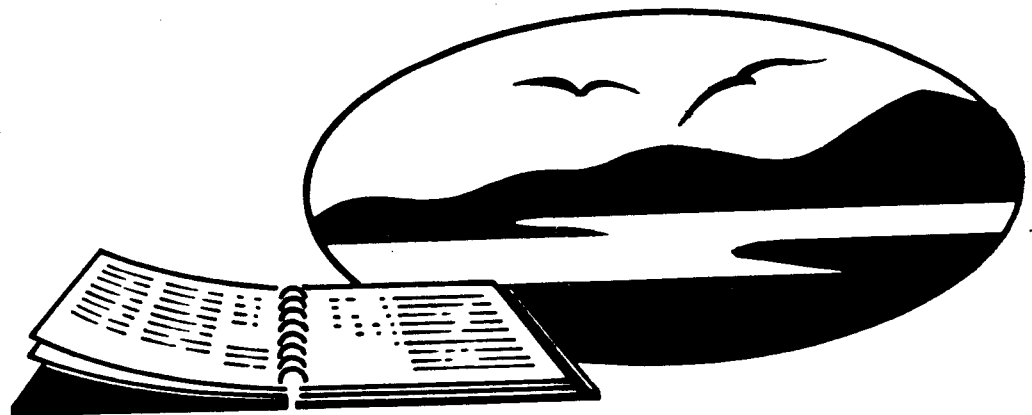




Alternative Uses Of Wetlands Other Than Conventional Farming In Iowa, Kansas, Missouri, And Nebraska



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**ALTERNATIVE USAGES OF WETLANDS OTHER THAN CONVENTIONAL FARMING
IN IOWA, KANSAS, MISSOURI, AND NEBRASKA**

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ALTERNATIVE USAGES OF WETLANDS OTHER THAN CONVENTIONAL FARMING
IN IOWA, KANSAS, MISSOURI, AND NEBRASKA

by

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Prepared for the U.S. Environmental Protection Agency, Region 7,
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ABSTRACT

Conversion of wetlands in Iowa, Kansas, Missouri, and Nebraska into agricultural dry lands in the past several decades has occurred as a means to obtain profit from what landowners would otherwise consider unprofitable land. This activity has resulted in substantial losses of wetlands valued for their unique ability to mitigate flood and storm damage, control erosion, discharge and recharge groundwater, improve water quality, and support a wide diversity of fish, wildlife, and vegetation.

Utilizing fish, wildlife, and vegetation from wetlands for profit is a way for wetland owners to recognize the value their wetlands add to their property. Landowners then have an incentive to preserve rather than convert their wetlands.

The alternative profitable usages of wetlands evaluated in this study are categorized for discussion into forest products, wildlife, native grasses and herbs. Lists were compiled for the wetland plant species that are potentially most useful and profitable. Some of the most marketable species are described in the appendices. Wherever possible, sample prices are included for either the final marketable product or the cost of planting.

Information is also included on the management of wetland areas, marketing strategies, and additional sources of information.

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INTRODUCTION

SUMMARY

The process of assigning economic values to wetland functions helps society to realize their value. Unfortunately, it is difficult, if not impossible, to quantify many of the wetland functions which benefit society, although some general economic values have been attached to such things as flood control and water quality. Furthermore, because most of the remaining wetlands exist on private land, the burden of conserving these areas lies with the landowner, while the public accrues the majority of the benefits. "Benefits which are offered to society at large in the form of waterfowl and fish production, flood control, or antipollution values do not bring measurable return to the individual property holder" (Horowitz, 1978). However, many farmers are realizing the value of maintaining the integrity of their wetlands.

An excellent example of the benefits to private landowners from preserving their wetlands is that of Dayton Hyde, an Oregon rancher. A year after returning a quarter of his land to wetlands, he experienced an increase in beef tonnage of 54 percent, a fact he attributes to the marshes which prevented destructive winter frosts and allowed native grasses to flourish on the nutrient rich area. In addition, birds and coyotes were attracted to the area and managed to keep the grasshopper and rodent populations under control. Finally, his new lake now attracts 5,000 waterbirds each year.

Ray McCormick, another landowner, returned a 19-acre field to a wetland, with assistance from the USDA Conservation Reserve

Program and the U.S. Fish and Wildlife Service. He says, "Wetlands are the most valuable part of my farm. Protection of wetlands is essential for agriculture...for purifying runoff, for recharging groundwater, for wildlife habitat" (Walter, 1990).

By harvesting some of the natural products produced in their wetlands, the benefits can become concentrated upon individual landowners, giving them an incentive to preserve, maintain, and even enhance their wetlands. A large number of harvestable wetland products gives landowners an opportunity to realize the economic potential of their wetlands in their natural state, rather than alter them for conventional farming. Timber, fur-bearers, wildfowl, fish, grasses for grazing, wild rice, landscaping plants, and herbs are among the many resources found in wetlands which can be harvested for profit. Thus, not only could the landowner derive financial benefit from preserving his/her wetland, but society as a whole would continue to derive the benefits from such things as flood control, water quality, and esthetic pleasure.

This paper attempts to explore the feasibility of profiting from such natural wetland products in Iowa, Kansas, Missouri, and Nebraska. It must be added that this is by no means a complete discussion of the alternative uses of wetlands, but merely a preliminary investigation into this area. The paper is divided into chapters, each a category of alternative wetland usages. At the end of each chapter, a list of additional sources of information is provided to assist in further investigation into each

alternative wetland use. Other sources may be available that are not included in the lists. The profitability of a suggested alternative may vary depending on current market conditions, adaptability of the alternative to the site specific wetland conditions, the amount of investment required, the type of management needed, and problems that might arise. It is not the intent of this paper to imply that each of the potential alternative uses of wetlands discussed will be profitable for every landowner, every year. Like conventional farming, or any other business, each landowner must analyze the potential of the alternative to be profitable for his/her own situation. The alternatives presented in this paper are options that have proven profitable to others and have potential for the four-state area. Some alternative usages suggested in this require long-term investments, which also must be taken into consideration.

BACKGROUND

The loss of wetlands throughout the United States in the last few decades has proceeded at an unprecedented rate. Depletion of this valuable resource can be attributed in part to the lack of recognition of wetland values and the emphasis on conventional agricultural products such as corn, milo, and soybeans. These attitudes have been reinforced by past governmental policies which provided subsidies and price supports to landowners who converted their wetlands for agricultural production.

The functions and values of wetlands began to be recognized in the 1970s when efforts were made to conserve these essential ecosystems. By 1982 when the United States Fish and Wildlife

Service conducted its National Wetlands Inventory, only 56% of the original wetlands in the lower 48 states remained. This survey estimated that between the mid-1950's and the mid-1970's, 9 million acres of wetlands were lost, an average annual loss of 458,000 acres. "Agricultural development was responsible for 87% of recent national wetland losses. Urban development and other development caused only 8% and 5% of the losses, respectively" (Tiner, 1984).

The definition of wetlands used by the U.S. Environmental Protection Agency and the U.S. Army Corps of Engineers since the 1970's is as follows:

...those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions.

The classification of wetlands by the U.S. Fish and Wildlife Service also categorizes wetlands into ecological systems. Cowardin, et al. (1979) define a system as "a complex of wetlands and deepwater habitats that share the influence of similar hydrologic, geomorphologic, chemical, or biological factors." The five major ecological systems in this classification of wetlands are marine, estuarine, riverine, lacustrine, and palustrine. The four states covered in this study (Iowa, Kansas, Missouri, and Nebraska) contain riverine, lacustrine and palustrine system wetlands. A riverine system is generally a freshwater river and its stream channels, and is **primarily** a deepwater habitat. The lacustrine system is also a deepwater system but includes "permanently flooded lakes and reservoirs (e.g., Lake Superior),

and intermittent lakes (e.g., playa lakes)" (Cowardin, et al. 1979). Within the lacustrine system is the littoral subsystem, a fringe area extending from the shore of a lake to a depth of two meters below the water which contains emergent, nonpersistent wetland vegetation. These are plants, such as wild rice (Zizania aquatica) and arrowhead (Sagittaria sp.) which fall below the surface of the water at the end of the growing season and so are not seen year round. The palustrine system is the most abundant type of inland wetland. These freshwater wetlands occur most frequently in our area along the margins of lakes, in upland depressions, in seepage areas along slopes, and on river flood plains. They also may be found on islands in lakes or rivers. Many of the wetlands of this type are flooded seasonally and can be dry during other periods.

For a long time the values of these inland, freshwater wetlands were ignored in favor of the estuarine and marine systems, whose values were better known and perhaps more obvious. However, the benefits from freshwater wetlands are great, including socioeconomic, ecological, and wildlife values.

SOCIOECONOMIC VALUES:

These values are the primary focus of this paper. They include such things as flood and storm damage protection, erosion control, water supply, groundwater discharge, groundwater recharge, harvest of natural products, livestock grazing, and recreation. Wetlands are able to temporarily store and release flood waters slowly, decreasing their velocity and desynchronizing flood peaks of tributary streams. This protects the property

and lives of those living downstream from flood damage. The U.S. Water Resources Council reported that in 1975, 107 people died in floods and estimated the property damage at \$3.4 billion. In 1977, the Council estimated that "134 million acres of the coterminous United States have severe flooding problems. Of this, 2.8 million acres are urban land and 92.8 million are agricultural land. Many of these flooded farmlands are wetlands or previously drained wetlands" (Tiner, 1984).

Closely linked with flood control is the ability of wetland vegetation to control erosion. Strips of trees and emergent plants along streams, rivers, and lakes stabilize the banks with their roots and diminish the velocity of flow and wave action, thus decreasing water turbidity and improving water quality.

Thus, wetland benefits are diffusely spread throughout society, so it is difficult to organize landowner support for wetlands. However, when landowners are able to directly benefit or profit from their wetlands, they have an incentive to preserve those areas. Profit can be obtained from these wetlands by marketing the resources that naturally occur there. Profitable products include wetland hay, furbearers, wildfowl, landscaping plants, wildflowers for floral arrangements, and forest products, to name just a few.

ECOLOGICAL VALUES:

Besides providing habitat for many forms of fish and wildlife, wetlands perform essential environmental functions. Because of their location between land and water, they act as sinks for the runoff from land before it reaches the water, and

filters for the nutrients, wastes, pollution, and sediment from flooding waters. These functions improve both water quality and vegetative production. In fact, wetlands perform these functions so efficiently, their frequency of use for treatment of domestic sewage from cities, feedlot waste, water pollution, and nutrient and heavy metal loads from dredged material is increasing (Tiner, 1984).

