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13.4.9. Preliminary Considerations for Manipulating Vegetation

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A wide diversity of plants has adapted to the dynamic nature of wetlands. The continually changing floral landscape is shaped by physical or abiotic components that include climate, fire, soil, and water. Water quantity, quality, and chemistry have a dominating influence on wetlands as do factors such as hydroperiod (period when soils are saturated) and hydrological regime. Other factors that may affect the abundance, structure, and species composition of macrophytes or robust emergents are natural grazing, disease, and interspecific plant competition.

Vegetation is important to waterfowl for producing seeds, tubers, and browse; providing nest sites; and serving as substrates for animal foods. For example, the emergent marsh stage with the greatest number and diversity of birds has been called the "hemimarsh." A maximum diversity and number of birds occur when vegetation cover and water interspersion in Type IV (semipermanent marsh) wetlands is at a 50:50 ratio. This wetland condition provides ideal nesting cover for waterbirds, as well as substrates and litter for invertebrate populations.

Emergent wetlands other than glacial marshes also require good interspersion of cover and water to attract waterfowl. Likewise, a diversity of wetland vegetation is much more desirable than a monoculture. As man expanded his activities in North America, the natural events producing mosaics of wetland vegetation were eliminated or altered. As an example, drainage or water diversion to enhance row crop production not only affects the immediate site, but often affects soil moisture conditions on adjacent areas as well.

This change in water availability influences plant species composition. Intensive cultivation for grains and forage, together with other human-related activities (water diversion projects, livestock grazing, and the elimination of natural fires) have modified the physical processes that influence the productivity of wetland systems. Managed areas throughout North America now must provide predictably good wetland habitat, despite modifications to water supplies, flooding regimes, and other physical factors.

Manipulation of wetland vegetation is a commonly employed tool. Although water-level manipulation is the traditional technique for modifing plant communities under intensively managed systems, other options include fire, grazing, and other physical and chemical disturbances. Values of vegetation structure and composition along with general concepts relating to manipulations are discussed.

Desirable or Undesirable?

Traditionally, plants in waterfowl wintering or migration corridors were considered desirable if they produced large amounts of seed for food, whereas on waterfowl breeding grounds cover for nesting, broods, and molting birds was the desired characteristic. The value of plants as food (in the form of tubers and browse) and cover has long been acknowledged. However, recent information indicates plants are vitally important to invertebrates as nutrient sources and substrates. Likewise, structural characteristics of vegetation may provide important habitat components when waterfowl court, molt, or require escape cover. Robust marsh vegetation serves as a nutrient pump within wetlands and can influence water chemistry and primary productivity. All of these functions are integral values of wetlands that are important considerations beyond the provision of seeds for waterfowl.

"Undesirable" plants are not simply "a group of plants whose seeds rarely occur in waterfowl gizzard samples." Rather, plants that quickly shift diverse floral systems toward monocultures, are difficult to reduce in abundance, have minimal values for wetland wildlife, or outcompete plants with greater value should be considered less desirable. When manipulation of undesirable plants is required, it should be timed so that the resultant decomposing vegetation can be used effectively by wetland invertebrates. If reflooding is shallow, these organisms with high protein content are readily available for consumption by waterfowl or shorebirds.

The Need For Disturbance

Vegetation within semipermanent and permanent wetlands can shift rapidly to a monoculture of robust plants. If water regimes remain constant or if muskrat populations are low, these monocultures may rapidly reduce associated waterfowl use. Manipulation of these monocultures by flooding or drying, fire, or chemical means can modify the structure and potentially increase plant and animal diversity. Disturbance tends to destroy monocultures and sets back succession. For instance, moist-soil wetlands that once were dominated by seed-producing annuals (Fig. 1), but have shifted to less desirable perennials after several years, may require mechanical mowing or discing.

"Undesired," especially exotic, plants may also plague managers. Problem plants often differ among regions. For example, purple loosestrife is a hardy perennial that causes management problems in the Northeast and Midwest, whereas American lotus with its elaborate tuber systems is a serious problem for managers in the Southeast and Midwest, where static water regimes occur. Invasions of young woody trees must be controlled in intensively managed marsh sites, because these same small sprouts can only be removed by very expensive bulldozer operations once sapling stages are reached. Problem woody and herbaceous growth forms are compared by region in Table 1.

