

Data gathered and analyzed by using the modules or similar techniques should be quantitatively and qualitatively compared. Such comparisons will help the team arrive at conclusions regarding dominant changes that have occurred, processes and mechanisms responsible for the changes, natural or human-related causes of these changes, and effects on resources and issues of interest.

In step 5, the team should revisit and answer, to the extent possible, the key analysis questions developed in step 2. Questions that cannot be answered to the satisfaction of the team may need further analysis then or in the future. The final watershed analysis report should include a description of those questions answered and explain if and why any questions were deferred.

Logic tracking and documentation are critical in step 5. In reaching conclusions regarding core topics and others, the team should use the weight of evidence to reach and support their conclusions. The team should also review and revise system diagrams, or other logic documentation methods, and identify dominant processes and relationships.

6. Recommendations

The purpose of this step is to bring the results of the previous steps to a conclusion, focusing on management recommendations that are responsive to watershed processes identified in the analysis. By documenting logical flow through the analysis, issues, and key questions (from step 2) are linked with the step 5 synthesis and interpretation of ecosystem understandings (from steps 1, 3, and 4). Monitoring activities are identified that are responsive to the issues and key questions. Data gaps and limitations of the analysis are also documented.

APPENDIX B

Great Basin Geomorphology and Plant Materials

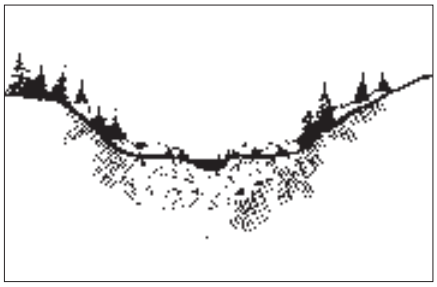
The following charts include information about Great Basin geomorphology and plant types common to the Basin.

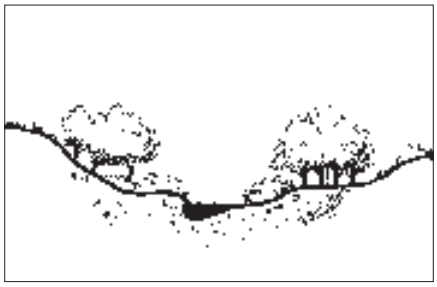
This information was taken from "The Practical Streambank Bioengineering Guide," 1998.

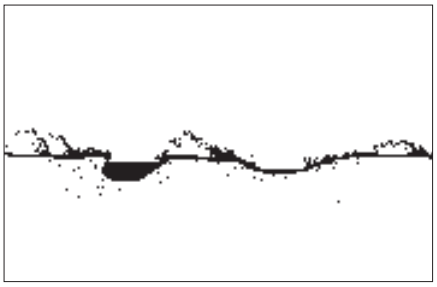
It was developed by the USDA Natural Resources Conservation Service, Plant Materials Center, Aberdeen, ID

Geomorphic Valley Forms

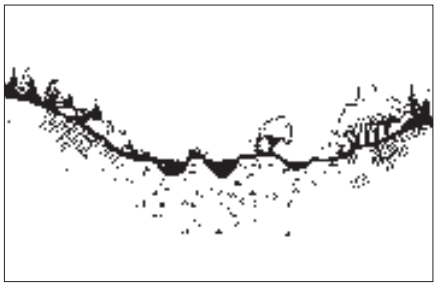
Valley Form	Stream Characteristics		
	Gradient and Flow	**Rosgen Type**	**Additional Information**
Glacial Headwaters and Valleys	Small, low gradient. Low order stream in U-shaped valleys.	C and E	Highly permeable substrate minimizes flooding during high precipitation events.
Erosional Fluvial Canyons	High gradient. Low to mid-order streams in V-shaped canyons	A	Highly confined, may be downcutting.
Depositional Fluvial Canyons	Moderate to high gradient. Low to mid-order streams in V-shaped canyons where deposition has occurred.	B	Moderate to highly confined with restricted meandering. Flow regimes are widely fluctuating.
Braided Stream Channels	Moderate gradient. Often located where fluvial canyons empty into broad valleys and deposit coarse sediment.	D	These zones are naturally highly erodible.
Mid-elevation Confined Alluvial valleys	Low gradient. Small to medium-sized low to mid-order streams	C	Moderately confined. Usually at 5,000 to 7,000 feet elevation in north, higher moving south in the region.
Low-elevation Confined Alluvial Valleys	Low gradient and highly sinuous	C	Slight to no confinement. Evaporation is high in Great Basin valleys
Lacustrine Basins	Slow moving, low gradient. Often ephemeral streamflow.		May terminate in a saline lake, dry lake bed, or playa. Soil conditions often very saline.

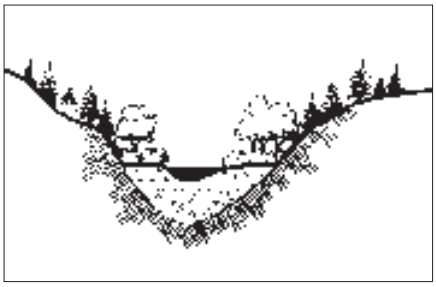






Vegetation	Revegetation Potential
Primarily herbaceous wetland species *(Juncus, Carex, Eleocharis)* with levees and hummocks supporting low-growing willows; planeleaf willow *(Salix planifolia)* and wolf willow *(S. wolfii)*.	Moderate revegetation potential due to high elevation and short growing season.
Narrow band of riparian vegetation, primarily deep-rooted species: river alder *(Alnus incana)*; water birch *(Betula occidentalis)*; common shrubs include: dogwood *(Cornus* spp.*),* chokecherry *(Prunus virginiana),* geyer willow *(Salix geyeriana)* and booth willow *(S. boothii).*	Relatively low due to high flow velocities, erosion rates and/or rock. Rely on bioengineering methods that include adequate protection of plantings.
Stream terraces support river alder, water brich, or cottonwoods: *(Populus trichocarpa, P. fremonti)*; common shrubs include: dogwood, chokecherry, geyer and booth willow. Other willows include: whiplash willow *(S. lasiandra)*, coyote willow *(S. exigua),* and drummond willow *(S. drummondiana)*.	Relatively low due to high flow velocities, floodplain scouring and/or. rock. Rely on bioengineering methods that include adequate protection of plantings.
Gravel bars and secondary channels may support cottonwood, coyote willow, and other species that establish on freshly deposited sediment.	Poor to fair; plantings are vulnerable to channel shifting; stream should be allowed to move as needed. Consider establishing and maintaining parent trees and shrubs as seed sources if large areas are denuded.
Booth and geyer willow dominate many communities on soils too waterlogged for deeper rooted alder, birch, and cottonwood; deeper rooted species may occur on small terraces.	High using booth and geyer willow as primary species for bioengineering treatments; river alder, water brich, and cottonwood may be planted where site conditions permit.
Black cottonwood (north and west), narrowleaf cottonwood (east), and Fremont cottonwood (south), are very common. Commonly associated with coyote willow and yellow willow *(S. lutea)*.	High using native cottonwood or willow; a typical planting along medium sized streams would include willows at the waterline and cottonwoods with understory shrubs on the upper banks and low terraces.
May include cottonwood and willow if in freshwater environment or salt-tolerant non-native, invasive species such as saltcedar *(Tamarix* spp.*)* or Russian olive *(Elaegnus angustifolia)*.	High using native species where conditions are not excessively saline.





Description of Native Shrubs and Trees For Riparian Areas in the Intermountain West

(after Bentrup and Hoag, 1998)

Species	Size/Form	Elevation Range[1]	Root Type	Rooting Ability from cuttings	Availability In Field[2]
Acer negundo Boxelder	Med. Tree	Low–Mid.	Moderately Spreading	Poor	Common
Alnus rubra Red alder	Med. Tree	Mid.–High	Shallow Spreading	Poor	Fairly Common
Alnus sinuata Sitka alder	Sm.–Med. Tree	Mid.–High	Shallow Spreading	Poor	Fairly Common
Alnus incana spp. tenuifolia Thinleaf alder	Sm.–Med. Tree	Mid.–High	Shallow Spreading	Poor	Common
Betula occidentalis Water birch	Lg. Shrub to Sm. Tree	Mid.–High	Shallow to Deep Spreading	Poor	Fairly Common
Cornus sericea Redosier dogwood	Med. Shrub	Mid.	Shallow	Moderate-need to nick & use hormone	Fairly Common
Crataegus douglasii Black/Douglas hawthorn	Sm. Tree	Low–Mid.	Shallow to Deep Spreading	Poor	Fairly Common
Pentaphylloides floribunda Shrubby cinquefoil	Sm. Shrub	Low–Mid.	Shallow to Deep Spreading	Poor	Very Common
Philadelphus lewisii Mockorange	Sm.–Med. Shrub	Low–Mid.	Spreading Fibrous	Poor	Common
Populus angustifolia Narrowleaf cottonwood	Lg. Tree	Mid.	Shallow	Very Good	Very Common
Populus fremontii Fremont cottonwood	Lg. Tree	Low–Mid.	Shallow Fibrous	Very Good	Fairly Common
Populus tremuloides Quaking aspen	Med. Tree	Mid.–High	Shallow	Poor	Very Common
Populus trichocarpa Black cottonwood	Lg. Tree	Low–Mid.	Shallow Fibrous	Very Good	Very Common
Prunus virginiana Chokecherry	Med.–Lg. Shrub	Low–Mid.	Rhizomatous	Good from root cuttings	Common
Rhus trilobata Skunkbush sumac	Med.–Lg. Shrub	Low–Mid.	Deep Spreading Rhizomatous	Poor	Fairly Common
Ribes aureum Golden current	Sm.–Med. Shrub	Low–Mid.	Spreading	Good (in greenhouse)	Common
Ribes cereum Wax/Squaw current	Sm.–Med. Shrub	Mid.–High	Fair	Common	
Rosa woodsii Wood's rose	Sm.–Med. Shrub	Low–Mid.	Shallow to Deep	Good (in greenhouse)	Very Common
Sambucus coerulea Blue elderberry	Sm. Tree	Mid.	Rhizomatous	Poor	Fairly Common
Sambucus racemosa Red elderberry	Med. Shrub	Mid.–High	Spreading	Poor	Fairly Common
Shepherdia argentea Silver buffaloberry	Lg. Shrub	Low–Mid.	Rhizomatous	Poor	Fairly Common

Footnotes:

U: Unknown

1: **Elevation Range:** data for this region.
- Low 2,000–4,500 feet
- Middle 4,500–7,000 feet
- High 7,000–10,000 feet

2: **Availability in the Field:** This refers to its natural occurrence in the region. This is particularly important for species that may be harvested for hardwood cuttings. The order of the ranking is from least to greatest: fairly Common, Common, and Very Common.

3: **Commercial Availability:** This refers to whether or not it is currently available in the nursery trade. Refer to the Resource section for information on a nurdery guide.

4: **Tolerance Deposition:** regrowth from shallow coverage by soil.

5: **Tolerance to flooding:**
- High: Damage after 10 to 30 days of flooding.
- Medium: Damage after 6 to 10 days of flooding.
- Low: Damage after 1 to 5 days of flooding.

6: **Tolerance to Drought:** Resistance to drought relative to native vegetation on similar sites.

7: **Tolerance to Salinity:** Resistance to salinity relative to native vegetation on similar sites.