WILDLIFE VALUES:

Wetlands provide essential habitats for many forms of fish and wildlife. Most freshwater fishes are completely dependent on wetlands for food, spawning and nursery ground (Peters, et al. 1979). Every year thousands of migrating waterfowl depend on wetlands for nesting, feeding, or resting, while other birds spend their entire lives in wetland environments. Many of the most economically important furbearers, such as mink, beaver, muskrat, and raccoon are wetland dependent, and other large mammals, such as deer, occasionally frequent wetlands. Finally, reptiles and amphibians are important residents in wetlands. According to Clark (1979), "nearly all of the approximately 190 species of amphibians in North America are wetland-dependent, at least for breeding" (Tiner, 1984).

The overwhelming evidence, therefore, is that wetlands are worth preserving, not simply as a conservation measure, but as a way to maintain and enhance the integrity of our agricultural system and society.

Chapter I
FOREST PRODUCTS

BACKGROUND

Many of the most profitable timber species naturally occur in wetland habitats. Eighty-two million acres of commercial forested wetland exist in the continental United States, and the standing value of southern wetland forests alone is \$8 billion (R.L. Johnson, 1979). Commercial forest land is defined by the USDA Forest Service as, "Forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization." However, alteration and conversion of these areas, much of it to agricultural fields by channelization or drainage, have reduced the natural plant communities in these wetlands by 70% (Willard et al., 1989), along with their productive potential.

Wetland associated forest products generally are found in riparian ecosystems. However, the term "riparian" is not necessarily restricted to riverine systems, but extends to those areas subjected to periodic flooding, including meadows and pond margins, (Willard et al., 1989). Thus riparian zones are able to protect or buffer water systems from adjacent land-use activities. These zones are most commonly referred to as bottomland hardwoods, flood plain forests, or wetland forests. They are characterized by a combination of high plant and wildlife species diversity, high density, and high productivity. The North Carolina Department of Environment, Health, and Natural Resources (1990) refers to riparian areas as Streamside Management Zones (SMZ) whose width is determined by the average percent slope of

the area adjacent to the stream and the average bank-to-bank width of the stream.

CLASSIFICATION OF WETLAND TREES

The trees which grow in wet areas are, to varying degrees, adapted or tolerant to flooding or inundation. In general, most plants remain unharmed by a limited duration of flooding during their non-growing season. During their growing season, however, periods of inundation can have deleterious effects on their growth, depending on their ability to adapt to the depletion of oxygen in the soil. Anaerobic bacteria thrive under such conditions, producing toxins such as ethylene, manganese and iron. Plants adapt to low oxygen and high toxicity in the soil through both metabolic and anatomical modifications including aerenchyma (air-filled tissue), and lenticels designed to increase the diffusion of oxygen to the tree's roots. Anatomically, there is an increased growth in adventitious and secondary roots which are more "pervious" to oxygen than normal roots. "Experimental research with ethylene, for example, has shown that at high concentrations, there is an increase in adventitious rooting in many plants" (Whitlow and Harris, 1979).

The classification of tree species according to their ability to endure periods of flooding ranges from very tolerant to intolerant. Very tolerant trees can withstand flooding for periods of two or more growing seasons. These species exhibit a marked increase in adventitious rooting during this period. Representatives of this category are black willow and eastern cottonwood. Tolerant species, such as red and silver maples,

sycamore and American elm, can withstand flooding for most of one growing season. Some new root development can be expected during this time. Intermediately tolerant species are able to survive flooding for periods of one to three months during their growing season. The root systems of these plants will produce few new roots or will remain dormant during the flooded period. Tree species in this category include pecan, mulberry, and Shumard oak. Intolerant species are able to survive flooding for only short periods (1 month or less) during their growing season because their root systems die. Shagbark hickory, black walnut and white oak are among the trees in this category (Teskey, 1977).

Another way that wetland plants are classified is by indicator categories (U.S. Fish and Wildlife Service, 1987) which reflect the range of estimated probabilities (expressed as a frequency of occurrence) of a species occurring in a wetland versus a nonwetland. These categories are obligate, facultative wetland, facultative, facultative upland and obligate upland. Obligate wetland (OBL) species occur almost always (approximately 99%) under natural conditions in wetlands. Facultative wetland (FACW) species usually occur in wetlands (67%-99%), but occasionally are found in nonwetlands. Facultative (FAC) means that a species is equally likely to be found in wetlands or nonwetlands (estimated probability 34%-66%). Facultative upland (FACU) plants usually occur in nonwetlands (67%-99%), but they are occasionally found in wetlands (1%-33%), while obligate upland (UPL) plants occur almost always (99%) under natural conditions

in nonwetlands in the region specified (Reed, 1988). Table 1 is a listing of the trees that fall into these categories in the four states being studied, along with the national indicator range of the species.

Table 1: EPA REGION VII REGIONAL WETLAND TREE LIST FOR IA, KS, MO, NE (U.S. Fish and Wildlife Service, 1987)

<u>Common Name</u>	<u>Scientific Name</u>	<u>National Indicator Range*</u>
Alder, Brook-side	<u>Alnus serrulata</u>	FACW+, OBL
Alder, European	<u>Alnus glutinosa</u>	FACW-
Alder, Speckled	<u>Alnus rugosa</u>	FAC, OBL
Arrow-wood	<u>Viburnum dentatum</u>	FAC
Ash, Black	<u>Fraxinus nigra</u>	FACW, FACW+
Ash, Green	<u>Fraxinus pennsylvanica</u>	FAC, FACW
Ash, Pumpkin	<u>Fraxinus profunda</u>	OBL
Ash, White	<u>Fraxinus americana</u>	FACU
Aspen, Big-tooth	<u>Populus grandidentata</u>	FACU-, FACU
Aspen, Quaking	<u>Populus tremula</u>	FACU-, FAC+
Basswood, American	<u>Tilia americana</u>	FACU
Beech	<u>Fagus grandifolia</u>	FAC+
Beech, American	<u>Fagus grandifolia</u>	FACU
Birch, Paper	<u>Betula papyrifera</u>	FACU, FACU+
Birch, River	<u>Betula nigra</u>	FACW, OBL
Birch, Spring	<u>Betula occidentalis</u>	FAC, FACW
Birch, Yellow	<u>Betula alleghaniensis</u>	FACU+, FAC
Black-haw	<u>Viburnum prunifolium</u>	FACU, FACU+
Black-Haw, Rusty	<u>Viburnum rufidulum</u>	UPL, FACU
Bladdernut, American	<u>Staphylea trifolia</u>	FAC
Box-elder	<u>Acer Negundo</u>	FAC, FACW
Buckeye, Ohio	<u>Aesculus glabra</u>	FACU, FAC+
Buckeye, Red	<u>Aesculus pavia</u>	FACU-, FAC+
Buckeye, Texas	<u>Aesculus glabra</u>	FACU-
Buckthorn, Common	<u>Rhamnus cathartica</u>	UPL, FACU
Bumelia, Buckthorn	<u>Bumelia lycioides</u>	FAC, FACW
Bumelia, Gum	<u>Bumelia lanuginosa</u>	FACU, FACU+
Burning-Bush, Eastern	<u>Eunymus atropurpureus</u>	FACU, FAC+
Butternut	<u>Juglans cinerea</u>	FACU-, FACU+
Buttonbush, Common	<u>Cephalanthus occidentalis</u>	OBL
Catalpa, Northern	<u>Catalpa speciosa</u>	FACU, FAC
Catalpa, Southern	<u>Catalpa bignonioides</u>	UPL, FAC-
Cedar, Eastern Red	<u>Juniperus virginiana</u>	FACU-, FACU

Table 1: EPA Region VII Regional Wetland Tree List for IA, KS, MO, NE (continued)

<u>Common Name</u>	<u>Scientific Name</u>	<u>Indicator Range</u>
Cherry, Black	<u>Prunus serotina</u>	FACU
Cherry, Choke	<u>Prunus virginiana</u>	FACU-, FAC
Cherry, Fire	<u>Prunus pensylvanica</u>	FACU-, FAC-
Club, Hercules	<u>Aralia spinosa</u>	FAC, FACW-
Corkwood	<u>Leitneria floridana</u>	OBL
Cottonwood, Eastern	<u>Populus deltoides</u>	FAC, FACW
Cottonwood, Lanceleaf	<u>Populus X acuminata</u>	FAC, FACW
Cottonwood, Narrowleaf	<u>Populus angustifolia</u>	FAC, FACW
Cottonwood, Swamp	<u>Populus heterophylla</u>	FACW+, OBL
Cypress, Bald	<u>Taxodium distichum</u>	OBL
Dogwood, Flowering	<u>Cornus florida</u>	FACU-, FACU
Dogwood, Rough-leaf	<u>Cornus drummondii</u>	FAC
Elm, American	<u>Ulmus americana</u>	FAC, FACW
Elm, Rock	<u>Ulmus Thomasi</u>	UPL, FAC+
Elm, Slippery	<u>Ulmus rubra</u>	FAC
Farkleberry	<u>Vaccinium arboreum</u>	FACU
Fir, Balsam	<u>Abies balsamea</u>	FAC, FACW
Gum, Black	<u>Nyssa sylvatica</u>	FAC
Gum, Sweet	<u>Liquidambar styraciflua</u>	FAC, FACW
Hackberry, Common	<u>Celtis occidentalis</u>	FACU, FAC
Hackberry, Nettleaf	<u>Celtis reticulata</u>	UPL, FACW
Hawthorn, Barberry	<u>Crataegus berberifolia</u>	FACU-, FAC+
Hawthorn, Cockspur	<u>Crataegus crus-galli</u>	FACU, FAC
Hawthorn, Downy	<u>Crataegus mollis</u>	FACU, FACW
Hawthorn, Glossy	<u>Crataegus X nitida</u>	FACU+, OBL
Hawthorn, Green	<u>Crataegus viridis</u>	FAC, FACW
Hawthorn, Little-Hip	<u>Crataegus spathulata</u>	FAC, FACW
Hawthorn, Parlsey	<u>Crataegus marshallii</u>	FACU+, FACW
Hawthorn, Washington	<u>Crataegus phaenopyrum</u>	FAC-, FAC
Hickory, Big Shellbark	<u>Carya laciniosa</u>	FAC, FACW
Hickory, Bitternut	<u>Carya cordiformis</u>	FACU+, FAC
Hickory, Pecan	<u>Carya illinoensis</u>	FACU, FACW
Hickory, Red	<u>Carya ovalis</u>	UPL, FACU
Hickory, Shag-Bark	<u>Carya ovata</u>	FACU-, FACU
Hickory, Sweet Pignut	<u>Carya glabra</u>	FACU-, FACU
Hickory, Water	<u>Carya aquatica</u>	OBL
Holly, American	<u>Ilex opaca</u>	FACU, FAC-
Holly, Deciduous	<u>Ilex decidua</u>	FACW-, FACW
Honey locust	<u>Gleditsia triacanthos</u>	FACU, FAC
Hop-Hornbean, Eastern	<u>Ostrya virginiana</u>	FACU-, FACU
Hornbean, American	<u>Carpinus caroliniana</u>	FAC
Locust, Black	<u>Robinia Pseudoacacia</u>	UPL, FAC
Maple, Drummond Red	<u>Acer rubrum</u>	FACW, OBL
Maple, Mountain	<u>Acer spicatum</u>	FACU-, FACU
Maple, Red	<u>Acer rubrum</u>	FAC
Maple, Rocky Mountain	<u>Acer glabrum</u>	FACU, FAC
Maple, Silver	<u>Acer saccharinum</u>	FAC, FACW
Maple, Sugar	<u>Acer saccharum</u>	UPL, FACU