Vegetation structure can also be modified with machinery to provide good interspersion. Mowing and rototilling have successfully produced the "hemimarsh" conditions under controlled experiments in Canadian prairies. Tracked vehicles are used to open dense stands of plants in Hawaii to improve habitat for endangered waterbirds, and duck-hunting clubs in California mow to create good interspersion for hunting. In summary, manipulation of vegetation may be desired to set back succession and reduce monocultures of robust plants, to diversify monotypic plant communities with undesirable characteristics, to reduce woody invasion in moist-soil areas, and to modify vegetation structure.

Initial Considerations in Development of Managed Wetlands

Careful considerations of potential vegetation problems and identification of anticipated, re-

	Year 1		Year 5		Year 6
Dominant vegetation	water smartweed		black willow		water smartweed
	common barnyardgrass	—*→	aster	—**→	straw-colored flatsedge
	sprangletop		swamp smartweed		common barnyardgrass

* Similar annual water regime/no physical disturbance.
** Physical disturbance (disc).

Figure 1. Successional shift of moist-soil plants.

Table 1. *Comparison of problem woody and herbaceous vegetation by region.*

Vegetation	West	Midwest/Southeast	Northeast
Woody	Salt cedar	Eastern cottonwood	Mountain alder
	Willow	Willow	
	Fremont cottonwood	Silver maple	
Herbaceous	Alkali bulrush	American lotus	Purple loosestrife
	Cattail	Cattail	
		Sesbania	
		Common cocklebur	
		Alligatorweed chafflower	

quired manipulations before construction can reduce management costs on intensively managed sites. Input by knowledgeable managers is essential as engineering plans are developed. Disturbance of unmodified or critical sites by development can negate any benefits of construction. Undoubtedly, any obstruction (such as a levee) will modify the previous hydrological regime. Typically, lands within levee systems become wetter because water is retained longer. Severe damage may be avoided by simply knowing where parking lots, drainage ditches, and roads can be placed. Initial considerations should include climatic, edaphic, and hydrologic information, as well as life history information for dominant flora (Table 2). An understanding of natural flooding regimes on a local scale should be developed in order to emulate natural conditions. Drainage patterns within a watershed indicate proper locations of levees and water-control structures. Improperly placed drainage structures preclude complete dewatering and reduce management options. Soil characteristics and potential to hold water affect seed germination and effectiveness of subsequent flooding. Placement of borrow ditches requires considerations such as costs of pumping water into or away from ditches and whether access to the site with equipment is required regularly. On areas where hunting is allowed, access across deep ditches is essential.

Costs associated with flooding, as well as providing as much area as possible with optimum water depths, make contour levees highly desirable. Optimum water control to enhance manipulation of plants and to promote proper flooding depths for most waterfowl requires levees on con-

Table 2. *A checklist of variables important in the development of management scenarios for wetland habitats critical to vegetation management.*

Management considerations
Climate
Precipitation cycle
Temperature ranges
Length of growing season
Soils
Structure/texture
Fertility
Topography
Residual herbicides
Water control potential
Water supply/source
Levees
Control structures
Pumps
Impoundments in complex
Number
Size
Juxtaposition
Plants
Species composition
Species life history
Structure and maturity
Seedbank
Exotic and problem species
Equipment for manipulations
Access
Repair capabilities
Other land uses
Grazing
Mineral development

tours at intervals of no more than 18 inches. Larger, more permanent levees that can withstand the weight of machinery and have a slope of 4:1 are desirable. On undeveloped areas, smaller levees built with road graders or specially designed equipment such as rice-levee plows offer management potential. These smaller levees, however, are less permanent and are difficult to repair if damage occurs during flooding.

Improvements in previously developed areas should stress fine tuning of water control or relocation of water-control structures. Major renovations may include establishment of contour levees, decreased intervals between levees, or reconfiguration of the area. Individual water control on each management parcel enhances management potential. For example, the addition of a header ditch with appropriate control structures may provide independent control on each management unit. Although initial development costs may be great, the area of high-quality habitat may increase dramatically. Installation of stoplogs that give finer control of water levels may be a minor but important improvement. Because plants readily respond to water level changes of as little as 1 in., the full potential of manipulations can only be met when the structure allows control at this level of precision. A mix of stoplogs of different dimensions, rather than only 4 in. or more in thickness, assures this potential. In dry regions, design of levees, ditches, and other control structures should be developed to make maximum use of available waters and reduce evapotranspiration.