Commercial Availability[3]	Deposition Tolerance[4]	Flooding Tolerance[5]	Drought Tolerance[6]	Salinity Tolerance[7]	Wildlife Value/Misc. Notes
Yes	High	High	High	Med.	
Yes	Med.	Med.	Low	Low	Big game browse upland bird food
Yes	Med.	Med.	Low	Low	Big game browse upland bird food
Yes	Med.	Med.	Low	Low	Big game browse upland bird food
Yes	Med.	Med	Low	Low	Big game browse
Yes	Low	High	Med.	Low	Big game browse, small mammal food upland bird food.
Yes	Med.	Low	High	Low	Browse for many species and cover
Yes	U	U	High	U	Big game browse
Yes	U	U	U	U	Big game browse
Yes	Med.	Med.	High	Med.	Big game browse
Yes	Med.	Med.	Med.	Med.	Big game browse
Yes	Low	Low	Med.	Med.	Big game browse
Yes	Med.	Med.	Med.	U	Big game browse
Yes	Low	Low	Low–Med.	Low–Med	Birds and small mammals eat fruits
Yes	High	Med.–High	Med.–High	Med.	Birds and small mammals eat fruits Can not tolerate long-term flooding
Yes	U	U	U	U	Birds and small mammals eat fruits
Yes	U	U	U	U	Birds and small mammals eat fruits
Yes	U	Low	Low–High	Low	Rosehips eaten by many species
Yes	Med.	Med.	Med.	Low	Fruits are important for birds
Yes	Med.	Med.	Med.	Low	Big game browse fruits eaten by birds and small mammals
Yes	U	U	U	Low	Fruits eaten by birds and small mammals

References:

Brunsfeld, S.J. and F.D. Johnson. 1985. *Field Guide to the Willows of East-Central Idaho.* Forest, Wildlife & Range Experiment Station. University of Idaho Bull. #39.

Ditterberner, P.L. and M.R. Olson. 1983. *The Plant Information Network (PIN) Data Base Colorado, Montana, North Dakota, Utah, and Wyoming.* U.S. Fish and Wildlife Service FWS/OBS-83/36.

Platts, W. and Others. 1987. *Methods for Evaluating Riparian Habitat With Applications to Management.* USDA, Forest Service, Intermountain Research Station, General Technical Report INT-221.

USDA Natural Resources Conservation Service. 1992. *Soil Bioengineering for Upland Slope Protection and Erosion Protection.* USDA NRCS Engineering Field Handbook. Chapter 18.

Species	Size/Form	Elevation Range[1]	Root Type	Rooting Ability from cuttings	Availability In Field[2]
Salix alba White/Golden willow	Med.–Lg. Tree	Low–Mid.	Shallow to Deep	Good	Common
Salix amygdaloides Peachleaf willow	Sm. Tree	Low	Fibrous	Very Good	Common
Salix bebbiana Bebb's willow	Lg. Shrub	Low to Mid.	Shallow to Deep	Good	Common
Salix boothii Booth willow	Med. Shrub	Mid.	Shallow to Deep	Moderate	Very Common
Salix drummondiana Drummond willow	Sm.–Med. Shrub	Mid.–High	Shallow to Deep	Good	Common
Salix exigua Coyote willow	Med. Shrub	Low–Mid.	Rhizomatous	Very Good	Very Common
Salix geyeriana Geyer willow	Med.. Shrub	Mid.	Shallow to Deep	Good	Very Common
Salix lasiandra Pacific willow	Sm. Tree	Low–Mid.	Shallow to Deep	Good	Common
Salix lemmonii Lemmon willow	Sm.–Med. Shrub	Mid.–High	Shallow to Deep	Good	Fairly Common
Salix lutea Yellow willow	Med.–Lg. Shrub	Low	Shallow to Deep	Good	Very Common
Salix nigra Black Willow	Lg. Tree	Low–Med.	Shallow to Deep	Good	Fairly Common
Salix planifolia Planeleaf willow	Sm. Shrub	Mid.–High	Shallow to Deep	Moderate	Fairly Common
Salix prolixa Mackenzie willow	Sm. Tree	Low–Med.	Shallow to Deep	Good	Fairly Common
Salix scouleriana Scouler willow	Lg. Shrub	Low–Mid.	Shallow to Deep	Need to treat with hormone	Fairly Common
Salix sitchensis Sitka willow	Sm.–Med. Tree	Low–Med.	Shallow to Deep	Moderate	Common

Footnotes:

U: Unknown

1: **Elevation Range:** data for this region.
- Low 2,000–4,500 feet
- Middle 4,500–7,000 feet
- High 7,000–10,000 feet

2: **Availability in the Field:** This refers to its natural occurrence in the region. This is particularly important for species that may be harvested for hardwood cuttings. The order of the ranking is from least to greatest: fairly Common, Common, and Very Common.

3: **Commercial Availability:** This refers to whether or not it is currently available in the nursery trade. Refer to the Resource section for information on a nurdery guide.

4: **Tolerance Deposition:** regrowth from shallow coverage by soil.

5: **Tolerance to flooding:**
- High: Damage after 10 to 30 days of flooding.
- Medium: Damage after 6 to 10 days of flooding.
- Low: Damage after 1 to 5 days of flooding.

6: **Tolerance to Drought:** Resistance to drought relative to native vegetation on similar sites.

7: **Tolerance to Salinity:** Resistance to salinity relative to native vegetation on similar sites.

Commercial Availability[3]	Deposition Tolerance[4]	Flooding Tolerance[5]	Drought Tolerance[6]	Salinity Tolerance[7]	Wildlife Value/Misc. Notes
Yes	High	High	Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes—limited	High	High	Low	Med.	Willows in general are good browse and provide excellent cover for many species
Yes—limited	High	High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes—limited	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes—limited	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes—limited	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
No	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes—limited	Med.	Med.–High	Low–Med.	Med.	Willows in general are good browse and provide excellent cover for many species
Yes	Med.	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
No	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes—limited	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species
Yes	High	Med.–High	Low–Med.	High	Willows in general are good browse and provide excellent cover for many species
Yes—limited	High	Med.–High	Low–Med.	Low	Willows in general are good browse and provide excellent cover for many species

References:

Brunsfeld, S.J. and F.D. Johnson. 1985. *Field Guide to the Willows of East-Central Idaho.* Forest, Wildlife & Range Experiment Station. University of Idaho Bull. #39.

Ditterberner, P.L. and M.R. Olson. 1983. *The Plant Information Network (PIN) Data Base Colorado, Montana, North Dakota, Utah, and Wyoming.* U.S. Fish and Wildlife Service FWS/OBS-83/36.

Platts, W. and Others. 1987. *Methods for Evaluating Riparian Habitat With Applications to Management.* USDA, Forest Service, Intermountain Research Station, General Technical Report INT-221.

USDA Natural Resources Conservation Service. 1992. *Soil Bioengineering for Upland Slope Protection and Erosion Protection.* USDA NRCS Engineering Field Handbook. Chapter 18.

APPENDIX C

Soil Bioengineering Monitoring Sheet

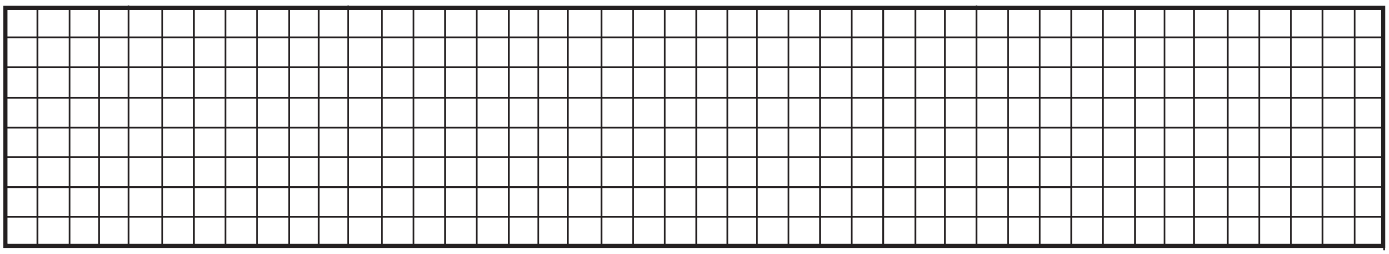
Project Name: _____ Project Location: _____
Monitoring Team: _____ Date: _____

Bioengineering Technique: _____
Riparian Species Present: _____
_____

Total # of poles or post plantings: _____ Average # of live stems per linear foot: _____
# of dead: _____ # of live: _____ _____
% of survival: _____ Average height of stems per linear foot: _____
Average height: _____ _____
Stem density per unit area: _____

Observations: _____
_____
_____
_____
_____

STREAM CROSS-SECTION ID#: _____ Measuring Tape Height: x y _____



Recommendations for maintenance:

APPENDIX D

Ecological Subregions

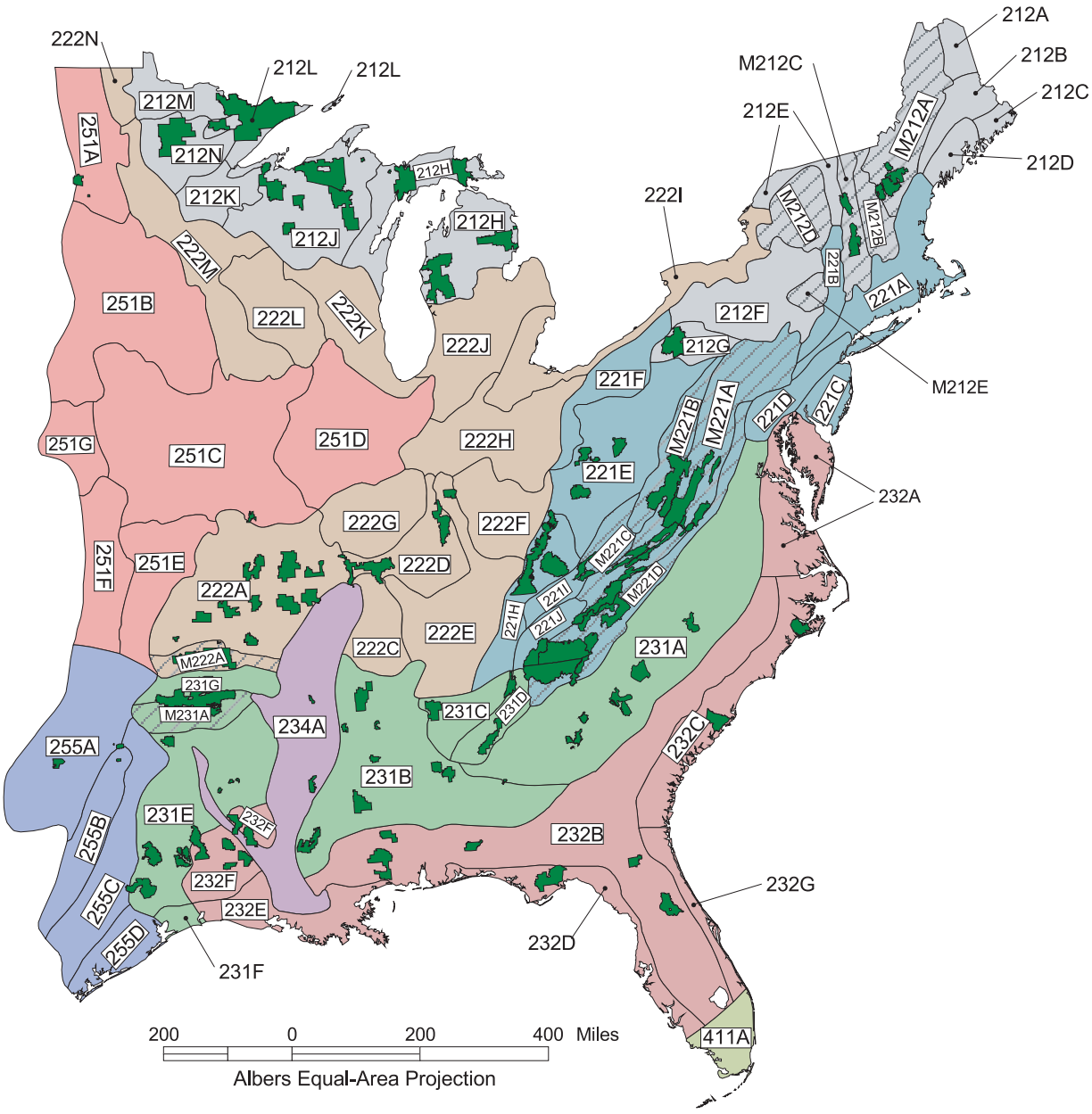
The Ecosystem Subregions and Forest maps have been included to show the diversity of the forests and the plants in relationship to their ecosystems as a planning tool.