Table 1: EPA Region VII Regional Wetland Tree List for IA, KS,
MO, NE (continued)

<u>Common Name</u>	<u>Scientific Name</u>	<u>Indicator Range</u>
Mesquite	<u>Prosopis juliflora</u>	UPL, FACU
Mulberry, Red	<u>Morus rubra</u>	FACU, FAC
Mulberry, White	<u>Morus alba</u>	UPL, FAC
Nannyberry	<u>Viburnum lentago</u>	FACU, FAC+
Oak Bur	<u>Quercus macrocarpa</u>	FACU, FAC
Oak, Cherry-Bark	<u>Quercus falcata</u>	FAC+, FACW
Oak, Chinkapin	<u>Quercus muhlenbergii</u>	FAC
Oak, Northern Red	<u>Quercus rubra</u>	FACU-, FACU
Oak, Nuttall	<u>Quercus nuttallii</u>	FACW, OB
Oak, Overcup	<u>Quercus lyrata</u>	OBL
Oak, Pin	<u>Quercus palustris</u>	FAC, FACW
Oak, Post	<u>Quercus stellata</u>	UPL, FACU
Oak, Shingle	<u>Quercus imbricaria</u>	FACU, FAC
Oak, Shumard	<u>Quercus shumardii</u>	FAC, FACW-
Oak, Southern Red	<u>Quercus falcata</u>	FACU-, FACU
Oak, Swamp Chestnut	<u>Quercus michauxii</u>	FACW-, FACW
Oak, Swamp White	<u>Quercus bicolor</u>	FACW+, OBL
Oak, Water	<u>Quercus alba</u>	FACU-, FACU
Oak, Willow	<u>Quercus phellos</u>	FAC+, FACW
Olive, Russian	<u>Elaeagnus angustifolia</u>	FACU-, FACW-
Osage-Orange	<u>Maclura pomifera</u>	UPL, FACU
Pawpaw, Common	<u>Asimina triloba</u>	FACU+, FAC
Pecan, Bitter	<u>Carya X lecontei</u>	OBL
Persimmon, Common	<u>Diospyros virginiana</u>	FACU, FAC
Pine, Ponderosa	<u>Pinus ponderosa</u>	UPL, FACU
Pine, Eastern White	<u>Pinus strobus</u>	FACU
Planer-Tree	<u>Planera aquatica</u>	OBL
Plum, Canada	<u>Prunus nigra</u>	UPL, FACU-
Poplar, Balsam	<u>Populus balsamifera</u>	FACU, FACW
Privet, Swamp	<u>Forestiera acuminata</u>	OBL
Redbud, Eastern	<u>Cercis canadensis</u>	UPL, FACU
Saltcedar	<u>Tamarix ramosissima</u>	FAC, FACW
Sassafras	<u>Sassafras albidum</u>	FACU-, FACU
Serviceberry, Downy	<u>Amelanchier arborea</u>	FACU, FAC
Snowball, American	<u>Styrax americana</u>	FACW-, OBL
Snowball, Big-leaf	<u>Styrax grandifolia</u>	FACU-, FACU
Spicebush, Northern	<u>Lindera benzoin</u>	FACW-, FACW
Sugarberry	<u>Celtis laevigata</u>	UPL, FACW
Sumac, Winged	<u>Rhus copallinum</u>	UPL
Sycamore, American	<u>Platanus occidentalis</u>	FAC, FACW
Tamarisk, Smallflower	<u>Tamarisk parviflora</u>	FAC, FACW
Tree, Tulip	<u>Lipiodendron tulipifera</u>	FACU, FAC
Tree, White Fringe	<u>Chionanthus virginicus</u>	FACU, FAC+
Tree of Heaven	<u>Ailanthus altissima</u>	FACU
Tupelo, Swamp	<u>Nyssa sylvatica</u>	FACW+, OBL
Wafer, Ash	<u>Ptelea trifoliata</u>	UPL, FAC
Walnut, Black	<u>Juglans nigra</u>	FACU
Walnut, River	<u>Juglans microcarpa</u>	FAC-, FAC

Table 1: EPA Region VII Regional Wetland Tree List for IA, KS, MO, NE (continued)

<u>Common Name</u>	<u>Scientific Name</u>	<u>Indicator Range</u>
Water, Locust	<u>Gleditsia aquatica</u>	OBL
Water, Tupelo	<u>Nyssa aquatica</u>	OBL
Willow, Black	<u>Salix nigra</u>	UPL, OBL
Willow, Coastal Plain	<u>Salix caroliniana</u>	FACW+, OBL
Willow, Crack	<u>Salix fragilis</u>	FAC, FAC+
Willow, Peach leaf	<u>Salix amygdaloides</u>	FACW
Willow, Shining	<u>Salix lucida</u>	FACW, FACW+
Willow, Weeping	<u>Salix babylonica</u>	FAC+, FACW
Willow, White	<u>Salix alba</u>	FACW-, FACW
Winterberry, Common	<u>Ilex verticillata</u>	FACW, OBL
Witch-Hazel, American	<u>Hamamelis virginiana</u>	FACU, FAC-
Yucca, Mound-Lily	<u>Yucca gloriosa</u>	FAC

* A positive (+) or negative (-) sign was used with the Facultative Indicator categories to more specifically define the regional frequency of occurrence in wetlands. The positive sign indicates a frequency toward the higher end of the category (more frequently found in wetlands), and a negative sign indicates a frequency toward the lower end of the category (less frequently found in wetlands).

In addition to the adaptability of plants to soil anaerobiosis and toxicity, there are several other factors which can determine each specific plant's ability to survive flooding. Among these factors are substrate composition, shoreline gradient, wave and current action, flood depth and duration, tolerances of individual species, and ecotypic variation within species (Whitlow, 1979).

MANAGEMENT OF WETLAND TIMBER

In some areas, it may be necessary for optimal timber production to control the level and duration of flooding during the growing season with draw-down mechanisms such as small impoundments, gates, and pumps. It must be emphasized, however, that efforts to control floods by construction of dams, channelization, or diking often result in an increase in stresses to the

riparian ecosystem. "Riparian productivity is reduced when normal seasonal flooding is abolished or reduced by dams" (Wray, 1987).

A permit for damming, channelizing, or diking is usually required from the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act, and will have to meet special environmental guidelines. Flooded conditions during the non-growing season, however, are not as stressful to the trees and provide ideal habitat for many wildlife species.

Five flood plain site types occur along rivers and streams. These are depressional swamps, well-drained silt flats, frequently flooded point bars and rapidly forming deposits, stable point bars, and pleistocene terraces. The well-drained silt flats adjacent to streams are the most valuable flood plain areas for timber production due to their high fertility. Wray (1987) recommends management of short rotation, even-aged stands by patch clear-cutting or group selection on an uneven-aged management basis. Patch clear-cutting is a harvest regime in which all trees are eliminated from a small area. Regeneration occurs naturally from seeds of adjacent uncut portions of the stand or from seeds or seedlings remaining on the site. On the other hand, "group selection removes small groups or clumps of trees in stands which have become uneven-aged over time or from prior high grading" (North Carolina Department of Environment, Health and Natural Resources, 1990). It is important that large enough areas are opened in order for reproduction and propagation to occur.

Pleistocene terraces, closer to uplands, can be managed similarly to upland sites because of their stable conditions with rare disturbances by flooding. The soil is usually deep, moist and fertile. These sites are well suited to either recreational use or plantations of high value trees. Patch clear-cutting is recommended to maintain this forest type (Wray, 1987).

The type of forested wetland and its associated plant communities which arise in response to the specific soils, hydrology, and successional state of a given forested wetland determine the ability of the area to support both game and non-game species of wildlife. Because the diversity of wildlife species reflects the diversity of habitats within a forest, "focusing forest management upon a particular plant community will restrict the range of some wildlife species for which suitable habitat could be provided. On the other hand, focusing wildlife management on a particular species can restrict options available for forest management" (North Carolina Department of Environment, Health, and Natural Resources, 1990). Thus, as the intensity of either management practice increases, restriction on the other follows.

However, these two management practices are not necessarily mutually exclusive as long as the affect on wildlife is factored into forest management plans. The bottomland and first terrace forested wetland types provide some of the most important habitat for wildlife and fisheries resources due to their diversity, which is reflected in a wide range of available wildlife species, such as raccoons, opossum, fox, mink, otter, beaver, deer, water-

fowl, many songbirds, and numerous reptiles and amphibians.

"Cyclic patterns of flooding and drying are important for providing fundamental components of aquatic food webs as well as spawning habitat for some fish species and amphibians" (North Carolina Department of Environment, Health, and Natural Resources, 1990).

A harvest regime which maintains a mosaic of young, mature, and old age stands is one forest management technique which preserves wildlife diversity. However, when management requires large harvests and intensive site preparation and planting, the North Carolina Department of Environment, Health and Natural Resources (1990) recommends the reservation of "up to 35 square feet of snags, mast, and dew trees, and the retention of uncut or lightly cut islands or corridors (SMZ) within the harvest area to maintain habitat for reduced populations of preharvest species."

POTENTIAL PROFIT FROM FORESTED WETLANDS

The potential profit from wetlands is great, particularly when considering the amount of land occupied by bottomland forests. For example, bottomland forests of Iowa, which include forested wetlands, occupy 416 thousand acres, or 28% of the state's total forested area. Predominant cottonwood stands, one of the major species of bottomland forest in Iowa, covers 12 thousand acres alone, and ranks first in terms of sawtimber volume. Out of the total hardwood volume of 315 billion board feet, 12% is cottonwood, surpassed only by white oak and red oak. Silver maple, another major bottomland forest species in Iowa, ranks second in sawtimber volume, comprising 10% of the total hardwood volume in the state (Wray and Thomson, 1987). A more

complete listing of the sawtimber and growing-stock volumes of some of the bottomland species in the four-state region is available in Tables 2-5.