Requirements of Vegetation Management

Manipulation of managed wetland areas often is better described as a learned craft or art, rather than strictly as applied science. Many differences exist among wetlands in different regions, areas, and sites. By recognizing the unique characteristics of their particular management area and of sites within each area, managers may enhance the ecological processes to emulate a more natural dynamic system. Preliminary assessments should include the following considerations:

Location—The site is of prime importance. Saline or alkaline areas have different problems from freshwater systems. Latitude is also important because of length of growing season and types of resources normally required by migrants or residents at that location.

Topography—An understanding of the subtle elevational differences within specific wetland sites is essential for predicting vegetation response. Further, the topography may influence management options such as rate of drawdown or appropriateness of management options (e.g., wet and dry sites for common snipe).

Water levels—A systematic record of water level changes is critical when assessing vegetation response to dewatering and when determining availability of optimum foraging depths (less than 10 inches)for dabbling ducks. A monitoring program should be designed with respect to the flooding source (i.e., rainfall or pumping), or important fluctuations may be overlooked.

Water quality—In some locations water sources should be monitored for the presence of toxic substances to alert managers to potential problems.

Site inspections and monitoring—Vegetation and wildlife responses should be monitored to evaluate site use and to identify manipulations needed to enhance or prevent certain vegetative conditions. Time of day, weather conditions, visibility, disturbance, and time in season are important considerations when observing wildlife use in a specific vegetation zone. Some species (e.g., migrants) may use specific wetland sites for only short periods of time, but these sites may be critical at those times. Monitoring schedules may vary depending on management objectives, but weekly or biweekly inspections or surveys during periods of peak use are more desirable than surveys at longer intervals. Records should be maintained for each unit rather than pooling all information for the area.

Plant identification—Plants must be identified at all stages, including the young seedling stage, to ensure proper timing and type of manipulation. For undesirable plants, effective control requires action at the young seedling stage and before seed maturation. Unfortunately, most taxonomic texts do not include adequate information for identification of seeds or seedlings.

Burrowing animals—Furbearers (such as muskrat and beaver) and other mammals (such as groundhogs) are important components of a dense wetland system, but control of these mammals is essential to maintain levee integrity in some situations.

Rough fish—Carp and some other fish create high turbidity that influences the establishment and growth of submergents. Tilapia cause problems by competing with waterbirds for food and by forming nest bowls that are difficult to drain. Control of such fish is an integral part of effective vegetation management.

Equipment—Equipment availability is essential for well-timed manipulations. Expensive dewatering activities may be wasted if equipment is unavailable or unreliable. Quick repair of equipment is often necessary when suitable conditions for manipulations may be restricted to a few weeks annually. Likewise, ineffective manipulations may occur with the most knowledgeable managers if inexperienced or overly enthusiastic equipment operators manipulate more than is necessary or modify the wrong vegetation.

Timing—Manipulations are most effective if implemented at critical times. Management strategies that are designed for convenience or are conducted routinely may be ineffective because they do not match floral phenology or chronology of wildlife activities. Proper timing of manipulations enhances the potential for maximum production of foods and may increase the use of foods produced. Manipulations to modify vegetation require careful considerations because of costs, structural changes, diverse wildlife requirements, and long-term implications.

Suggested Reading

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Appendix. Common and Scientific Names of Plants and Animals Named in Text.

Plants	
Silver maple	*Acer saccharinum*
Mountain alder or speckled alder	*Alnus incana*
Alligatorweed chafflower	*Alternathera philoxeroides*
Straw-colored flatsedge	*Cyperus strigosus*
Common barnyardgrass	*Echinochloa crusgalli*
Sprangletop	*Leptochloa* spp.
Purple loosestrife	*Lythrum salicaria*
American lotus	*Nelumbo lutea*
Common reed	*Phragmites australis*
Marsh knotwood or water smartweed	*Polygonum coccineum*
Swamp smartweed	*Polygonum hydropiperoides*
Eastern cottonwood	*Populus deltoides*
Fremont cottonwood	*Populus fremontii*
Willow	*Salix* spp.
Black willow	*Salix nigra*
Saltmarsh bulrush or alkali bulrush	*Scirpus robustus*
Sesbania	*Sesbania* spp.
Saltcedar tamarisk or salt cedar	*Tamarix pentandra*
Cattail	*Typha* spp.
Common cocklebur	*Xanthium strumarium*
Birds, mammals, and fish	
Common snipe	*Gallinago gallinago*
Beaver	*Castor canadensis*
Groundhog or woodchuck	*Marmota monax*
Nutria	*Myocastor coypus*
Muskrat	*Ondatra zibethicus*
Common carp	*Cyprinus carpio*
Tilapia	*Tilapia* spp.

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