The information was taken from the "Ecoregions and Subregions of the United States" map, 1994. Detailed information on ecoregions can be found in "Ecological Subregions of the United States: Section Descriptions," WO-WSA-5. There is no publication number. It was prepared by W. Henry McNab and Peter E. Avers, July 1994, of the ECOMAP Team of the Forest Service. It covers subregions. The Eastern United States is covered in much more detail than the Western United States, so don't be confused if you can't find something.

Another source is "Descriptions of the Ecoregions of the United States." USDA Miscellaneous Publication Number 1391. The descriptions in this book are much more general than in the previously mentioned book.

The Caribbean National Forest in Puerto Rico and the Institute of Pacific Islands Forestry in Hawaii are not shown as part of the forest map because no digital data was available. Their ecoregions are shown.

Locations of U.S. National Forests and Grasslands in Relation to Ecological Subregions of the United States - (East)



Maps compiled by Chris Chandler,
San Bernardino National Forest, 1999

Locations of U.S. National Forests and Grasslands in Relation to Ecological Subregions of the United States - (East)

National Forests and Grasslands

HUMID TEMPERATE DOMAIN

Warm Continental Division

Laurentian Mixed Forest Province

212A Aroostook Hills & Lowlands Section
212B Maine & New Brunswick Foothills & Central Lowlands Section
212C Fundy Coastal & Interior Section
212D Central Maine Coastal & Interior Section
212E St. Lawrence Valley Section
212F Northern Glaciated Allegheny Plateau Section
212G Northern Unglaciated Allegheny Plateau Section
212H Northern Great Lakes Section
212J Southern Superior Uplands Section
212K Western Superior Section
212L Northern Superior Uplands Section
212M Northern Minnesota & Ontario Section
212N Northern Minnesota Drift & Lake Plains Section

Warm Continental Regime Mountains

Adirondack-New England Mixed Forest-Coniferous Forest-Alpine Meadow Province

M212A White Mountains Section
M212B New England Piedmont Section
M212C Green, Taconic, Berkshire Mountains Section
M212D Adirondack Highlands Section
M212E Catskill Mountains Section

Hot Continental Division

Eastern Broadleaf Forest (Oceanic) Province

221A Lower New England Section
221B Hudson Valley Section
221C Upper Atlantic Coastal Plain Section
221D Northern Appalacian Piedmont Section
221E Southern Unglaciated Allegheny Plateau Section
221F Western Glaciated Allegheny Plateau Section
221H Northern Cumberland Plateau Section
221I Southern Cumberland Mountains Section
221J Central Ridge and Valley Section

Eastern Broadleaf Forest (Continental) Province

222A Ozark Highlands Section
222C Upper Gulf Coastal Plain Section
222D Interior Low Plateau, Shawnee Hills Section
222E Interior Low Plateau, Highland Rim Section
222F Interior Low Plateau, Bluegrass Section
222G Central Till Plains, Oak-Hickory Section
222H Central Till Plains, Beech-Maple Section
222I Erie and Ontario Lake Plain Section
222J South Central Great Lakes Section
222K Southwestern Great Lakes Morainal Section
222L North Central U.S. Driftless and Escarpment Section
222M Minnesota & NE Iowa Morainal, Oak Savannah Section
222N Lake Agassiz, Aspen Parklands Section

Hot Continental Regime Mountains

Central Appalachian Broadleaf Forest-Coniferous Forest-Meadow Province

M221A Northern Ridge & Valley Section
M221B Allegheny Mountains Section
M221C Northern Cumberland Mountains Section
M221D Blue Ridge Mountains Section

Ozark Broadleaf Forest - Meadow Province

M222A Boston Mountains Section

Subtropical Division

Southeastern Mixed Forest Province

231A Southern Appalachian Piedmont Section
231B Coastal Plains, Middle Section
231C Southern Cumberland Plateau Section
231D Southern Ridge and Valley Section
231E Mid Coastal Plains, Western Section
231F Eastern Gulf Prairies and Marshes Section
231G Arkansas Valley Section

Outer Coastal Plain Mixed Forest Province

232A Middle Atlantic Coastal Plain Section
232B Coastal Plains and Flatwoods, Lower Section
232C Atlantic Coastal Flatlands Section
232D Florida Coastal Lowlands (Western) Section
232E Louisiana Coast Prairies and Marshes Section
232F Coastal Plains and Flatwoods, Western Gulf Section
232G Florida Coastal Lowlands (Eastern) Section

Lower Mississippi Riverine Forest Province

234A Mississippi Alluvial Basin Section

Subtropical Regime Mountains

Ouachita Mixed Forest - Meadow Province

M231A Ouachita Mountains Section

Prairie Division

Prairie Parkland (Temperate) Province

251A Red River Valley Section
251B North-Central Glaciated Plains Section
251C Central Dissected Till Plains Section
251D Central Loess Plains Section
251E Osage Plains Section
251F Flint Hills Section
251G Central Loess Plains Section

Prairie Parkland (Subtropical) Province

255A Cross Timbers and Prairie Section
255B Blackland Prairies Section
255C Oak Woods and Prairies Section
255D Central Gulf Prairies and Marshes Section

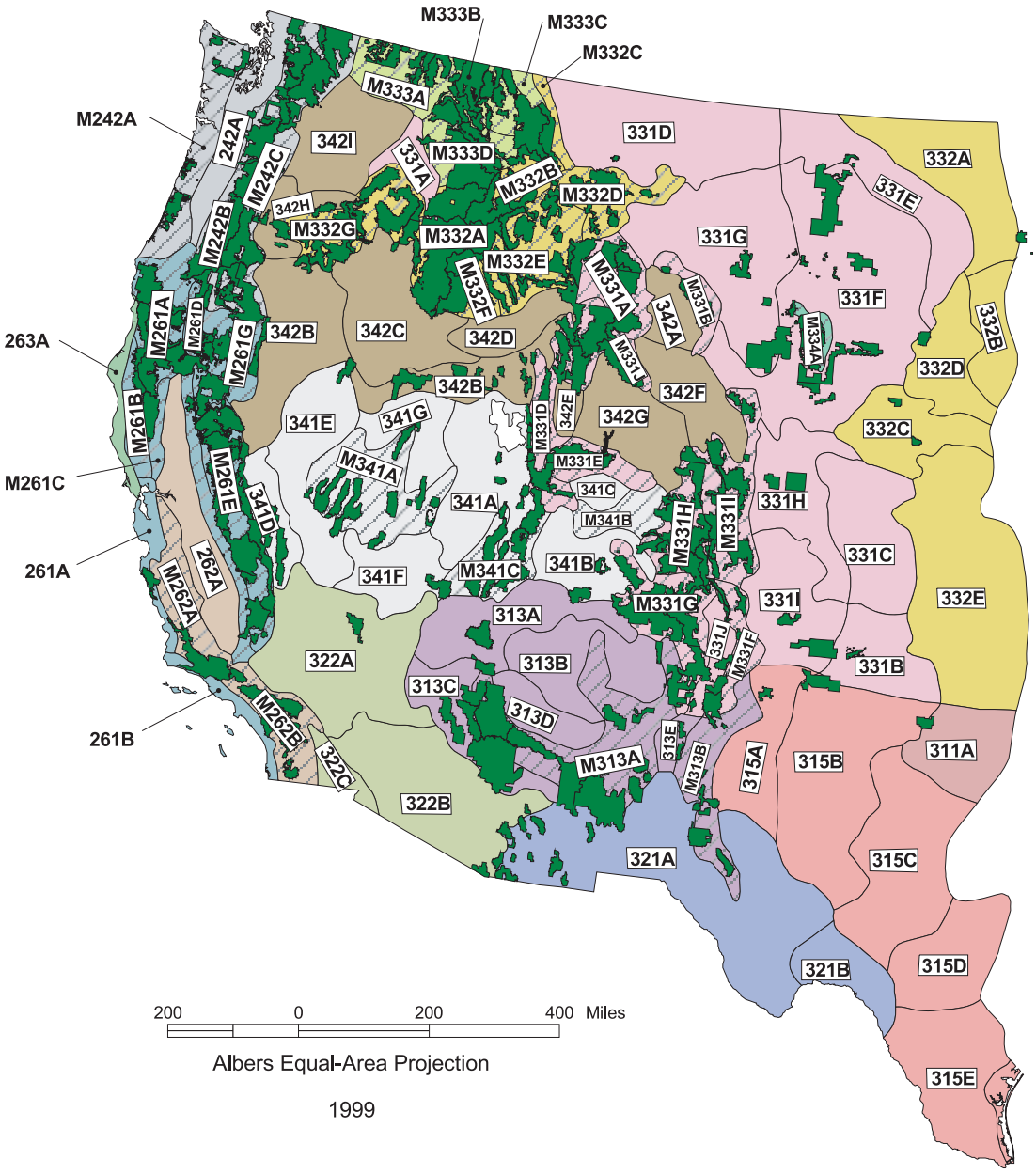
HUMID TROPICAL DOMAIN

Savanna Division

Everglades Province

411A Everglades Section

Locations of U.S. National Forests and Grasslands in Relation to Ecological Subregions of the United States - (West)



Maps compiled by Chris Chandler, San Bernardino National Forest, 1999

Locations of U.S. National Forests and Grasslands in Relation to Ecological Subregions of the United States - (West)

National Forests and Grasslands

HUMID TEMPERATE DOMAIN

Marine Division

Pacific Lowland Mixed Forest Province
- 242A Willamette Valley and Puget Trough Section

Marine Regime Mountains

Cascade Mixed Forest-Coniferous Forest-Alpine Meadow Province
- M242A Oregon and Washington Coast Ranges Section
- M242B Western Cascades Section
- M242C Eastern Cascades Section

Mediterranean Division

California Coastal Chapparral Forest and Shrub Province
- 261A Central California Coast Section
- 261B Southern California Coast Section

California Dry Steppe Province
- 262A Great Valley Section

California Coastal Steppe-Mixed Forest-Coniferous Forest-Alpine Meadow Province
- 263A Northern California Coast Section

Mediterranean Regime Mountains

Sierran Steppe-Mixed Forest-Coniferous Forest-Alpine Meadow Province
- M261A Klamath Mountains Section
- M261B Northern California Coast Ranges Section
- M261C Northern California Interior Coast Ranges Section
- M261D Southern Cascades Section
- M261E Sierra Nevada Section
- M261F Sierra Nevada Foothills Section
- M261G Modoc Plateau Section

California Coastal Range Open Woodland-Shrub-Coniferous Forest-Meadow Province
- M262A Central California Coast Ranges Section
- M262B Southern California Mountains and Valleys Section

DRY DOMAIN

Tropical/Subtropical Steppe Division

Great Plains Steppe and Shrub Province
- 311A Redbed Plains Section

Colorado Plateau Semi-Desert Province
- 313A Grand Canyon Lands Section
- 313B Navajo Canyonlands Section
- 313C Tonto Transition Section
- 313D Painted Desert Section
- 313E Northern Rio Grande Intermontane Section

Southwest Plateau and Plains Dry Steppe and Shrub Province
- 315A Pecos Valley Section
- 315B Texas High Plains Section
- 315C Rolling Plains Section
- 315D Edwards Plateau Section
- 315E Rio Grande Plain Section
- 315F Southern Gulf Prairies and Marshes Section