Table 2: NET VOLUME OF GROWING STOCK AND SAWTIMBER ON COMMERCIAL LAND BY INDIVIDUAL SPECIES, IOWA, 1974 (Data collected from May 1973 to June 1974) (Spencer et al., 1980)

<u>Species</u>	<u>Growing Stock</u> (million cubic feet)	<u>Sawtimber</u> (million board feet*)
Balsam Fir	0.1	-
Swamp White Oak	4.7	15.6
Bur Oak	77.8	278.4
Silver Maple	109.5	361.7
Green Ash	23.7	79.9
American Elm	58.5	145.9
Black Walnut	31.8	88.3
Eastern Cottonwood	91.7	436.4
Hackberry	15.9	43.2
Black Willow	31.0	82.0
River Birch	12.1	40.4
Boxelder	5.0	7.9

*Note: The volume of trees to be marketed as veneer logs or sawlogs is usually measured in board-feet. One board-foot equals the volume of wood in a 12-inch by 12-inch piece of wood, 1-inch thick.

Table 3: NET VOLUME OF GROWING STOCK AND SAWTIMBER ON COMMERCIAL FOREST LAND BY INDIVIDUAL SPECIES, KANSAS, 1981 (Data collected from October 1980 to July 1981) (Spencer, et al. 1984).

<u>Species</u>	<u>Growing Stock</u> (thousand cubic feet)	<u>Sawtimber</u> (thousand board feet)
Bur Oak	60,920	286,120
Pecan	8,986	28,043
Silver Maple	21,011	87,834
Green Ash	60,059	181,569
American Elm	25,366	59,400
Black Walnut	57,868	169,979
Black Willow	11,629	47,901
Boxelder	10,376	22,839
Hackberry	86,674	299,581
Common Persimmon	1,113	612
River Birch	781	2,278
Eastern Cottonwood	134,292	610,060

Table 4: NET VOLUME OF GROWING STOCK AND SAWTIMBER ON COMMERCIAL FOREST LAND BY INDIVIDUAL SPECIES, MISSOURI, 1972 (Data collected from January 1970 to May 1973) (Spencer, et al. 1976)

<u>Species</u>	<u>Growing Stock</u> (million cubic feet)	<u>Sawtimber</u> (million board feet)
Bur Oak	19.7	60.5
Overcup Oak	5.2	14.1
Swamp Chestnut Oak	3.5	14.2
Swamp White Oak	31.1	82.0
Shomard Oak	7.7	34.9
Pin Oak	58.4	209.9
Water Oak	.3	1.2
Willow Oak	6.6	28.3
Pecan	9.4	30.4
Shellbark Hickory	33.1	76.5
Water Hickory	.3	1.7
Silver Maple	59.8	204.9
Sweetgum	8.0	23.4
Green Ash	44.1	100.3
American Sycamore	125.0	473.4
Eastern Cottonwood	65.3	306.9
River Birch	26.0	66.4
American Elm	60.2	103.4
Boxelder	6.1	20.5
Hackberry	33.5	75.3
Common Persimmon	3.8	1.3
Black Willow	64.0	189.1

Table 5: NET VOLUME OF GROWING STOCK AND SAWTIMBER ON COMMERCIAL FOREST LAND BY INDIVIDUAL SPECIES, NEBRASKA, 1983 (Data collected from April 1982 to March 1983) (Raile, 1986)

<u>Species</u>	<u>Growing Stock</u> (thousand cubic feet)	<u>Sawtimber</u> (thousand board feet)
Bur Oak	36,859	112,770
Shagbark Hickory	2,629	652
American Basswood	5,992	25,795
Silver Maple	5,250	11,301
Slippery Elm	1,802	2,849
Green Ash	25,900	89,308
Black Willow	11,060	31,457
Hackberry	16,516	44,675
Black Walnut	5,131	11,030
Boxelder	5,294	12,823
Eastern Cottonwood	142,218	510,947

The majority of commercial forest land is owned by farmers. Thus, the opportunity for profit is literally in a landowner's back yard. The breakdown of forested area into ownership classes is as follows according to USDA Forest Service Resource Bulletins:

<u>STATE</u>	<u>OWNERSHIP TYPE</u>	<u>PERCENT OWNED</u>
Iowa (1974)	Public:	
	Federal	
	National forest	0%
	Other federal	4%
	State	3%
	County and Municipal	less than 1%
	Private:	
	Farmer	68%
	Forest industry	1%
	Miscellaneous	24%
Kansas (1981)	Public:	
	Miscellaneous federal	3%
	State	1%
	County and Municipal	less than 1%
	Indian	less than 1%
	Private:	
	Farmer	62%
	Miscellaneous private	34%
Missouri (1972)	Public:	
	National forests	11%
	Other	5%
	Private:	
	Farmers	50%
	Miscellaneous	34%
Nebraska (1983)	Public:	
	National forests	6%
	State	4%
	Other	2%
	Private	
	Farmer	71%
	Miscellaneous	17%

Some general prices for a few of the bottomland forest species reveal the value such trees add to wetlands.

IOWA (based on 1990 estimates and the experience of William Ferris, State Foresters Office)

<u>Species</u>	<u>\$/1000 board feet</u>
Silver maple	\$100
Willow	\$40-\$50
Mixed stand (silver maple, cottonwood, hackberry, willow)	\$55-\$65

KANSAS (based on 1990 estimates of Len Gould, Department of Forestry)

<u>Species</u>	<u>\$/1000 board feet</u>
Pecan	\$50-\$180
Cottonwood	\$30- \$50
Green ash	\$80-\$200
Silver maple	\$50-\$100

MISSOURI (based on 1990 estimates of Shelby Jones, Department of Conservation)

<u>Species</u>	<u>\$/1000 board feet</u>
Silver maple	\$30- \$100
Cottonwood	\$20- \$80
Sycamore	\$20- \$80
Black walnut	\$100- \$600
(veneer)	\$250-\$3000
Hickory	\$20- \$100
Ash	\$50- \$250
American elm	\$20- \$100
Hackberry	\$20- \$100

The economic value of standing trees is determined by the price a buyer is willing to pay, which in turn is determined by species, size, and quality. Depending on these primary factors, the wood may be sold for a number of purposes, including veneer logs, sawlogs, pulpwood, fence posts or firewood. According to the 1990 U.S. Industrial Outlook: Prospects for Over 350 Manufacturing and Service Industries (U.S. Department of Commerce, 1990), the values of products have been increasing

in the past several years in the industries of logging, sawmill, hardwood dimension and flooring mills, hardwood veneer and plywood, pulp mills, and paper and paperboard mills.

Potentially the most valuable of the wetland species are black walnut and pecan. Ash, cottonwood, maple, and others typically are of less value. However, these values depend on the quality of the wood, how old the tree is and the primary purpose for which the tree was grown. This explains the wide range of values for the trees listed above. In general, larger diameter trees with greater merchantable height will bring more money than smaller trees of the same species and of similar quality. Buyers prefer straight trees with few defects which include both open and closed wounds, metal hardware, bird pecks, bumps or bulges, twisted bark, curves, overgrown limb knots, and both live and dead limbs.

VENEER:

The U.S. Department of Commerce, Bureau of the Census, reported that, in 1987, the hardwood veneer and plywood industry shipped products worth \$1.8 billion that were primary to the industry.

Veneer lumber is made from the highest quality walnut and oak trees. They must be at least 18 inches d.b.h. (diameter at breast height, which is the diameter of the tree outside the bark at 4 1/2 feet above the ground) but are usually commercially mature at 20-24 inches d.b.h. They must have an eight foot minimum first log and be essentially free of all defects. According to Prestemon et al. (1987), "a recent economic analysis

estimated that a vigorously growing walnut tree with a veneer-quality first log 8 feet long increases in value at a rate of 60% annually between the 15 and 17 inch diameter class; and between the 17 and 21 inch diameter class, the value is still increasing 20% per year. An 8-foot log from a tree with a d.b.h. of 22 inches has twice the volume of a 16 inch tree, and the price per board foot may be two or four times higher".

Veneer wood from walnut and oak is regarded as one of the best for furniture because of its strength, hardness and shock resistance for its weight. Its dark color, besides being attractive, does not require staining. In addition, black walnut has little resistance against a cutting edge, so shavings peel off without leaving marks (Arno, 1986).

Although these trees are the most profitable, they must be carefully managed through pruning, weeding and thinning. It is estimated that a plantation which starts with 450 to 700 trees has an eventual harvest of 100 or fewer. However, there is no reason not to sell the younger thinned trees to other markets for sawlogs or firewood, for example. In addition, black walnut nuts are harvestable both for their meat and for making a stain which can be applied to other, lighter woods.

SAWWOOD:

The next lower level of tree quality is marketable for lumber logs which can range from grade lumber to saw logs, pallet lumber logs, tie logs and fence posts, depending on the quality and desirability of the species. For example, fast-growing hardwoods like cottonwood make excellent rough construction

lumber. "The diameter of cottonwood trees may increase one inch or more per year when proper growing conditions exist. This growth rate equals or exceeds that of softwood species commonly converted into structural lumber" (Funck et al., 1988).

However, the hardness of wood is not related to whether or not it is called a hardwood, as is evidenced by Table 6:

Table 6: COMPARATIVE HARDNESS OF SOME NORTH AMERICAN WOODS

Soft	Moderately Soft	Moderately Hard	Hard	Very Hard
Softwoods	Softwoods	Softwoods	Softwoods	Softwoods
balsam fir various spruce	cedar, western red pine, white	bald cypress hemlock southern yellow pine tamarack and larch	southern yellow pine some Juniper	none
Hardwoods	Hardwoods	Hardwoods	Hardwoods	Hardwoods
basswood buckeye "poplars"	butternut catalpa tulip tree willow	birch cherry chestnut elm black gum hackberry magnolia soft maple sassafras sweet gum sycamore	ash beech holly hard maple mulberry red oaks white oaks walnut, black	hickory locust, black locust, honey Osage orange persimmon

PULPWOOD:

Small, low quality trees are suitable for pulpwood. Pulpwood is usually sold on the basis of weight. The weight of a tree can be estimated using appropriate conversion tables

when the d.b.h. and number of 8-foot lengths in a tree are known. Pulp mill establishments shipped \$3.7 billion of products considered primary to the industry in 1987. These establishments manufacture pulp from wood as well as from other materials such as tags, wastepaper and straw (U.S. Department of Commerce, Bureau of the Census, 1987).

FIREWOOD:

Another market for small trees and branches is firewood. "Although the price paid for standing trees marketed as firewood may be low, processing into cut-to-length, split dry firewood can yield a return higher in some locations than low quality sawlogs" (Prestemon et al., 1987). The standard cord is the traditional measurement of fuelwood. It represents a stack of wood containing 128 cubic feet of wood plus air spaces, assuming that 3 to 8 inch diameter hardwood contains 80 cubic feet. A typical cord contains 4 foot logs in a pile 4 feet high and 8 feet long.

In 1987, the logging industry shipped \$10 billion of products considered primary to that industry. Establishments and products included in the logging industry are fuelwood harvesters, pole cutting contractors, pulpwood contractors engaged in cutting, and manufacturers of wooden posts, fence rails, saw logs and timber. Table 7 is a breakdown of forest products sold in the four-state region according to USDA forest inventories.

Table 7: BREAKDOWN OF FOREST PRODUCTS FOR GROWING STOCK AND SAWTIMBER ON COMMERCIAL LAND, ALL SPECIES
(Spencer et al., 1980), (Spencer et al., 1984),
(Spencer et al., 1976), (Raile, 1986) (*See dates for survey data collection on pages 20 and 21 of this report.)

<u>State</u>	<u>Forest Products</u>	<u>Growing Stock</u>	<u>Sawtimber</u>
<u>Iowa</u> (1974*)		<u>Thousand Cubic Feet</u>	<u>Thousand Board Feet</u>
	Saw logs	7,162	41,176
	Veneer logs and bolts	865	3,921
	Pulpwood	1,609	7,017
	Cooperage logs and bolts	93	562
	Piling	-	-
	Poles	-	-
	Mine timbers	8	10
	Posts	126	373
	Other	222	1,210
	Fuelwood	3,106	7,387
<u>Kansas</u> (1980*)		<u>Thousand Cubic Feet</u>	<u>Thousand Board Feet</u>
	Saw logs	4,340	26,269
	Veneer logs	72	475
	Cooperage logs	40	237
	Fuelwood	7,577	20,895
	Posts	52	114
<u>Missouri</u> (1972*)		<u>Cords</u>	<u>Thousand Board Feet</u>
	Saw logs	609,005	247,615
	Cooperage logs	97,467	46,581
	Veneer logs	8,506	3,136
	Charcoal wood	67,077	7,799
	Pulpwood	20,752	6,998
	Posts	22,001	3,374
	Poles	3,374	462
	Fuelwood	98,492	18,587
	Mine timbers	1,216	114
	Handle bolts	4,594	1,778
	Miscellaneous	11,312	4,871
<u>Nebraska</u> (1983*)		<u>Thousand Cubic Feet</u>	<u>Thousand Board Feet</u>
	Saw logs	2,915	18,551
	Veneer logs	112	518
	Cooperage logs	18	106
	Fuelwood	5,167	14,190
	Posts	79	93
	Pulpwood	12	18
	Other	94	512

An example of the profit to be made from firewood is provided by Dale Green of Castalia, Iowa (Successful Farming, Feb. 1987). Although cutting the firewood to length, splitting, and drying costs him substantial time and effort, he is able to market the material at a favorable price. If the customer picks up the wood, Green charges \$40 per pickup load, or \$20 per ton. If he delivers, the price is \$50 per load for a three quarter ton pickup, or \$25 per ton. If he stacks the wood for the customer, he charges \$5 per hour. He reports a fixed cost for saws, wood splitter, and wedges of \$1,000 and estimates that he makes \$7.50 per hour for labor and equipment.

OTHER INCOME SOURCES FROM FORESTED WETLANDS:

Other ways of deriving income from forested wetlands include selling tree saplings to nurseries, selling nuts from pecan and black walnut trees (markets range from nurseries to organic food stores to road side stands), leasing the land to hunter and other wildlife enthusiasts, and trapping furbearers. Finally, some people are farming their woodlands for shiitake, edible mushrooms, which are planted on thinned hardwoods in the form of a seed culture, called spawn or inoculum. Logs generally fruit one year for each inch of diameter during both spring and fall. Two pounds of mushrooms can be harvested per log. With 300 logs per cord, and shiitake at \$5 per pound, one cord might return \$3000. Offsetting this return are relatively minimal costs of production such as a chain saw, a drill, a hammer to inoculate the spawn, and shiitake spawn itself which can be purchased for about \$160 per cord (Successful Farming, Feb. 1987).

MULTICROPPING:

Multicropping may be the best solution for owners who have limited time and money to invest in intensive forest production. A few combinations which complement one another are growing hay crops with trees, such as black walnut and switchgrass, or pecan and cordgrass. Care must be taken, if machinery is used, not to damage the crop trees. If animals are being grazed, fences may be necessary around the trees to prevent them from being eaten, trampled or scratched. Another combination might be red oaks with cordgrass. The composted mulch from the oaks could be sold to garden supply stores, while the grass provides excellent forage or hay during the summer.

COST-SHARE PROGRAMS:

A further way to offset some of the costs of putting a forested wetland into production is by setting aside the land in the USDA Conservation Reserve Program (CRP) for 10 years. By specifying tree planting in the application, technical and monetary assistance for planting are provided. Black walnut and pecan both qualify for the program. Unfortunately, current regulations allow only a third of the land to be planted in a single species so there is a smaller chance of getting a good crop when the trees mature. However, a CRP participant receives payment during the ten year plan while he/she manages the trees in their early crucial stages of development. When the land comes out of CRP, the pecan nuts will almost be ready for their

first harvest, while commercially harvestable quantities of walnuts will be produced beginning in their twentieth year. The relatively early and annual yields from nut production supplement the returns from timber, resulting in more profit for the landowner. (Kurtz et al., 1984).

Other cost-share programs include the Agricultural Conservation Program (ACP) and the Forestry Incentive Program (FIP). Both programs are administered by the Agricultural Stabilization and Conservation Service (ASCS) with review and approval at the county level. The ACP is a program wherein a landowner applies for financial assistance for installing conservation measures. These measures include terracing, soil erosion control, farm sewage treatment lagoons, grass seeding, and tree planting. Technical assistance for such endeavors is provided by the Soil Conservation Service (SCS). The grasses and trees may be harvested, as long as the conservation measures remain intact. Cost-sharing is currently from 50-75%, up to \$3500 per landowner per year, depending on the county.

The FIP is similar to the ACP except it applies only to forestry management, technical assistance is provided by the state's forestry agency, and cost-sharing is up to 65%, not to exceed \$10,000 per landowner.

Furthermore, many states have their own form of cost-sharing or tax exemption for wetlands. In Iowa, for example, an owner of a forested wetland can apply for tax exemption under their Forest

Reserve Law. To qualify, the forest must be at least two continuous acres and generally no less than 66 feet wide. Each acre must contain at least 200 trees, and no more than one-fifth of the total number of trees in the reservation may be removed in any one year unless the trees are lost due to natural causes. If the number of trees falls below 200, the owner is given one year to restore their numbers to 200 or above per acre.

These financial programs provide an excellent opportunity to use a wetland without having to bear the full financial burden of restoring, seeding, or planting.

CONCLUSION

Although maintenance of forested wetlands is important for timber production and wildlife habitat, these areas provide other far-reaching benefits due to the function of their hydrological systems. Among these may be enhanced groundwater recharge and discharge, filtration and purification of surface waters, temporary storage and reduction of flood waters, and stream bank protection. Thus, the practice of silviculture in wetland forests in which forest crops are tended, harvested and then reforested, realizes the commercial production capabilities of the land without the impact on the ecosystem associated with logging and clearing the trees for conversion of wetlands to other uses. Forested wetlands are compatible with and enhance other wetland functions while adding value to the land, a motivation for some landowners to retain their forested wetlands in a condition that preserves their ability to enjoy the wetland functions and benefits.

ADDITIONAL SOURCES OF INFORMATION ON FOREST PRODUCTS

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"Some Marketing Alternatives for Pecans"
Publication GZ030
New Mexico Agricultural Information Department
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New Mexico State University
Las Cruces, NM 88003

Pecan South/Pecan Quarterly Magazine
Published bimonthly by the Texas Pecan Growers Association
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Chapter II
WILDLIFE VALUES

OVERVIEW

Wetlands comprise some of the most productive natural ecosystems in the world. This is demonstrated by the wide diversity of wildlife sustained by wetland-produced food, cover and nursery ground for part or all of their life cycle. Most freshwater fish feed upon wetland-produced food and use wetlands as nursery grounds, while most of the important recreational fish spawn in wetlands. A variety of waterfowl as well as a large number of songbirds feed, nest, and raise their young in wetlands. Furbearers, such as muskrat, mink and beaver, along with big game mammals, such as black bear and deer, use wetlands for food and shelter. Thus, these areas are ideal for all forms of wildlife recreation (EPA, 1988).

WILDLIFE RECREATION

Outdoor recreation is extremely popular in the United States, and according to the 1985 National Survey of Fishing, Hunting, and Wildlife Associated Recreation (U.S. Department of the Interior Fish and Wildlife Service, 1988), "wildlife-associated recreation was one of this country's most popular forms of outdoor recreation in 1985". Among the 46.4 million persons 16 years of age and older who fished, there were 38.4 million anglers who fished in freshwater other than the Great Lakes. These fishermen accounted for 785.9 million fishing days and \$17.8 billion of fishing expenditures, an average of 20 days and \$463 per fisherman. In addition, 16.7 million hunters over 16 years old spent 334 million days hunting, spending a total of \$10.1 billion on hunting-related expenditures with an average of

20 days in the field and \$603 per hunter in 1985. Among these, there were 5 million migratory bird hunters in 1985. They spent 41.7 million days and \$1.1 billion in pursuit of migratory birds, an average of 8 days and \$216 per hunter.

Along with fishing, hunting and trapping, wildlife recreation includes some nonconsumptive activities such as feeding, photographing and observing wildlife. In 1985, 134.7 million Americans 16 years or older enjoyed these activities, some of whom were also fishermen and hunters, spending over \$14.3 billion, for an average of \$221 per participant.

POTENTIAL VALUE FROM WETLAND WILDLIFE

LEASE-FEE HUNTING:

At the same time that the popularity of outdoor recreation has expanded, the available wetlands, both public and private, have greatly declined. Thus, the remaining wetlands have become an increasingly valuable commodity to wildlife enthusiasts. "Of the North American wildlife species, those occupying wetlands are among the most sought after by sport hunters and provide the greatest monetary return from a commercial harvest. For most sporting or commercial species, wetlands comprise an important part of their habitat in some part of their range" (Chabreck, 1978). Evidence of the concern over the lack of hunting land is provided by a poll conducted by the National Shooting Sports Foundation in 1986 which reported that "hunters rank access to hunting land the number one problem in the sport today" (Basset and Freiling, 1987).

This demand for quality hunting provides landowners with an opportunity for an alternative source of income from their wetland through fee hunting (also called lease hunting) which occurs whenever a landowner allows a hunter access to his/her property in exchange for money or conservation services which benefit landowner and hunter alike. The agreement is sometimes formalized with a signed lease. "If trends continue, hunting land will become an increasingly valuable commodity, especially near urban areas or in locations where public land is scarce" (Basset and Freiling, 1987). In 1985, 736,000 acres of wetlands were leased for migratory bird hunting to 41,000 lessors. A total of \$26,139,000 was spent to lease the land, with each hunter paying an average of \$346 (U.S. Department of the Interior Fish and Wildlife Service, 1989).

This region of the country does not have a well-documented fee hunting record as do the southern and mid-Atlantic states where fee hunting has become a successful tradition. For example, Texas landowners hold about 14,000 leasing licenses and earn \$150 to \$200 million a year in hunting fees. One attribute that this region does share with those states is a small proportion of public lands, indicating the potential for a market in this area. Examples of fees charged in other states are provided in Table 8. Although most of the game species listed are not restricted to wetlands, the fees shown may provide an idea of the range of profits to be made from this activity.