Tropical/Subtropical Regime Mountains

Arizona-New Mexico Mountains Semi-Desert-Open Woodland-Coniferous Forest-Alpine Meadow Province
- M313A White Mountain-San Francisco Peaks Section
- M313B Sacramento-Monzano Mountain Section

Tropical/Subtropical Desert Division

Chihuahuan Semi-Desert Province
- 321A Basin and Range Section
- 321B Stockton Plateau Section

American Semi-Desert and Desert Province
- 322A Mojave Desert Section
- 322B Sonoran Desert Section
- 322C Colorado Desert Section

Temperate Steppe Division

Great Plains-Palouse Dry Steppe Province
- 331A Palouse Prairie Section
- 331B Southern High Plains Section
- 331C Central High Tablelands Section
- 331D Northwestern Glaciated Plains Section
- 331E Northern Glaciated Plains Section
- 331F Northwestern Great Plains Section
- 331G Powder River Basin Section
- 331H Central High Plains Section
- 331I Arkansas Tablelands Section
- 331J Northern Rio Grande Basin Section

Great Plains Steppe Province
- 332A Northeastern Glaciated Plains Section
- 332B Western Glaciated Plains Section
- 332C Nebraska Sand Hills Section
- 332D North-Central Great Plains Section
- 332E South-Central Great Plains Section

Temperate Steppe Regime Mountains

Southern Rocky Mountain Steppe-Open Woodland-Coniferous Forest-Alpine Meadow Province
- M331A Yellowstone Highlands Section
- M331B Bighorn Mountains Section
- M331D Overthrust Mountains Section
- M331E Unita Mountains Section
- M331F Southern Parks and Rocky Mountain Ranges Section
- M331G South-Central Highlands Section
- M331H North-Central Highlands and Rocky Mountain Section
- M331I Northern Parks and Ranges Section
- M331J Wind River Mountain Section

Middle Rocky Mountain Steppe-Coniferous Forest-Alpine Meadow Province
- M332A Idaho Batholith Section
- M332B Bitterroot Valley Section
- M332C Rocky Mountain Front Section
- M332D Belt Mountain Section
- M332E Beaverhead Mountain Section
- M332F Challis Volcanic Section
- M332G Blue Mountains Section

Northern Rocky Mountain Forest-Steppe-Coniferous Forest-Alpine Meadow Province
- M333A Okanogan Highlands Section
- M333B Flathead Valley Section
- M333C Northern Rockies Section
- M333D Bitterroot Mountains Section

Black Hills Coniferous Forest Province
- M334A Black Hills Section

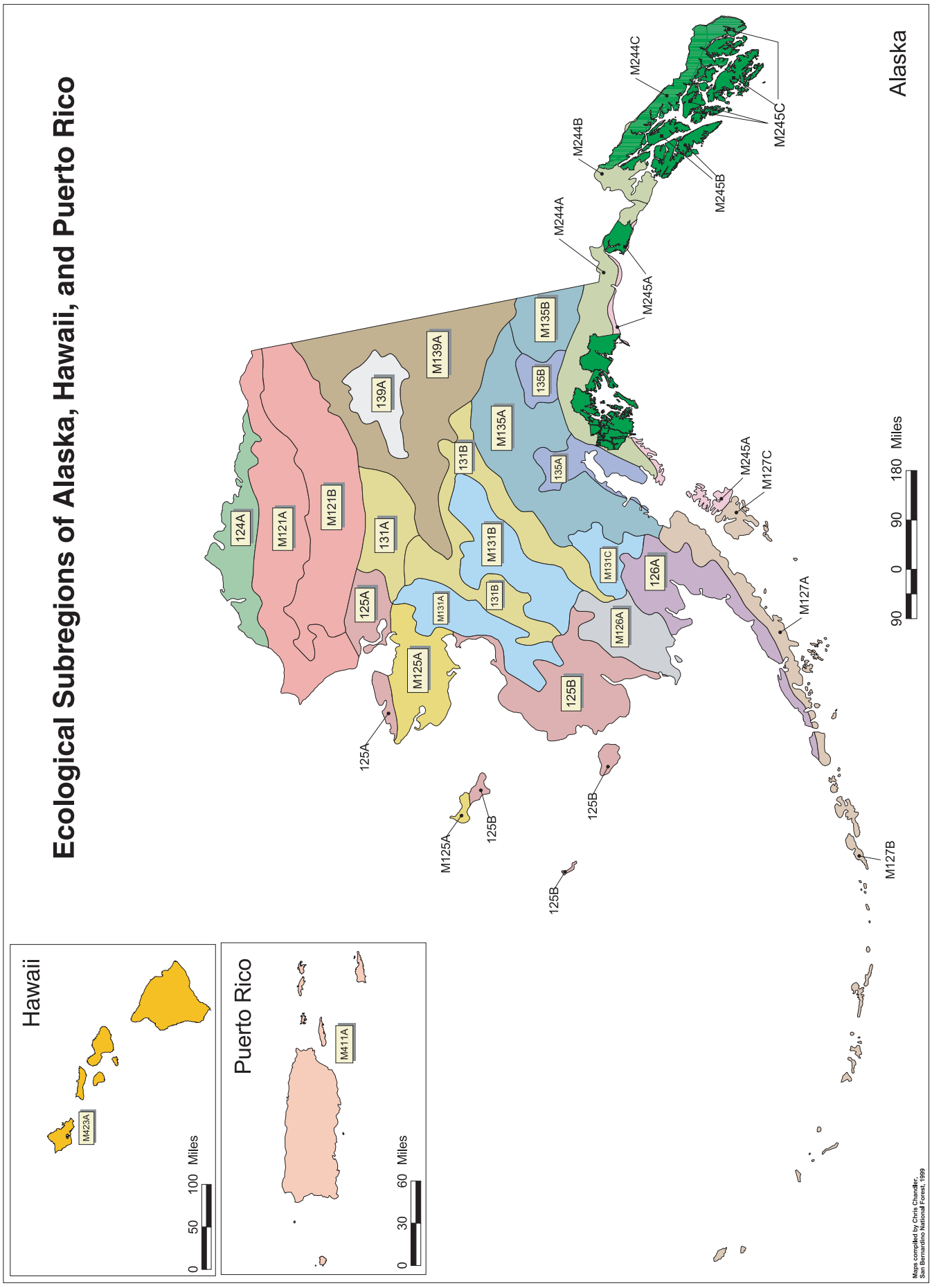
Temperate Desert Division

Intermountain Semi-Desert and Desert Province
- 341A Bonneville Basin Section
- 341B Northern Canyon Lands Section
- 341C Unita Basin Section
- 341D Mono Section
- 341E Lahontan Basin Section
- 341F Southeastern Great Basin Section
- 341G Northeastern Great Basin Section

Intermountain Semi-Desert Province
- 342A Bighorn Basin Section
- 342B Northwestern Basin and Range Section
- 342C Owyhee Uplands Section
- 342D Snake River Basalts Section
- 342E Bear Lake Section
- 342F Central Basin and Hills Section
- 342G Greater Green River Basin Section
- 342H High Lava Plains Section
- 342I Columbia Basin Section

Temperate Desert Regime Mountains

Nevada-Utah Mountains-Semi-Desert-Coniferous Forest-Alpine Meadow Province
- M341A Central Great Basin Mountains Section
- M341B Tavaputs Plateau Section
- M341C Utah High Plateaus and Mountains Section


Ecological Subregions of Alaska, Hawaii, and Puerto Rico
Alaska
Hawaii
M423A
0 50 100 Miles
Puerto Rico
M411A
0 30 60 Miles
124A
M121A
M121B
125A
131A
139A
M139A
M125A
131B
M131A
M131B
135B
M135B
135A
M135A
M131C
126A
M126A
125B
M244A
M244B
M244C
M245A
M245B
M245C
M127A
M127B
M245A
M127C
90 0 90 180 Miles
Maps compiled by Chris Chandler,
San Bernardino National Forest, 1999

Ecological Subregions of Alaska, Hawaii, and Puerto Rico


National Forest and Grasslands

POLAR DOMAIN

Tundra Division


Arctic Tundra Province

124A Coastal Plain Section


Bering Tundra (Northern) Province

125A Kotzbue Sound Lowlands Section

125B Yukon-Kuskokwim Delta Section


Bering Tundra (Southern) Province

126A Bristol Bay Lowlands Section

Tundra Regime Mountains


Brooks Range Tundra-Polar Desert Province

M121A Foothills Section

M121B Mountains Section


Seward Peninsula Tundra-Meadow Province

M125A Seward Mountains Section


Ahklun Mountains Tundra-Meadow Province

M126A Ahklun Mountains Section


Aleutian Oceanic Meadow-Heath Province

M127A Alaska Peninsula Section

M127B Aleutian Islands Section

M127C West Kodiak Island Section

Subarctic Division


Yukon Intermontane Plateaus Tayga Province

131A Upper Kobuk Valley Section

131B Yukon-Koskokwim Bottoms Section


Coastal Trough Humid Tayga Province

135A Cook Inlet Lowlands Section

135B Cooper River Basin Section


Upper Yukon Tayga Province

139A Upper Yukon Flats Section

Subarctic Regime Mountains


Yukon Intermontane Plateaus Tayga-Meadow Province

M131A Nulato Hills Section

M131B Koskokwim Mountains Section

M131C Nushagak-Lime Hills Section


Alaska Range Humid Tayga-Tundra-Meadow Province

M135A Alaska Mountains Section

M135B Wrangell Mountains Section


Upper Yukon Tayga-Meadow Province

M139A Upper Yukon Highlands Section

HUMID TEMPERATE DOMAIN

Marine Regime Mountains


Pacific Coastal Mountains Forest-Meadow Province

M244A Chugach-St. Elias Mountains Section

M244B Lynn Canal Section

M244C Boundary Range Section


Pacific Gulf Coastal Forest-Meadow Province

M245A Northern Gulf Section

M245B Northern Alexander Archipelago Section

M245C Southern Alexander Archipelago Section

HUMID TROPICAL DOMAIN

Savanna Regime Mountains


Puerto Rico Province

M411A Dry-Humid Mountains Section

Rainforest Regime Mountains


Hawaiian Islands Province

M423A Hawaiian Islands Section

APPENDIX E

Plants for Soil Bioengineering and Associated Systems

The following is from the NRCS "Engineering Field Handbook," Chapter 16, Appendix 16B. The charts give a good idea of the native plants that are indigenous to specific areas and their rooting and growth characteristics.

Region numbers are explained on page 182.

Woody plants for soil bioengineering and associated systems

Scientific name	Common name	Region occurence	Commercial availability	Plant type	Root type	Rooting ability from cutting
Acer circinatum	vine maple	9,0	yes, but in limited quantities	shrub to small tree	fibrous, rooting at nodes	fair to good
Acer glabrum	dwarf maple	4,5,7,8,9,0,A	yes	small tree		poor
Acer negundo	boxelder	1,2,3,4,5,6, 7,8,9,0	yes	small to medium tree	fibrous, moderately deep, spreading, suckering	poor
Acer rubrum	red maple	1,2,3,6	yes	medium tree	shallow	poor
Acer saccharinum	silver maple	1,2,3,4,5,6,8	yes	medium tree	shallow, fibrous	poor
Alnus pacifica	pacific alder			tree		poor
Alnus rubra	red alder	9,0,A	yes	medium tree	shallow, spreading, suckering	poor to fair
Alnus serrulata	smooth alder	1,2,3,5,6	yes	large shrub	shallow, spreading	poor
Alnus viridis ssp.sinuata	sitka alder	9,0,A	yes, but very limited quantities	shrub to small tree	shallow	poor
Amelanchier alnifolia var cusickii	cusick's serviceberry	9	yes	shrub		poor
Amelanchier utahensis	utah serviceberry	9		small to large shrub		
Amorpha fruitcosa	false indigo	1,2,3,4,5,6,7,8,0	yes	shrub		poor
Aronia arbutifolia	red chokeberry	1,2,3,6	yes	shrub		poor
Asimina triloba	pawpaw	1,2,3,5,6	yes	small tree	tap and root suckers	poor to fair
Baccharis glutinosa	seepwillow	6,7,8,0	yes	medium shrub	deep & wide-spreading, fibrous	good
Baccharis halimifolia	eastern baccharis	1,2,6	yes	medium shrub	fibrous	good
Baccharis pilularis	coyotebush	9,0		medium evergreen shrub	fibrous	good
Baccharis salicifolia	water wally	6,7,8,0		medium evergreen shrub	fibrous, deep, wide-spreading	good
Baccharis viminea	mulefat baccharis	6,7,8,0		medium evergreen shrub	fibrous	good

Growth rate	Establishment speed	Spread potential	Plant materials type	Notes
slow	slow	good	plants	Branches often touch & root at ground level. Often occurs with conifer overstory. Occurs British Columbia to CA.
			plants	Usually dioecious, grows in poor soils.
fast	fast	fair	plants, rooted cuttings	Use in sun & part shade. Survived deep flooding for one season in Pacific NW.
fast when young	medium	good	plants	Not tolerant of high pH sites. Occurs on and prefers sites with a high water table and/or an annual flooding event.
fast when young	medium	fair	plants	Plants occur mostly east of the 95th parallel. Survived 2 years of flooding in MS.
most alders are fast			plants	A species for forested wetland sites in the Pacific northwest. Plant on 10- to 12-foot spacing.
fast	fast	good	plants	Usually grows west of the Cascade Mtns, within 125 miles of the ocean & below 2,400 feet elevation. A nitrogen source. Short lived species. May be seedable. Susceptible to caterpillars.
slow	medium	fair	plants	Thicket forming. Survived 2 years of flooding in MS. Roots have relation with nitrogen-fixing actinomycetes, susceptible to ice damage, needs full sun.
rapid first year, moderate thereafter	medium	fair to good	plants	A nitrogen source. Occurs AK to CA.
medium	medium	medium	plants	Usually seed propagated. Occurs in eastern WA, northern ID, & eastern OR. A different variety is Pacific serviceberry A. alnifolia var semiintegrifolia. Host to several insect & disease pests.
			plants	Occurs in southeast OR, south ID, NV, & UT.
medium	fast	poor	plants, seed	Supposedly root suckers. Has been seeded directly on roadside cut and fill sites in MD.
fast	fast		plants, seed	Rhizomatous. May produce fruit in second year.
fast		poor	root cuttings, plants	Does produce thickets where native & can be propagated by layering & root cuttings. Occurs NY to FL & TX.
			plants	Thicket forming.
fair	fast	fair	fascines, cuttings, plants,	Resistant to salt spray; unisexual plants. Occurs MA to FL & TX.
		fair	fascines, stakes, brush mats, layering, cuttings	Pioneer in gullies, many forms prostrate & spread ing. May be seedable. Colony-forming to 1 foot high in CA coastal bluffs.
		fair	fascines, brush mats, stakes, layering, cuttings	Was B. glutinosa. Thicket forming, unisexual plants.
			fascines, stakes, brush mats, layering, cuttings	May be B. salicifolia.

Scientific name	Common name	Region occurence	Commercial availability	Plant type	Root type	Rooting ability from cutting
Betula nigra	river birch	1,2,3,5,6	yes	medium to large tree		poor
Betula occidentalis	water birch	4,5,7,8,9,0,A	yes	medium tree	fibrous, spreading	
Betula papyrifera	paper birch	1,3,4,5,9,A	yes	medium tree	shallow, fibrous	poor
Betula pumila	low birch	1,3,4,8,9		small to large shrub	fibrous	poor
Carpinis caroliniana	american hornbeam	1,2,3,6	yes, limited sources	small tree		poor
Carya aquatica	water hickory	1,2,3,6	yes	tall tree	tap to shallow lateral	poor
Carya cordiformis	bitternut hickory	1,2,3,5,6	yes	tree	tap & dense laterals	poor
Carya ovata	shagbark hickory	1,2,3,4,5,6	yes	medium tree	tap	poor
Catalpa bignonioides	southern catalpa	1,2,3,5,6,7	yes	tree		poor
Celtis laevigata	sugarberry	1,2,3,5,6,7,9,0	yes	medium tree	relatively shallow	poor
Celtis occidentalis	hackberry	1,2,3,4,5,6,8	yes	medium tree	medium to deep fibrous	poor
Cephalanthus occidentalis	buttonbush	1,2,3,5,6,7,8,0	yes	large shrub		fair to good
Cercis canadensis	redbud	1,2,3,5,6,7,8	yes	small tree	tap	poor
Chilopsis linearis	desert willow	6,7,8,0	yes	shrub	fibrous	
Chionanthus virginicus	fringetree	1,2,3,6	yes	small tree		poor
Clematis ligusticifolia	western clematis	1,2,4,5,6,7,8,9,0	yes	vine	shallow & fibrous	poor
Clethera alnifolia	sweet pepperbush	1,2,6	yes	shrub		poor
Cornus amomum	silky dogwood	1,2,3,4,5,6	yes	small shrub	shallow, fibrous	fair
Cornus drummondii	roughleaf dogwood	1,2,3,4,5,6	yes	large shrub	root suckering, spreading	fair
Cornus florida	flowering dogwood	1,2,3,5,6	yes	small tree	shallow, fibrous	poor
Cornus foemina	stiff dogwood	1,2,3,4,5,6		medium shrub		fair
Cornus racemosa	gray dogwood	1,2,3,4,5,6	yes	medium to small shrub	shallow, fibrous	fair
Cornus rugosa	roundleaf dogwood	1,3		medium to small shrub	shallow, fibrous	fair to good

Growth rate	Establishment speed	Spread potential	Plant materials type	Notes
fast when young	fast	poor	plants	Plants coppice when cut. Survived 1 year of flooding in MS. Hybridizes with B papyrifera.
			plants	Occurs on the Pacific Coast to CO.
fast when young	fast	poor	plants	Not tolerant of more than a few days inundation in a New England trial. Short lived but the most resistant to borers of all birches.
			plants	Occurs Newfoundland to NJ & MN.
slow	slow	poor	plants	Not tolerant of flooding in TN Valley trial. Occurs MD to FL & west to southern IL & east TX. A northern form occurs from New England to NC & west to MN & AR.
slow	fast	poor	plants	A species for forested wetland sites.
slow		poor	plants	Roots & stumps coppice. Not tolerate flooding in a MO trial. Occurs Quebec to FL & LA. Transplants with difficulty.
slow	slow	poor	plants	Hard to transplant. Occurs Quebec to FL & TX.
fair	fair	poor	plants	Occurs in SW GA to LA; naturalized in New England, OH, MI, & TX.
medium	slow	low	plants	Very resistant to witches-broom. Occurs FL, west to TX & southern IN. Also in Mexico. Leaf fall allelopathic.
medium to fast	slow	low	plants	Survived 2 years of flooding in MS. Not tolerate more than a few days inundation in a MO trial. Susceptible to witches-broom. Occurs Quebec to NC & AL.
slow	medium	poor	brush mats, layering plants	Survived 3 years of flooding in MS. Will grow in sun or shade.
slow	slow	poor	plants	Juvenile wood & roots will root.
medium	medium	low	plants	Occurs TX to southern CA & into Mexico. 'Barranco,' 'Hope,' & 'Regal' cultivars were released in New Mexico.
slow		poor	plants	Susceptible to severe browsing & scale. Occurs PA to FL & west to TX.
fast	fast	good	plants	Produces new plants from layering in sandy soils at 7- to 8-inch precip & 1,000-foot elevation.
slow			plants	Has rhizomes; salt tolerant on coastal sites. Occurs ME to FL.
fast	medium	poor	fascines, stakes, brush mats, layering, cuttings, plants	Pith brown, tolerates partial shade. 'Indigo' cultivar was released by MI PMC.
		fair	fascines, stakes, layering, brush mats,	Root suckers too. Pith usually brown. Occurs Saskatchewan to KS & NE, south to MS, LA, & TX.
fair	fair	poor	plants	Hard to transplant as bare root; coppices freely. Not tolerant of flooding in TN Valley trial.
fast			fascines, plants	Formerly C. racemosa. Occurs VA to FL & west to TX. Pith white.
medium		fair	fascines, stakes, brush mats, layering, cuttings, plants	Forms dense thickets. Pith usually brown, tolerates city smoke. Occurs ME & MN to NC & OK.
			fascines, cuttings, plants	Pith white. Use in combination with species with root_abil = good to excellent. Occurs Nova Scotia to VA & ND.

Scientific name	Common name	Region occurence	Commercial availability	Plant type	Root type	Rooting ability from cutting
Cornus sericea ssp sericea	red-osier dogwood	1,3,4,5,7,8,9,0,A	yes	medium shrub	shallow	good
Cornus stricta	swamp dogwood			shrub		poor
Crataegus douglasii	douglas hawthorn	3,8,9,0,A	yes	small tree	tap to fibrous	poor to fair
Crataegus mollis	downy hawthorn	1,2,3,4,5,6	yes	tree	tap	poor to fair
Cyrilla racemiflora	titi	1,2,6,C		small tree		poor
Diospyros virginiana	persimmon	1,2,3,5,6	yes	medium tree	tap	poor
Elaeagnus commutata	silverberry	1,3,4,8,9,A	yes	small tree	shallow, fibrous	poor to fair
Forestiera acuminata	swamp privet	1,2,3,6	yes	large shrub to small tree		fair
Fraxinus caroliniana	carolina ash	1,2,6		large tree	fibrous	poor
Fraxinus latifolia	oregon ash	9,0	yes	medium tree	moderately shallow, fibrous	poor
Fraxinus pennsylvanica	green ash	1,2,3,4,5,6,8,9	yes	medium tree	shallow, fibrous	poor
Gleditsia triacanthos	honeylocust	1,2,3,4,5,6,7,8,9	yes	medium tree	deep & widespread	poor to fair
Hibiscus aculeatus	hibiscus	2,6	yes	shrub		poor
Hibiscus laevis	halberd-leaf marshmallow		yes	shrub		poor
Hibiscus moscheutos	common rose mallow	1,2,3,5,6,7,0	yes	shrub		poor
Hibiscus moscheutos ssp.lasiocarpos	hibiscus		yes	shrub		poor
Holodiscus discolor	oceanspray	9,0	yes, from contract growers.	shrub		poor to fair
Ilex coriacea	sweet gallberry	1,2,6,C	yes	small to large shrub		poor
Ilex decidua	possomhaw	1,2,3,5,6	yes	large shrub to small tree		poor
Ilex glabra	bitter gallberrry	1,2,6	yes	small shrub		poor
Ilex opaca	american holly	1,2,3,6	yes	small tree	tap root & prolific laterals	poor
Ilex verticillata	winterberry	1,2,3,6	yes	small to large shrub		poor
Ilex vomitoria	yaupon	1,2,6	yes	large shrub		poor
Juglans nigra	black walnut	1,2,3,4,5,6	yes	medium tree	tap & deep & widespread laterals	poor

Growth rate	Establishment speed	Spread potential	Plant materials type	Notes
fast	medium	fair	fascines, stakes, brush mats, layering, cuttings, plants	Forms thickets by rootstocks & rooting of branches. Survived 6 years of flooding in MS. Pith white, tolerates partial shade. Formerly C. stolonifera. 'Ruby' cultivar was released by NY PMC.
			plants	May be same as C. foemina.
slow		poor	cuttings, plants	Forms dense thickets on moist sites. Grown from seed or grafted. Occurs British Columbia to CA & MN.
			plants	Occurs Ontario & MN to AL, AR & MS. 'Homestead' cultivar was released by ND PMC.
			plants	Semievergreen, a good honey plant. Occurs VA to FL & on to South America. Prefers organic sites.
slow	fair	poor	plants	Forms dense thickets on dry sites. Stoloniferous & tap rooted. Occurs CT toFL & TX.
fast	fast	fair	plants	Grows well in limestone & alkaline soils.
slow		poor	plants	Thicket forming. Survived 3 years of flooding in MS.
fast	fast		plants	Easily transplanted. Occurs in swamps VA to TX.
fast when young	medium	fair	plants	May be grown from seed but usually grafted. Usually occurs west of the Cascade Mtns.
fast	fast	good	plants	Survived 3 years of flooding in MS. 'Cardan' cultivar was was released by ND PMC.
fast	fast	medium	plants	Survived deep flooding for 100 days 3 consecutive years. Has been used in reg_occ 7,8,9. Native ecotypes have thorns!
			plants	
			plants	Was H. militaris.
			plants	
			plants	
medium to rapid	fast	poor	plants	Often pioneers on burned areas. Occurs from British Columbia to CA to ID. Usually grown from seed or cuttings.
			plants	Evergreen.
slow			plants	Survived 3 years of flooding in MS.
slow			plants	Evergreen, sprouts after fire. Stoloniferous! Occurs eastern US & Canada.
slow	medium	poor	plants	Easy to transplant when young.
slow			plants	Prefers seasonally flooded sites. Plants dioecious.
			plants	Root suckers.
fair	fair	poor	plants	Though drought tolerant, will not grow on poor or dry soil sites. Not tolerate flooding in TN Valley trial.