Table 8: Examples of Lease Prices* (Bassett and Freiling, 1987)*

<u>Location</u>	<u>Games Species</u>	<u>Fees</u>	<u>Date</u>
Alabama	Deer, Turkey	\$.50 - \$15/A**	1985
	Dove	\$75 - \$150/A \$150/Day, including meals & lodging	1985
Florida	Deer, Turkey	Range \$.25 - \$7.25/A Average \$1.46/A	1985
	Quail	\$10 - \$15/Day	1985
Georgia	Deer, Small Game	\$2 - \$10/A	1986
	Deer	\$90/Day	1981
	Deer	\$.50 - \$5/A	1981
	Quail	\$100 - \$410/Day	1981, 1986
	Trout	\$45/Day, 4 trout limit	1986
Louisiana	Deer, Small Game	\$1 - \$10/A	1981
	Ducks	\$150 - \$5000/Section, marshland	1981
	Geese	\$7.50 - \$10/A \$75 - \$100/Day	1981
Maryland	Geese	\$7.50 - \$10/A	1981
		\$75 - \$100/Day	
North Carolina	Deer, Quail	\$1.25/A	1986
	Dove	\$5 - \$10/Day	
Tennessee	Ducks	\$100 - \$200/A Wetland	1986
Texas	Deer	\$4 - \$8/A includes services, trophy, animals	1983
	Deer	\$300/2.5 Days	1986

*Prices vary depending on time period of lease whether the lease is short-term (day, weekend, or week), or annual

**A = Acre

Management of Leased Property

The basic type of fee hunting arrangement is a fee for simple access to the land with few or no services provided to the hunter. Addition of hunter services increases the fee one can charge for access. However, larger investments in time and money

are the trade-off. A few of the extra services which could be provided to hunters are:

- blinds, decoys, whistles
- campsites, cabins, trailer hookups
- cleaning and refrigeration of game
- dogs, kennels
- hunting guides
- meals
- organized shoots
- target shooting

In addition, improvements in the wildlife habitat that raise the quality of the hunting, also will increase the value of the hunting land. The quality and diversity of the wildlife on a leased area is the most important factor in determining the success of lease-fee hunting. Thus, it may be more efficient to concentrate management efforts on preventing disturbances and on improving habitats, including food sources and water availability. These can be provided by plantings for food, cover, and nesting sites, fences and water management. Appendix 1, although not exhaustive, describes some plants that will enhance wildlife habitat. Note that the sample prices for seeds, tubers or plants are a one-time investment for most of these plants, because they will grow back year after year. Fencing may be required on ranches where animals will decrease the productivity of the wetland and disturb the wildlife if allowed to graze in those areas.

Finally, some amount of water management may have to be implemented, depending upon the condition of the wetlands. To provide the water conditions conducive for germination and plant growth, most wetlands created or modified for wildlife must be

managed for complete dewatering in order to influence the plant community. Wildlife managers often use water level control structures and a reliable source of water in order to manipulate water depths to control specific plants for nest sites (birds) and food sources (furbearers and birds). Areas that are flooded in the spring and later dewatered create mudflat conditions attractive to migrant shorebirds and ducks, but also allow germination of the seedbanks (Kusler and Kentula, eds. 1989).

It is important that a diversity of plant life is available to support the wide range of wildlife that live in wetlands. For instance, marginal nonpersistent emergents produce large seed crops, deeper water persistent emergents are good for nest sites and provide tubers for herbivores, and submergent plants are a source of food and act as substrate for invertebrates (Kusler, and Kentula, eds. 1989).

Types of Leases

The three standard lease lengths are short-term (day, weekend, or week), seasonal, or annual. Seasonal and annual leases, while providing less potential income per season, involve less day to day work and assure the landowner of a fixed, guaranteed income from hunters with whom they can develop a long-term relationship. Short-term leases, on the other hand, can often charge higher fees although the total income for a season is not guaranteed. They also require more intensive management i.e., "more contact with people, more advertising, and more bookkeeping" (Basset and Freiling, 1987), but the landowner has more flexibility and control over the property and its policies. In many

instances, geographic location influences the type and amount of payment for hunting. Preserves within close proximity to large cities can afford to charge higher prices and pick and choose their members. On the other hand, rural preserves that are not easily accessible from towns or cities may require daily-fee hunts.

Drawing up a written lease has several advantages. It clearly states the expectations of the landowner and the hunter, the details of the operation, and the form of payment. This lowers the likelihood that misunderstandings will occur and may offer some protection against liability should the owner be sued. By drawing up and discussing the lease agreement with prospective clients, it also gives the landowner a chance to evaluate prospective lessors and screen potential problem hunters. Basset and Freiling (1987) explain that the basic elements of the lease should include the following:

- Name of parties-lessee and lessor
- What is leased-access and hunting rights
- Description of tract-size, boundaries, off-limit areas, hazards
- Species to be hunted
- Permitted hunting methods
- Payment-amount or kind and due date
- Length of lease-day, week, month, season or year
- Guest privileges
- Liability statements
- Conditions for subleasing, cancellation, renegotiation, renewal

A popular form of lease arrangement is a contract with a hunting club. Most often the club will either out-right buy a piece of land or lease it from the landowner, in return for which they have the right to then charge their members for its use. In other instances, the landowner receives a portion of the profits

made by the club. The benefit of this system is that the owner does not have to advertise or screen clients and often the club maintains or enhances the wildlife habitat. The Mid-American Game Bird Association leases land from farmers at an average of \$3,000 per year for a ten acre wetland, restores or enhances wetlands and wildlife habitat, and then charges hunters for access to the land. According to John Nee, the director of the organization, land which is currently worth \$100-\$300 could be doubled or tripled in value if the wetland is restored and leased for hunting.

Because of the high demand for outdoor recreation, it may be possible to lease land for nonconsumptive or off-season activities such as birdwatching, firewood cutting, mushroom and wild edibles hunting, wildflower picking, photography, and pond or stream fishing.

TRAPPING:

A further use of wetland-associated wildlife is furtrapping, a multimillion dollar industry in the wetlands of the United States. Supplemental income can be derived from trapping furbearers either through direct sale of the pelts to dealers or stores, by leasing wetlands for fur harvest, or by sharing a percentage of the fur harvest value from pelts trapped on leased wetlands. The 1985 National Survey of Fishing, Hunting, and Wildlife Associated Recreation (U.S. Department of the Interior, Fish and Wildlife Service, 1988) reported 508,000 total trappers, among which 316,000 trapped for sport, 162,000 trapped for income, and 30,000 did not specify. The average trapper spent

23 trapping days annually for a total of 11,508,000 days of trapping per year.

Furbearing animals include many species and occupy most habitat types. Many of these species use wetlands as a component of their habitat, but are usually adaptable to either upland or wetland habitat. "The diversity of a particular wetland usually determines the number of animals that an area will support. Habitat requirements vary considerably among various groups and among species within groups" (Chabreck, 1978). Some of the furbearers which occupy wetlands, at least temporarily are the opossum, black bear, raccoon, weasel, mink, river otter, skunk, coyote, red fox, gray fox, bobcat, cougar, beaver, muskrat, and deer (Brabander et al., 1985). Commercially important species which require a wetland environment for at least a portion of their life cycle in IA, KS, MO, and NE are beaver, mink, muskrat and raccoon.

Beaver (Castor canadensis): Occur in low densities in bottomland hardwood habitat along streams, with about 2-3 per mile of stream and 1-5 per acre of wetland. They feed on mice, rabbits, fish, muskrats, frog, and crayfish. Up to one-third could be taken on a sustained yield basis.

Mink (Mustela vison): Live in low densities in the bottomland hardwood habitat along streams, with about 2-3 per mile of stream and 1-5 per acre of wetland. They feed on mice, rabbits, fish, muskrats, frog, and crayfish. Up to one-third could be taken on a sustained yield basis.

Muskrat (Ondatra zibethica): These are prolific rodents that live in marshes, ponds and streams. They require still or slow-moving water with plenty of vegetation in the marshes or along banks. Wetlands that dry up in the summer will not support these animals. The best marshes are 1-3 feet deep with a lot of cattail and bulrush. Eighty percent of the muskrats in an area can be taken without harm. Good marshes produce a sustained yield of up to 20 muskrats per acre, while streams produce 5-15 per mile.

Raccoon (Procyon lotor): Omnivores (those animals that eat both plants and animals) which prefer streams, although they will be found around the edges of marshes. These animals need large trees and hollow logs for dens. Population density is 5-20 per 100 acres throughout the Midwest but are more concentrated along streams and wetlands. The maximum sustainable yield is 40% of a given population (McCullough, 1990).

Tables 9-16 illustrate the additional income that can be earned from trapping furbearing mammals in wetlands.

Table 9: FURS PURCHASED FROM IOWA TRAPPERS AND HUNTERS
AS REPORTED BY IOWA FUR BUYERS 1988-1989
(Andrews and Humburg, 1989)

<u>SPECIES</u>	<u>NUMBER OF PELTS PURCHASED</u>	<u>AVERAGE PRICE PER PELT</u>	<u>TOTAL VALUE</u>
Muskrat	192,214	\$ 2.05	\$ 394,038.70
Mink	13,996	\$22.06	\$ 308,751.76
Raccoon	190,556	\$ 7.96	\$1,516,825.76
Beaver	18,459	\$ 9.22	\$ 170,191.98
Red Fox	15,445	\$12.15	\$ 187,656.75
Gray Fox	769	\$12.06	\$ 9,274.14
Coyote	4,650	\$ 4.41	\$ 20,506.50
Opossum	19,824	\$.57	\$ 11,299.68

Table 9: Furs Purchased From Iowa Trappers and Hunters
as Reported by Iowa Fur Buyers 1988-1989 (Continued)

<u>SPECIES</u>	<u>NUMBER OF PELTS PURCHASED</u>	<u>AVERAGE PRICE PER PELT</u>	<u>TOTAL VALUE</u>
Striped Skunk	712	\$ 1.31	\$ 932.72
Badger	1,034	\$ 3.57	\$ 3,723.51
TOTALS	457,668	\$ 5.69	\$2,602,695.00

Table 10: FLUCTUATIONS IN IOWA'S FURBEARER MARKET 1984-1989
(Andrews, et al. 1984-1989)

<u>SEASON</u>	<u>NUMBER OF PELTS PURCHASED</u>	<u>AVERAGE PRICE PER PELT</u>	<u>TOTAL VALUE</u>
1984-85	804,167	\$10.66	\$ 8,574,748.98
1985-86	601,714	\$ 8.58	\$ 5,163,651.66
1986-87	990,236	\$10.44	\$10,335,629.88
1987-88	925,989	\$ 8.74	\$ 8,097,248.52
1988-89	457,668	\$ 5.70	\$ 2,602,695.00