Scientific name	Common name	Region occurence	Commercial availability	Plant type	Root type	Rooting ability from cutting
Juniperus virginiana	eastern redcedar	1,2,3,4,5,6	yes	large tree	tap & dense fibrous laterals	poor
Leucothoe axillaris	leucothoe	1,2	yes	small to large shrub		poor
Lindera benzoin	spicebush	1,2,3,5,6	yes	shrub		poor
Liquidambar styraciflua	sweetgum	1,2,3,6	yes	large tree	tap to fibrous	poor
Liriodendron tulipifera	tulip poplar	1,2,3,5,6	yes	large tree	deep & widespreading	poor
Lonicera involucrata	black twinberry	3,7,8,9,0,A	yes	small to large shrub	fibrous & shallow	good
Lyonia lucida	fetterbush	1,2		small to large shrub		poor
Magnolia virginiana	sweetbay	1,2,6	yes	small tree		poor
Myrica cerifera	southern waxmyrtle	1,2,6,C	yes	small shrub	fibrous	poor
Nyssa aquatica	swamp tupelo	1,2,3,6	yes	large tree	shallow, fibrous	poor
Nyssa ogeeche	ogeeche lime	2		large shrub to small tree	sparse, fibrous	poor
Nyssa sylvatica	blackgum	1,2,3,6	yes	tall tree	sparse, fibrous, very long, descending	poor
Ostrya virginiana	hophornbeam	1,2,3,4,5,6	yes	small tree		poor
Persea borbonia	redbay	1,2,6	yes	small to large evergreen tree		poor
Philadelphus lewesii	lewis mockorange	9,0	yes	large shrub	fibrous	poor
Physocarpus capitatus	pacific ninebark	8,9,0,A	yes	large shrub	fibrous	good
Physocarpus malvaceus	mallow ninebark	8,9	yes	small shrub	shallow but with rhizomes	fair
Physocarpus opulifolius	common ninebark	1,2,3,4,5,6,8,9	yes	medium shrub	shallow, lateral	fair
Pinus taeda	loblolly pine	1,2,3,6	yes	medium tree	short tap changes to shallow spreading laterals	poor
Planera aquatica	water elm	1,2,3,5,6		small tree		poor
Platanus occidentalis	sycamore	1,2,3,5,6	yes	large tree	fibrous, widespreading	poor
Platanus racemosa	California sycamore	0		tall tree		
Populus angustifolia	narrowleaf cottonwood	4,5,6,7,8,9,0		large tree	shallow	good
Populus balsamifera	balsam poplar	1,2,3,4,5,8,9,0,A	yes	tall tree	deep, fibrous	v good

Growth rate	Establishment speed	Spread potential	Plant materials type	Notes
slow	medium	good	plants	Not tolerate flooding in TN Valley trial.
slow			plants	Evergreen.
slow			plants	Prefers acid soils. Dioecious.
slow		fair	plants	A species for forested wetland sites.
fast	fast		plants	Hard to transplant.
fast	fast	poor to fair	fascines, stakes, cuttings, plants	
			plants	Evergreen.
slow			plants	Occurs in swamps from MA to FL and west to east TX.
medium	slow	slow	plants	Evergreen. Occurs east TX & OK, east to FL & north to NJ.
	slow		plants	Trees from the wild do not transplant well.
slow	medium	poor	plants	Largest fruit of all Nyssa. Vegetative reproduction not noted. Only grows close to perennial wetland sites.
medium	slow	fair	plants	A species for forested wetland sites. Difficult to transplant but plant in sun or shade on 10- to 12-foot spacing.
slow	slow		plants	Difficult to transplant. Tolerated flooding for up to 30 days during 1 growing season.
slow	slow		plants	
fast	medium to fast	medium	plants	Usually grown from seed.
			fascines, brush mats, layering, cuttings, plants	Usually occurs west of the Cascade Mtns.
			cuttings, plants	Propagated by seed or cuttings. Usually occurs east of the Cascade Mtns.
slow	slow	poor	fascines, brush mats, layering, cuttings, plants	Use in combination with other species with rooting ability good to excellent.
fast	fast	poor	plants	
fairly fast			plants	Occurs KY to FL, west to IL & TX.
fast	fast	medium	plants	A species for forested wetland sites. Tolerates city smoke & alkali sites. Plant on 10- to12-foot spacing. Transplants well.
			plants	A species for forested wetlands sites in CA.
			fascines, stakes, poles, brush mates layering, cuttings, plants	Under development in ID for riparian sites.
fast	fast		fascines, stakes, poles, brush mats, layering, cuttings, plants	

Scientific name	Common name	Region occurence	Commercial availability	Plant type	Root type	Rooting ability from cutting
Populus deltoides	eastern cottonwood	1,2,3,4,5,6,7,8,9	yes	tall tree	shallow, fibrous, suckering	v good
Populus fremontii	fremont cottonwood	6,7,8,0		tree	shallow, fibrous	v good
Populus tremuloides	quaking aspen	1,2,3,4,5,7,8,9,0,A	yes	medium tree	shallow, profuse suckers, vigorous underground runners	poor to fair
Populus trichocarpa	black cottonwood	4,7,8,9,0,A	yes	large tree	deep & widespread fibrous	v good
Prunus angustifolia	wild plum	1,2,3,5,6	yes	small shrub suckering	fibrous, spreading,	poor
Prunus virginiana	common chokecherry	1,2,3,4,5,6,7,8,9, 0,A	yes	large shrub	shallow, suckering	poor
Quercus alba	white oak	1,2,3,5,6	yes	large tree	tap to deep, well-developed fibrous	poor
Quercus bicolor	swamp white oak	1,2,3,5,6	yes	medium tree	somewhat shallow	poor
Quercus garryana	oregon white oak	9,0	yes	shrub to large tree	deep tap & well-developed laterals	poor
Quercus laurifolia	swamp laurel oak	1,2,6		tree	tap	poor
Quercus lyrata	overcup oak	1,2,3,6	yes	medium tree	tap deteriorates to dense shallow laterals	poor
Quercus macrocarpa	bur oak	1,2,3,4,5,6,9	yes	large tree	deep tap & well-developed laterals	poor
Quercus michauxii	swamp chestnut oak	1,2,3,6		medium tree	tap & deep laterals	poor
Quercus nigra	water oak	1,2,3,6		medium tree	shallow & spreading	poor
Quercus pagoda	cherrybark oak			tree		poor
Quercus palustris	pin oak	1,2,3,5,6	yes	large tree	well-developed fibrous laterals after taproot disintegrates	poor
Quercus phellos	willow oak	1,2,3,6	yes	medium to large tree	shallow, fibrous	poor
Quercus shumardii	shumard oak	1,2,3,5,6	yes	large tree	shallow	poor
Rhododendron atlanticum	coast azalea	1,2		small shrub		poor
Rhododendron viscosum	swamp azalea	1,2		shrub		poor

Growth rate	Establishment speed	Spread potential	Plant materials type	Notes
fast	fast	poor	fascines, stakes, poles, brush mats, layering, cuttings, root suckers, plants	Short lived. Endures heat & sunny sites. Survived over 1 year of flooding in MS. Hybridizes with several other poplars. Plant roots may be invasive. May be sensitive to aluminum in the soil.
fast			fascines, stakes, poles, brush mats, layering, cuttings, plants	Tolerates saline soils. Dirty tree.
fast	fast	fair	layering, root cuttings plants	Short lived. A pioneer species on sunny sites. Normal propagation is by root cuttings. Not tolerant of more than a few days inundation in a New England trial. Use rooted plant materials.
fast	fast	good	fascines, stakes, poles, brush mats, layering, cuttings, plants	A species for forested wetland sites. Was P. trichophora. Usually grown from cuttings. Under development in ID for riparian sites. Plant on 10- to 12- foot spacing. May be P. balsimifera
medium	fast	good	plants, root cuttings	Thicket forming. 'Rainbow' cultivar released by Knox City, TX, PMC.
medium	medium	fair	plants	A species for forested wetland sites. Has hydrocyanic acid in most parts, especially the seeds. Usually grown from seed. Thicket forming. Plant on 5- to 8-foot spacing. Reportedly poisonous to cattle.
slow	slow	slow	plants	Did not survive more than a few days flooding in a trial in New England. Difficult to transplant larger specimens.
fast	medium	fair	plants	Survived 2 years of flooding in MS.
slow	slow	fair	plants	Usually grows west of the Cascade Mtns, in the Columbia River Gorge to the Dalles & to Yakima, WA. Propagated from seed sown in fall.
fast	fast		plants	Often used as a street tree in the southeast US.
slow	slow	slow	plants	Often worthless as a lumber species.
medium	fast	poor	plants	Survived 2 years of flooding in MS. 'Boomer' cultivar released by TX PMC.
fair	fair	poor	plants	
fast on good sites	slow	poor	plants	Easily transplanted.
			plants	
fast	fast	fair	plants	A species for forested wetland sites. Survived 2 years of flooding in MS. Plant on 10- to 12-foot spacing.
fast	medium	fair	plants	Easily transplanted.
medium	slow	low	plants	
fast		good by stolons	plants	Mat forming from suckers & stolons. Occurs from DE to SC.
slow			plants	Has stoloniferous forms. Occurs from ME to SC. Highly susceptible to insects & diseases.