Table 11: FLUCTUATIONS IN IOWA'S FURBEARER MARKET 1984-1989
(Values include beaver, mink, muskrat, raccoon only)

<u>SEASON</u>	<u>NUMBER OF PELTS PURCHASED</u>	<u>AVERAGE PRICE PER PELT</u>	<u>TOTAL VALUE</u>
1984-85	751,314	\$10.58	\$ 7,946,326.40
1985-86	557,264	\$ 8.54	\$ 4,760,465.30
1986-87	922,501	\$10.48	\$ 9,666,396.20
1987-88	864,419	\$ 8.74	\$ 7,558,267.90
1988-89	415,225	\$ 5.76	\$ 2,389,808.00

Table 12: MISSOURI 1988-1989 FUR MARKET AND HARVEST SUMMARY
(Kulowiec and Hamilton, 1989)

<u>SPECIES</u>	<u>HARVEST</u>	<u>AVERAGE PELT PRICE</u>	<u>TOTAL PELT VALUE</u>	<u>% OF TOTAL PELT VALUE</u>
Raccoon	106,539	\$ 7.80	\$831,009.20	67.8
Opossum	16,607	\$ 1.04	\$ 17,271.28	1.4
Red Fox	2,193	\$13.16	\$ 28,859.88	2.4
Gray Fox	3,087	\$14.62	\$ 45,131.94	3.7
Coyote	3,112	\$ 2.89	\$ 8,993.66	0.7
Bobcat	1,014	\$38.13	\$ 27,491.73	2.2

Table 12: Missouri 1988-1989 Fur Market and Harvest Summary
(Continued)

<u>SPECIES</u>	<u>HARVEST</u>	<u>AVERAGE PELT PRICE</u>	<u>TOTAL PELT VALUE</u>	<u>% OF TOTAL PELT VALUE</u>
Mink	4,406	\$29.69	\$ 130,814.14	10.7
Beaver	7,249	\$ 7.47	\$ 54,150.03	4.4
Muskrat	40,436	\$ 2.04	\$ 82,489.44	6.7
Striped Skunk	153	\$ 1.03	\$ 157.59	---
Spotted Skunk	0	---	\$ 0.00	---
Badger	44	\$ 2.00	\$ 88.00	---
Weasel	4	\$.25	\$ 1.00	---
TOTALS	184,844	\$ 6.64	\$1,226,452.91	100.0

Table 13: TRENDS IN MISSOURI FUBEARER VALUES IN LAST 20 SEASONS
(includes raccoon, coyote, bobcat, mink, beaver, muskrat, striped skunk, spotted skunk, badger, weasel) (Kulowiec and Hamilton, 1989)

<u>SEASON</u>	<u>NO. OF PELTS HARVESTED</u>	<u>VALUE TO FUR-TAKERS</u>	<u>VALUE/PELT</u>
1970-71	233,414	\$ 258,587.00	\$ 1.11
1971-72	325,686	\$ 666,274.00	\$ 2.05
1972-73	334,899	\$1,736,296.00	\$ 5.18
1973-74	881,276	\$2,312,918.00	\$ 6.07
1974-75	464,825	\$2,479,370.00	\$ 5.33
1975-76	497,138	\$4,684,644.00	\$ 9.42
1976-77	474,584	\$5,848,010.90	\$12.32
1977-78	320,673	\$3,467,450.20	\$10.81
1978-79	451,226	\$8,613,607.20	\$19.09
1979-80	634,338	\$9,081,482.10	\$14.32
1980-81	479,637	\$5,588,128.70	\$11.65
1981-82	409,627	\$6,241,229.40	\$15.24
1982-83	400,264	\$3,700,867.85	\$ 9.25
1983-84	255,330	\$2,894,466.30	\$11.34
1984-85	392,634	\$4,927,167.30	\$12.55
1985-86	232,561	\$2,694,062.30	\$11.58
1986-87	443,508	\$6,221,726.15	\$14.03
1987-88	351,530	\$3,690,660.31	\$10.50
1988-89	184,844	\$1,226,452.91	\$ 6.64

Table 14: SUSTAINED YIELDS AND VALUES OF FURBEARER PELTS, NEBRASKA 1990 (McCullough, 1990)

<u>SPECIES</u>	<u>SUSTAINED ANIMAL YIELD</u>	<u>CURRENT PELT VALUE</u>	<u>HIGHEST PELT VALUE IN LAST 10 YEARS</u>
Beaver	1 colony (6-8)	\$ 5 - \$20	\$100
Mink	2-3/mi stream or 1-5/100 acres wetland	\$10 - \$20	\$40
Muskrat	20/acre marsh or 5-15/mi. stream	\$ 1	\$ 5
Raccoon	5-20/100 acres	\$ 3 - \$10	\$40

Table 15: DISTRIBUTION AND VALUE OF THE FUR HARVEST BY SPECIES IN THE U.S. IN 1975-1976 AS A PERCENT OF THE NATIONAL TOTAL (Chabreck, 1979)

	<u>BEAVER</u>	<u>MINK</u>	<u>MUSKRAT</u>
IOWA	2.6	7.4	6.0
MISSOURI	1.2	2.4	1.4
NEBRASKA	3.6	1.5	1.2
KANSAS	3.3	0.8	0.8
TOTALS	10.7	12.1	9.4
AVG. PELT PRICES	\$6	\$10	\$3.50

Table 16: AVERAGE U.S. PELT PRICES FOR BEAVER, MINK, MUSKRAT, RACCOON FROM 1970-1976 (Deems and DePursley, 1978)

<u>SEASON</u>	<u>BEAVER</u>	<u>MINK</u>	<u>MUSKRAT</u>	<u>RACCOON</u>
1970-71	\$10.00	\$ 7.50	\$1.40	\$ 3.50
1971-72	\$12.00	\$ 9.50	\$2.25	\$ 6.50
1972-73	\$14.00	\$12.00	\$3.00	\$10.00
1973-74	\$13.50	\$11.50	\$3.00	\$15.00
1974-75	\$11.00	\$ 8.00	\$3.00	\$12.00
1975-76	\$ 6.00	\$10.00	\$3.50	\$19.00

AQUACULTURE:

Every year millions of fishermen rely on wetland habitats to produce fish for their recreational enjoyment. In 1985 there

were 38.4 million anglers who fished in freshwater other than the Great Lakes. These fishermen accounted for 785.9 million days of fishing, an average of 20 days and \$463 per fisherman (U.S. Department of the Interior, Fish and Wildlife service, 1988). In Kansas alone in 1985, 567,700 residents fished an average of 20.2 days, spending \$399 per fisherman (U.S. Department of the Interior, Fish and Wildlife Service, 1989).

While all species of fish rely to some extent on wetlands, their degree of utilization is highly variable, depending on the species. "The young of both fresh water and salt water fishes often seek shallow waters, where their food is more concentrated than in deeper water and where they are protected from predation. Additionally, shallow water is a place of permanent residence for some species and a feeding ground for transients" (Peters et al., 1978). Most freshwater fish are considered wetland-dependant because they feed in wetlands or on wetland-produced food, use wetlands as nursery grounds, or spawn in the aquatic portions of wetlands (Delaware Conservationist, Fall, 1987).

Fishing Leases

Freshwater fish are primarily harvested for recreation, although some species such as trout, buffalo, carp and catfish are often harvested for commercial use as well. Other major freshwater fish are the sunfishes, pickerels, bullheads and perches.

Due to the high demand for fishing and the shortage of available fishing land, a profitable enterprise could be made from leasing wetlands to fishermen either independently or in

conjunction with a hunting lease. According to the 1985 National Survey of Fishing, Hunting, and Wildlife Associated Recreation (U.S. Department of the Interior, Fish and Wildlife Service, 1988), 5,090,000 acres of freshwater land was leased that year to 121,000 fishermen who spent \$19,676,000 or \$148 per fisherman for access to that land. Out of this total, 268,000 acres were wetlands, leased by 58,000 fishermen.

Commercial Fish Production

Besides profiting from recreational fishing, income may be derived from raising fish for commercial harvests. This enterprise requires a substantial investment of labor and capital, depending on the size and type of operation, and the production methods used. Although commercial fish farming in Missouri is a small industry (approximately 4.8 million pounds of food fish were produced in 1986), the state's water resource of over 350,000 farm ponds, estimated at 250,000 acres has the potential to support a sizable fish industry. "Using existing ponds eliminates a major production cost, and cage-culture techniques make otherwise unproductive ponds (those that are too deep or with too many obstructions to seine) available for commercial production" (Belusz, 1987). A rough estimate of the economic variables involved in catfish production is as follows:

<u>Pond Size</u>	<u>Stocking Rate</u>	<u>Production Cost Per 100 Lbs.</u>	<u>Net Return Per Acre</u>
1 acre	3500/acre	\$64.40	\$98
5 acres	3500/acre	\$54.00	\$387
10 acres	3500/acre	\$53.90	\$388
20 acres	3500/acre	\$49.80	\$531

Pond Stocking

Fish farming is not limited to just food fish. Among the other types of operations are pond stocking, baitfishes, fingerlings, and broodfish. Production of fish for pond stocking for recreational fishing is usually much less labor intensive than for food-size fish, while the return may be the same or even higher. Some of the most popular species for pond stocking are largemouth bass, catfish, bluegills, crappie, and hybrid sunfish. A stocker is generally four inches to 1 pound or more. In 1987, 10-12 inch catfish stockers were being sold for about \$.70 each or \$1.87 a pound. This could provide a supplemental income for small-scale food-fish growers. However, delivery of the live fish is usually required, which may be prohibitive in terms of equipment costs (Belusz, 1987).

Baitfish

Baitfish production is also a desirable enterprise for a number of reasons. Firstly, small ponds, which may not be suitable for other fishes can support baitfish. Secondly, 300-800 pounds of minnows can be produced from a well-managed pond. In 1987, the average price for minnows was about \$2.50 per pound wholesale, making a few acres of pond into a valuable piece of land. In addition, proximity to major fishing lakes can make production even more lucrative for sale either directly to fishermen or to local retailers. Two of the most popular bait fishes are the golden shiner and fathead minnow. Commercial production of minnows in the U.S. is worth about \$100 million for sport-fishing at the farm level (Belusz, 1987).

Besides being a good baitfish, minnows are eagerly eaten by poultry and provide a good alternate source of protein. However, if poultry are allowed more than one feeding of minnows per day, the meat or eggs from the poultry takes on a fishy flavor.

Crayfish and Leeches

Crayfish and leeches can also be sold to bait dealers. Like minnows, they can be managed in shallow and weed-choked ponds not suitable for fish. Most crayfish crops are used for bait. However, in the Bootheel of Missouri where crayfish may grow over three inches, they are large enough for food production (Belusz, 1987). Although there has been little if any food size crayfish production in our region outside of the Bootheel of Missouri, it could be a successful enterprise, especially in Southern Missouri.