Scientific name	Common name	Region occurence	Commercial availability	Plant type	Root type	Rooting ability from cutting
Rhus copallina	flameleaf sumac	1,2,3,4,5,6	yes	medium shrub	fibrous, suckering	poor to fair
Rhus glabra	smooth sumac	1,2,3,4,5,6,7,8,9	yes	large shrub	fibrous, suckering	poor to fair
Robinia pseuodoacacia	black locust	1,2,3,4,5,6,7,8,9,0	yes	medium tree	shallow	poor
Rosa gymnocarpa	baldhip rose	9,0		shrub		fair to good
Rosa nutkana	nootka rose	7,8,9,0,A		shrub		fair to good
Rosa palustris	swamp rose	1,2,3,5		small shrub	shallow	good
Rosa virginiana	virginia rose	1,2,3	yes	small shrub	rhizomatous & fibrous	good
Rosa woodsii	woods rose	3,4,5,6,7,8,9,0,A		shrub		fair to good
Rubus allegheniensis	allegheny blackberry	1,2,3,5,6,0		small shrub	fibrous	good
Rubus idaeus ssp. strigosus	red raspberry	1,2,3,4,5,6,7,8,9,A		small shrub	fibrous	good
Rubus spectabilis	salmonberry	9,0,A		small shrub	fibrous	good
Salix X cottetii	dwarf willow	not native	yes	small shrub	shallow	v good
Salix amygdaloides	peachleaf willow	1,2,3,4,5,6,7,8,9	yes	large shrub to small tree	shallow to deep	v good
Salix bebbiana	bebb's willow	1,3,4,5,7,8,9,A		small shrub to large tree	fibrous	
Salix bonplandiana	pussy willow	7	yes	medium shrub to large tree	fibrous	v good
Salix boothii	booth willow	8,9		shrub		
Salix discolor	pussy willow	1,2,3,4,9	yes	large shrub	shallow, fibrous, spreading	v good
Salix drummondiana	drummond's willow	7,8,9,0	yes	shrub		good
Salix eriocephala	erect willow	7,8,9,0	yes	large shrub	fibrous	v good
Salix exigua	coyote willow	1,2,3,4,5,6,7,8,9, 0,A	yes	medium shrub	shallow, suckering, rhizomatous	good
Salix geyeriana	geyer's willow	7,8,9,0		small to large shrub		

Growth rate	Establishment speed	Spread potential	Plant materials type	Notes
fast	fast	fair	root cuttings, root suckers, plants	Thicket forming.
fast	fast	fair to good	root cuttings, root suckers, plants	Thicket forming.
medium to fast	fast	good	root cuttings, plants	Normal propagation is by root cuttings or seed. Not tolerant of flooding in TN Valley trial. Escaped in regions 5,7,8,9,0. Reported toxic to livestock.
			cuttings, plants	A browsed species.
			cuttings, plants	A browsed species.
			fascines, plants	
fair	fast	fair	plants	
			cuttings, plants	A browsed species.
			plants	Normal propagation is by root cuttings.
			plants	Was R. strigosus. Normal propagation is by root cuttings.
			plants	Normal propagation is by root cuttings. Use in combination with other species. Rooting ability is good to excellent.
medium	fast	poor	fascines, stakes, brush mats, layering, cuttings, plants	Not a native species. Plant plants on 2' to 6' spacing. 'Bankers' cultivar released by Kentucky PMC.
fast	fast		fascines, stakes, poles, brush mats, layering, cuttings, plants	Often roots only at callus cut. May be short-lived. Under development in ID for riparian sites. Not tolerant of shade. Hybridized with several other willow species.
			cuttings, plants	Does not form suckers. Usually east of the Cascade Mtns & in ID & MT.
			fascines, stakes, poles, brush mats, layering, cuttings, plants	Eaten by livestock when young.
				Under development in Idaho for riparian sites.
rapid			fascines, stakes, poles, layering, cuttings, plants	Use on sunny to partial shade sites.
			fascines, cuttings, plants	Usually east of the Cascade Mtns. Under development in ID for riparian sites. 'Curlew' cultivar released by WA PMC.
	fast		fascines, stakes, poles, layering, cuttings, plants	A botanic discrepancy in the name, it may be S. ligulifolia! 'Placer' cultivar released by OR PMC.
fast			fascines, stakes, poles, brush mats layering, cuttings, plants	Relished by livestock. Under development in ID for riparian sites. 'Silvar' cultivar released by WA PMC.
			cuttings, plants	Occurs east of the Cascade Mtns at higher elevations. Relished by livestock. Under development in ID for riparian sites.

Scientific name	Common name	Region occurence	Commercial availability	Plant type	Root type	Rooting ability from cutting
Salix gooddingii	goodding willow	6,7,8,0		small shrub to large tree	shallow to deep	good to excel
Salix hookeriana	hooker willow	9,0	yes	large shrub to small tree	fibrous, dense	v good
Salix humilis	prairie willow	1,2,3,4,5,6		medium shrub	fibrous, spreading	good
Salix interior	sandbar willow	1,3,4,5,7,8,9,A	yes	large shrub	shallow to deep	exce
Salix lasiolepis	arroyo willow	6,7,8,9,0	yes	tall shrub to small tree	fibrous	v good
Salix lemmonii	lemmon's willow	8,9,0	yes	medium shrub	fibrous	v good
Salix lucida	shining willow	1,3,4,5,7,8,9,0		medium to tall shrub	fibrous, spreading	v good
Salix lucida ssp. lasiandra	pacific willow	4,7,8,9,0,A	yes	large shrub to small tree	fibrous	v good
Salix lutea	yellow willow	1,4,5,7,8,9,0		medium to tall shrub	fibrous	v good
Salix nigra	black willow	1,2,3,5,6,7,8	yes	small to large tree	dense, shallow, sprouts readily	good to excel
Salix pentandra	laurel willow	not native	yes	large shrub to small tree	fibrous, spreading	good
Salix purpurea	purpleosier willow	1,2,3,5	yes	medium tree	shallow	excel
Salix scouleriana	scouler's willow	4,7,8,9,0,A		large shrub to small tree	shallow	v good

Growth rate	Establishment speed	Spread potential	Plant materials type	Notes
fast	fast		fascines, stakes, poles, brush mats, layering, cuttings, plants	Not tolerate alkaline sites. Some say this is western black willow.
rapid when young, medium thereafter	medium		fascines, stakes, poles, brush mats, layering, cuttings, plants	May have salt tolerance. Can compete well with grasses. 'Clatsop' cultivar was released by OR PMC.
	medium		fascines, stakes, poles, brush mats, layering, cuttings, plants	Thicket forming.
medium	medium	fair	fascines, stakes, poles, brush mats, layering, cuttings, plants	Thicket forming. This species has been changed to S. exigua. Use in combination with species with rooting ability good to excellent.
rapid when young, medium thereafter	medium		fascines, stakes, poles, brush mats, layering, cuttings, plants	Roots only on lower 1/3 of cutting or at callus. 'Rogue' cultivar released by OR PMC.
	fast		fascines, stakes, poles, brush mats, layering, cuttings, plants	Occurs at high elevations, east of the Cascade Mtns. Under development in ID for riparian sites. 'Palouse' cultivar released by WA PMC.
rapid			fascines, stakes, poles, brush mats, layering, cuttings, plants	
medium to slow	medium to slow		fascines, stakes, poles, brush mats, layering, cuttings, plants	A species for forested wetlands sites. There are several subspecies of S. lucida. Under development in ID for riparian sites. Susceptible to several diseases and insects. Plant on to 10- 12-foot spacing. 'Nehalem' cultivar released by OR PMC.
			fascines, stakes, poles, brush mats, layering, cuttings, plants	Usually browsed by livestock. Under development in ID for riparian sites.
fast	fast	good	fascines, stakes, poles, brush mats, layering, cuttings, root cuttings, plants	May be short lived. Survived 3 years of flooding in MS. Needs full sun. Susceptible to several diseases & insects.
fast	medium	poor	fascines, stakes, poles, brush mats, layering, cuttings, plants	From Europe, sparingly escaped in the East. Insects may defoliate it regularly.
fast	fast	poor	fascines, stakes, poles, brush mats, layering, cuttings, plants	Tolerates partial shade. 'Streamco' cultivar released by NY PMC.
fast			fascines, stakes, poles, brush mats, layering, cuttings, plants	Pioneers on burned sites. Occurs on both sides of the Cascade Mtns in low to high elevations. Often roots only at callus.

Scientific name	Common name	Region occurence	Commercial availability	Plant type	Root type	Rooting ability from cutting
Salix sitchensis	sitka willow	9,0,A	yes	very large shrub		v good
Sambucus canadensis	american elder	1,2,3,4,5,6,8,9	yes	medium shrub	fibrous & stoloniferous	good
Sambucus cerulea	blue elderberry	6,7,8,9,0	yes	large shrub	fibrous	poor
Sambucus cerulea ssp. mexicana	mexican elder	6,7,8,0,H		large shrub		good
Sambucus racemosa	red elderberry	1,2,3,4,7,8,9,0,A	yes	medium shrub		good
Sambucus racemosa ssp. pubens	red elder	1,2,3,4,9,A		medium shrub	deep laterals	fair to good
Spiraea alba	meadowsweet spirea	1,2,3,4	yes	short dense tree	dense shallow, lateral	fair to good
Spiraea betulifolia	shinyleaf spirea	1,2,4,9		shrub		
Spiraea douglasii	douglas spirea	2,3,9,0	yes	small dense shrub	fibrous, suckering	good
Spiraea tomentosa	hardhack spirea	1,2,3,5		small shrub	dense, shallow	poor to fair
Styrax japonica	Japanese snowbell	1,2,3,5,6	yes	large shrub		poor
Symphoricarpos albus	snowberry	1,3,4,5,7,8,9,0,A	yes	small shrub, dense colony forming	shallow, fibrous, freely suckering	good
Taxodium distichum	bald cypress	1,2,3,5,6	yes	medium tree	tap with laterals for knees for aeration	poor
Tsuga canadensis	eastern hemlock	1,2,3	yes	large tree	shallow fibrous	poor
Ulmus americana	american elm	1,2,3,4,5,6,8	yes	large tree	tap on dry sites to shallow fibrous on moist sites	poor
Viburnum dentatum	arrowwood	1,2,3,6	yes	medium to tall shrub	shallow, fibrous	good
Viburnum lantanoides	hubblebush viburnam	1,2,3		medium shrub	shallow, fibrous	good
Viburnum lentago	nannyberry	1,2,3,4,5,9	yes	large shrub	shallow	fair to good
Viburnum nudum	swamp haw	1,2,6		large shrub		poor
Viburnum trilobum	american cranberry bush	1,3,4,5,9	yes	medium shrub		poor

Growth rate	Establishment speed	Spread potential	Plant materials type	Notes
rapid when young medium thereafter	medium		fascines, stakes, poles, brush mates layering, cuttings plants	Occurs on both sides of the Cascade Mtns. Vigorous shoots branch freely; lends itself to bioengineering uses; excellent survival in trials. 'Plumas' cultivar released by OR PMC.
fast	fast	poor	fascines, cuttings plants	Softwood cuttings root root easily in spring or summer. Pith white.
v fast	v fast	poor	plants	
			fascines, plants	Was S. mexicana. Evergreen. Softwood cuttings root easily in spring or summer.
medium	slow		fascines, brush mats, layering, cuttings plants	Softwood cuttings root easily in spring or summer. Pith brown. This may be S. callicarpa.
			fascines, plants	Occurs west of the Cascade Mtns, usually within 10 miles of the ocean & on the coastal bays & estuaries. Softwood cuttings root easily in spring or summer. Pith brown. Use in combination with species with rooting ability good to excellent.
	medium		plants	Propagation by leafy softwood cuttings in mid-summer under mist.
			plants	Usually grown from seed. Occurs east of the Cascade Mtns at medium to high elevations.
rapid	fast	excellent	fascines, brush mats, layering, cuttings, division of suckers, plants	Resists fire & prolific sprouter (forms thickets). Propagation by leafy softwood cuttings in midsummer under mist. 'Bashaw' cultivar released by WA PMC.
			plants	Propagation by leafy softwood cuttings in midsummer under mist. A weed in New England pastures. Use rooted materials.
			plants	
rapid	slow	fair	fascines, brush mats, layering, cuttings, plants	Plant in sun to part shade, especially on wet sites.
medium	fast	poor	plants	Plant on 10- to 12-foot spacing. Tolerates upland sites in region 6 with 32" rainfall.
slow	slow	low	plants	
medium	medium	poor	plants	A species for forested wetland sites. Survived near 2 years of flooding in MS. Plant on 10- to 12-foot spacing; tolerates full shade.
fast	slow		layering, cuttings plants	Thicket forming; tolerates city smoke. Use rooted plant materials.
			fascines, stakes, brush mats, layering cuttings, plants	Was V. alnifolium. Thicket forming. Branch tips root at soil.
fast	fast		fascines, cuttings, stakes, plants	Thicket forming; tolerates city smoke. Tolerates full shade. Older branches often root when they touch soil. Use in combination with species with rooting ability good to excellent.
			plants	D. Wymann says it is more adapted to the South than V. cassinoides.
medium	slow		layering, plants	Use rooted plant materials. Fruits are edible.

Woody plants with fair to good or better rooting ability from unrooted cuttings

Scientific name	Common name
Acer circinatum	vine maple
Baccharis glutinosa	seepwillow
Baccharis halimifolia	eastern baccharis
Baccharis pilularis	coyotebush
Baccharis salicifolia	water wally
Baccharis viminea	mulefat baccharis
Cephalanthus occidentalis	buttonbush
Cornus amomum	silky dogwood
Cornus drummondii	roughleaf dogwood
Cornus foemina	stiff dogwood
Cornus racemosa	gray dogwood
Cornus rugosa	roundleaf dogwood
Cornus sericea ssp sericea	red-osier dogwood
Lonicera involucrata	black twinberry
Physocarpus capitatus	pacific ninebark
Physocarpus opulifolius	common ninebark
Populus angustifolia	narrowleaf cottonwood
Populus balsamifera	balsam poplar
Populus deltoides	eastern cottonwood
Populus fremontii	fremont cottonwood
Populus trichocarpa	black cottonwood
Rosa gymnocarpa	baldhip rose
Rosa nutkana	nootka rose
Rosa palustris	swamp rose
Rosa virginiana	virginia rose
Rosa woodsii	woods rose
Rubus allegheniensis	allegheny blackberry
Rubus idaeus ssp.strigosus	red raspberry
Rubus spectabilis	salmonberry
Salix X cottetii	dwarf willow
Salix amygdaloides	peachleaf willow
Salix bonplandiana	pussy willow
Salix discolor	pussy willow
Salix drummondiana	drummond's willow
Salix eriocephala	erect willow
Salix exigua	coyote willow
Salix gooddingii	goodding willow
Salix hookeriana	hooker willow
Salix humilis	prairie willow
Salix interior	sandbar willow
Salix lasiolepis	arroyo willow
Salix lemmonii	lemmon's willow
Salix lucida	shining willow
Salix lucida ssp. lasiandra	pacific willow
Salix lutea	yellow willow
Salix nigra	black willow
Salix pentandra	laural willow
Salix purpurea	purpleosier willow
Salix scouleriana	scouler's willow
Salix sitchensis	sitka willow
Sambucus canadensis	american elder
Sambucus cerulea ssp. mexicana	mexican elder
Sambucus racemosa	red elderberry
Sambucus racemosa ssp. pubens	red elder
Spiraea alba	meadowsweet spirea
Spiraea douglasii	douglas spirea
Symphoricarpos albus	snowberry
Viburnum dentatum	arrowwood
Viburnum lantanoides	hubblebush viburnam
Viburnum lentago	nannyberry

Woody plants with poor to fair rooting ability from unrooted cuttings

Scientific name	Common name
Acer glabrum	dwarf maple
Acer negundo	boxelder
Acer rubrum	red maple
Acer saccharinum	silver maple
Alnus pacifica	pacific alder
Alnus rubra	red alder
Alnus serrulata	smooth alder
Alnus viridis ssp.sinuata	sitka alder
Amelanchier alnifolia var cusickii	cusick's serviceberry
Amorpha fruitcosa	false indigo
Aronia arbutifolia	red chokeberry
Asimina triloba	pawpaw
Betula nigra	river birch
Betula papyrifera	paper birch
Betula pumila	low birch
Carpinis caroliniana	american hornbeam
Carya aquatica	water hickory
Carya cordiformis	bitternut hickory
Carya ovata	shagbark hickory
Catalpa bignonioides	southern catalpa
Celtis laevigata	sugarberry
Celtis occidentalis	hackberry
Cercis canadensis	redbud
Chionanthus virginicus	fringetree
Clematis ligusticifolia	western clematis
Clethera alnifolia	sweet pepperbush
Cornus florida	flowering dogwood
Cornus stricta	swamp dogwood
Crataegus douglasii	douglas' hawthorn
Crataegus mollis	downy hawthorn
Cyrilla racemiflora	titi
Diospyros virginiana	persimmon
Dlaeagnus commutata	silverberry
Forestiera acuminata	swamp privet
Fraxinus caroliniana	carolina ash
Fraxinus latifolia	oregon ash
Fraxinus pennsylvanica	green ash
Gleditsia triacanthos	honeylocust
Hibiscus aculeatus	hibiscus
Hibiscus laevis	halberd-leaf marshmallow
Hibiscus moscheutos	common rose mallow
Hibiscus moscheutos ssp. lasiocarpos	hibiscus
Holodiscus discolor	oceanspray
Ilex coriacea	sweet gallberry
Ilex decidua	possomhaw
Ilex glabra	bitter gallberrry
Ilex opaca	american holly
Ilex verticillata	winterberry
Ilex vomitoria	yaupon
Juglans nigra	black walnut
Juniperus virginiana	eastern redcedar
Leucothoe axillaris	leucothoe
Lindera benzoin	spicebush
Liquidambar styraciflua	sweetgum
Liriodendron tulipifera	tulip poplar
Lyonia lucida	fetterbush
Magnolia virginiana	sweetbay
Myrica cerifera	southern waxmyrtle
Nyssa aquatica	swamp tupelo
Nyssa ogeeche	ogeeche lime
Nyssa sylvatica	blackgum
Ostrya virginiana	hophornbeam
Persea borbonia	redbay
Philadelphus lewesii	lewis mockorange
Physocarpus malvaceus	mallow ninebark
Physocarpus opulifolius	common ninebark
Pinus taeda	loblolly pine
Planera aquatica	water elm
Platanus occidentalis	sycamore
Populus tremuloides	quaking aspen
Prunus angustifolia	wild plum
Prunus virginiana	common chokecherry
Quercus alba	white oak
Quercus bicolor	swamp white oak
Quercus garryana	oregon white oak
Quercus laurifolia	swamp laurel oak
Quercus lyrata	overcup oak
Quercus macrocarpa	bur oak
Quercus michauxii	swamp chestnut oak
Quercus nigra	water oak
Quercus pagoda	cherrybark oak
Quercus palustris	pin oak
Quercus phellos	willow oak
Quercus shumardii	shumard oak
Rhododendron atlanticum	coast azalea
Rhododendron viscosum	swamp azalea
Rhus copallina	flameleaf sumac
Rhus glabra	smooth sumac
Robinia pseuodoacacia	black locust
Sambucus cerulea	blue elderberry
Spiraea tomentosa	hardhack spirea
Styrax americanus	Japanese snowbell
Taxodium distichum	bald cypress
Tsuga canadensis	eastern hemlock
Ulmus americana	american elm
Viburnum nudum	swamp haw
Viburnum trilobum	american cranberrybush

Grasses and forbs useful in conjunction with soil bioengineering and associated systems

Scientific name	Common name	Warm season or non-competitive	Soil preference	pH preference	Drought tolerance	Shade tolerance
Agrostis alba	redtop					
Ammophila breviligulata	American beachgrass		sands	5.5	fair	poor
Andropogon gerardii	big bluestem	yes	loams	6.0	good	poor
Arundo donax	giant reed		sandy	7.0	good	poor
Elymus virginicus	wildrye	yes noncompetitive	loams	6.0	fair	good
Eragrostis trichodes	sand lovegrass	yes	sands	6.0	good	poor
Festuca rubra	red fescue	noncompetitive	loams	6.5	good	good
Hemarthria altissima	limpograss		sandy		poor	poor
Panicum amarulum	coastal panicgrass	yes	sands to loams	5.5	good	poor
Panicum clandestinum	deertongue	yes				
Panicum virgatum	switchgrass	yes	loams to sands	6.0	good	poor
Paspalum vaginatum	seashore paspalum		sandy			poor
Pennisetum purpureum	elephantgrass					poor
Poa pratensis	Kentucky bluegrass		loam	6.5	poor	poor
Schizachyrium scoparium	little bluestem	yes	sands to loams	6.5	good	poor
Sorghastrum nutans	Indiangrass	yes	sands to	6.5	fair	poor

Deposition tolerance	Flood tolerance	Flood season	Min. h_2o	Max. h_2o	Wetland indicator[1]
good			0		1,facu- 2,upl 3,upl*
poor	fair		0		1,fac 2,fac 3,fac- 4,facu 5,fac- 6,facu 7,fac- 8,facu 9facu
	poor		0	1"	1,facu- 2,facw 3,facw 6,fac+ 7,facw 8,facw 0,facw C,ni H,ni
fair	good		0		1,facw-
poor	poor		0		
poor	fair		0		1,facu
poor	good		0	1'	1,facw 2,facw 6,facw
fair	good		0		1,facu- 2,fac 6,facu-
fair	good	all	0		1,fac 2,fac+ 3,fac+ 4,fac 5,fac 6,facw 7,fac+ 8,fac 9,fac+ H,ni
	good		1/2'	1'	2,obl 6,facw* C,ni H,ni
			0	2'	2,facu+ C,ni H,ni
poor	fair		0		1,facu
poor	poor		0		1,facu
poor	poor		0		1,upl

Grasses and forbs useful in conjunction with soil bioengineering and associated systems

Scientific name	Common name	Warm season or non-competitive	Soil preference	pH preference	Drought tolerance	Shade tolerance
Spartina pectinata	prairie cordgrass	yes	sands to loams	6.0	good	fair
Zizaniopsis miliacea	giant cutgrass		loam	4.3-6.0	poor	poor

[1] Wetland indicator terms (from USDI Fish and Wildlife Service's National List of Plant Species That Occur in Wetlands, 1988):
Region code number or letter:

- 1 Northeast (ME, NH, VT, MA, CT, RI, WV, KY, NY, PA, NJ, MD, DE, VA, OH)
- 2 Southeast (NC, SC, GA, FL, TN, AL, MS, LA, AR)
- 3 North Central (MO, IA, MN, MI, WI, IL, IN)
- 4 North Plains (ND, SD, MT (eastern), WY (eastern))
- 5 Central Plains (NE, KS, CO (eastern))
- 6 South Plains (TX, OK)
- 7 Southwest (AZ, NM)
- 8 Intermountain (NV, UT, CO (western))
- 9 Northwest (WA, OR, ID, MT (western), WY (western))
- 0 California (Ca)
- A Alaska (AK)
- C Caribbean (PR, VI, CZ, SQ)
- H Hawaii (HI, AQ, GU, IQ, MQ, TQ, WQ, YQ)

Indicator categories (estimated probability):

- fac Facultative—Equally likely to occur in wetlands or nonwetlands (34-66%).
- facu Facultative upland—Usually occur in nonwetlands (67-99%), but occasionally found in wetlands (1-33%)
- facw Facultative wetland—Usually occur in wetlands (67-99%), but occasionally found in nonwetlands.
- obl Obligate wetland—Occur almost always (99%) under natural conditions in wetlands.
- upl Obligate upland—Occur in wetlands in another region, but occur almost always (99%) under natural conditions in nonwetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the National List.

Frequency of occurrence:

- – (negative sign) indicates less frequently found in wetlands.
- + (positive sign) indicates more frequently found in wetlands.
- * (asterisk) indicates wetlands indicators were derived from limited ecological information.
- ni (no indicator) indicates insufficient information was available to determine an indiator status.

Deposition tolerance	Flood tolerance	Flood season	Min. h_2o	Max. h_2o	Wetland indicator[1]
fair	fair		0	1"	1,obl 2,obl 3,facw+ 4,facw 5,facw 6,facw+ 7,facw 8,obl 9,obl
	good	all	1/2'	2'	1,obl 2,obl 3,obl 6,obl