Missouri alone supports 27 species and subspecies of crayfish, the majority confined to the area south of the Missouri River. Their habitats vary, depending on the species, from rivers and rocky streams, to ponds and swamps, or cave springs and underground streams. Stream-living crayfish make excellent bait for bass, drum and catfish. Collecting wild crayfish by seine, net or hand is legal with a fishing permit up to a limit of 150 in Missouri (Johnson, undated). If the number of crayfish collected in one year exceeds 150, a fine will be imposed.

Fingerling and Broodfish

As the interest in food-fish production grows around the area, the demand for fingerlings will increase proportionately. This form of aquaculture requires the most technical skill and

knowledge for such things as broodfish management, knowledge of spawning, and care of young fish and their diseases. However, fry or eggs can be purchased to reduce the effort and risk. In addition, on a limited acreage, profitable numbers of fingerlings can be produced. According to Belusz (1987), from 10,000 to 500,000 fingerlings per acre can be produced. If 70,000 fry are stocked per acre, 4-6 inch long fingerlings will develop in about 120 days.

To supplement the income from a small fingerling operation, broodfish can be raised. Sexually mature female catfish weighing five pounds produce 2,000-4,000 eggs per pound (Belusz, 1987). Several broodfish might be used to maintain the fingerling production while some could be sold to other operators, often at a high price.

Food-fish

Food-fish production, unlike fingerling production requires larger acreage and more water. An average acre can only produce 2,000 to 5,000 food-fish under good management. Belusz (1987) contends that growers can produce food-size catfish in ponds or cages at stocking rates from a few hundred, to more than 6,000 pounds per acre. He estimates that the capitalization costs for a pond culture operation are as follows:

Harvesting Seine	\$ 800.00
Hauling Tank	\$ 827.00
Agitators	\$ 398.00
Holding Nets (2)	\$ 140.00
Scale (for weighing feed)	\$ 50.00
Dip Nets (4)	\$ 107.00
Water Test Kit	\$ 200.00
Emergency Aeration Equip.	\$ 600.00
Boat and Motor	\$ 800.00
TOTAL	\$3,922.00

For an existing 2-acre pond stocked at 3,000 pounds/acre, Belusz estimates net returns of:

<u>Net Return</u>	<u>Return Per Acre</u>	<u>Price Received Per Pound</u>
\$844.50	\$422.25	\$.65
\$1,549.50	\$774.75	\$.75
\$2,254.50	\$1,127.25	\$.85

Besides catfish, other commercially produced food-fish are rainbow trout, Chinese carp and hybrid striped bass. Rainbow trout require high oxygen levels which are available when water temperatures are below 70 degrees F, usually from October to mid-May.

Chinese carp are not only valuable as food fish, but they are also beneficial when used in conjunction with other fish crops like catfish. The carp improve water quality by feeding on microscopic and rooted plants. Because of their ability to control pond vegetation, they are valuable fingerlings; 8-11 inch fish sold for \$4-\$6 each in 1987, according to Belusz (1987).

Finally, the hybrid striped bass, which can be grown in open ponds or raceways, is considered a gourmet food fish as well as a prized recreational fish. Thus, this would be a good fish to grow for restaurant markets, pond stocking or fingerlings.

The marketing possibilities for fish are varied, depending on the type of product and size of the operation. Large-scale operations usually sell their fish to processing plants while small-scale producers may wish to directly market their products to fish ponds for recreation or stocking, or self-process them for sale to small commercial outlets or individual buyers.

However, small-scale producers could save the time and effort of direct marketing by selling their crops to a processing plant if one was conveniently located.

Bullfrogs

Another avenue of aquaculture that could be pursued in wetlands is frog production, particularly bullfrogs (Rana catesbiena). An existing pond is ideal because frogs need water to spawn in the spring. A supplementary water supply may be necessary to maintain a constant water level if the area often suffers from drought. According to Pitts (1986), a pond must be at least 50 feet wide with plenty of vegetation growing along its edge to provide cover and insect forage. He recommends a water depth of 3-4 feet for hibernating tadpoles and adult frogs who burrow into the muddy bottom to survive freezing temperatures during the winter. Tadpoles do best in somewhat clear water with an algae bloom which "provides adequate phytoplankton and zooplankton for tadpole food" (Pitts, 1986). A pond enclosure is necessary to exclude predators and prevent the frogs from escaping. The frogs greatest predators are snakes, although ducks, crows, and raccoons also find them tasty. A solid fence, such as corrugated tin roofing is recommended with an electric wire placed about four inches above the top.

Because adult frogs are voracious carnivores, placing decayed meat along the pond's edge is one way to attract the frogs' food. Their cannibalistic nature makes it necessary that adequate supplies of food and space are provided.

Bullfrogs are considered game animals and thus commercial rearing, buying, and selling must be done according to the regulations and permits of the state's Department of Conservation and wildlife codes. Stocking an area for bullfrog reproduction and growth may either constitute rearing the frogs or taking them from the wild for commercial use. Therefore, it is advisable to consult with a local conservation agent before proceeding with production.

Thus, frog culture is an extremely difficult and unpredictable venture, and one that requires a lot of experience and patience. However, the rewards if one is successful are great, due to the high market demand for these animals. Although restaurants buy frog legs at around \$4.00 per pound, biological supply houses and research laboratories are a larger and more predictable consumer of adult frogs. There also is a small market for tadpoles for restocking purposes at prices comparable to those for minnows (Pitt, 1986).

Summary

Those landowners who possess only a wetland will have to confine their aquaculture production to crops that can be raised in shallow water, such as minnows, crayfish, leeches, fingerlings, and young fish for stocking. It also may be necessary to have a source of water if the wetland is not wet all year round.

If, however, the wetland is adjacent to a larger body of water, aquaculture can be extended to food-fish, brood-fish, and bullfrog production, as well as lease-fee fishing.

For those landowners without an available water source for aquaculture production, a shallow excavation, which enlarges and/or deepens the wetland may be a viable option.

ADDITIONAL SOURCES OF INFORMATION ON TRAPPING

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Iowa Department of Natural Resources
1203 N. Shore Drive
Clear Lake, IA 58428
(515) 357-3517

Missouri Furbearer Update
Thomas Kulowiec and David Hamilton
Missouri Department of Conservation
1110 S. College Avenue
Columbia, MO 65201-5299

Chuck McCullough, Furbearer/Disease Specialist
Nebraska Game and Parks Commission
2200 N. 33rd Street
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Lincoln, NE 68503-0370
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South Central Region
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Emporia, KS 66801
(316) 342-0658

Fur Takers of America International
Marcia Walston, Treasurer
Rt. 3, Box 211 A1
Aurora, IN 47001

International Fur Trade Federation
Ecology Section
36 Vejlesoevej
DK 2840 Holte, Denmark

ADDITIONAL SOURCES OF INFORMATION ON FEE HUNTING

Fee Hunting - Extra Income?

By Barbara Bassett and Deretha Freiling
Publication MP635
Available from Extension Publications
115 S. Fifth Street
Columbia, MO 65211

Mid-America Game Bird Association
636 E. 97th Street
Kansas City, MO 64131

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Ron Bell
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Mound City, MO 64470
(816) 442-3187

Prairie Pothole Joint Venture
IA Department of Natural Resources
East 9th and Grand Avenue
Wallace Building
Des Moines, IA 50319-0034
(515) 281-5145

Marvin Kraft
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(316) 342-0658

ADDITIONAL SOURCES OF INFORMATION ON AQUACULTURE

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Paula Moore, President
J and J Fish Farm
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Harviell, MO 63945
(314) 989-6424

American Fisheries Society
5410 Grosnevor Lane, Suite 110
Bethesda, MD 20814
(301) 897-8616

Missouri Department of Conservation
P.O. Box 180
Jefferson City, MO 65102
(314) 751-4115

Fish Farming Handbook
Evan Browand and John B. Gratzek
AVI Publishing Co., Inc.
250 Post Road East
Westport, CT 06880

Fish Farming Techniques
Larry Belusz
The Instructional Materials Laboratory
#10 Industrial Educational Building
6th and Stewart Rd.
Columbia, MO 65211
(314) 882-2883

Third Report to the Fish Farmers
U.S. Fish and Wildlife Service, 1984
Superintendent of Documents
U.S. Government Printing Office
Washington, D.C. 20402
Stock No. 124-101-00654-4

Missouri Farm's Aquaculture Special
Missouri Farm Magazine, 1987
Rt. 1, Box 237
Clark, MO 65243
(314) 687-3525

Aquaculture Magazine
(Bimonthly)
P.O. Box 2329
Asheville, NC 28802

Water Farming Journal
(Monthly)
3400 Neyrey Drive
Metairie, LA 70002
(504) 454-8934

Aquaculture News

Commercial Frog Farming
L.A. Helfrich and D.L. Garling
VA Polytechnic Institute and State University
Department of Fisheries and Wildlife Sciences
Fisheries Extension
152 Cheatham Hall
Virginia Tech.
Blacksburg, VA 24061

Chapter III
NATIVE GRASSES FOR FORAGE AND HAY

Native grasses which grow in wet areas include some of the most productive and nutritious forage and hay available. Thus, they provide a highly profitable use of a wetland while remaining compatible with its unique characteristics. According to the Missouri Conservation Department (1984), "Native warm-season grasses (WSG) are bunch grasses whose stands have more bare ground under and between individual plants and a greater number of associated broadleaf forbs, legumes and insects than do cool-season grasses (CSG)." They grow during warm weather months (late spring and summer) as opposed to most lawn and pasture grasses such as bluegrass and fescue which grow during cooler months in the spring and fall. Grazing trials have demonstrated that cattle gain significantly more on WSG in the summer than on CSG. In addition, the bunchy, upright growth form of WSG provides better habitat conditions for many species of wildlife for longer periods. Proper management of WSG requires 12 inches of stubble over winter which provides more cover than the 1-4 inch height of grazed CSG (Missouri Conservation Department, 1984).

The major wetland tolerant species of native warm-season grasses that provide good hay and forage include:

Andropogon gerardii (big bluestem)
Panicum virgatum (switchgrass)
Spartina pectinata (prairie cordgrass)
Tripsacum dactyloides (eastern gama grass)

For a full description of these grasses see Appendix 2.

In order for warm-season grasses to benefit both livestock forage and wildlife habitat on the same acreage, they must be properly managed, which includes preventing over-utilization from

grazing or haying (these grasses must not be cut or grazed below 6-8 inches) and periodic prescribed burning. "Most, if not all, prescribed burning of WSG by private landowners is conducted during the three week period following 'green-up' in April and May, just after WSG breaks dormancy but before they exceed three inches in new growth" (Missouri Department of Conservation, 1984). Burning is the most effective and economical tool for controlling woody plants and CSG, allowing the WSG, which have evolved a tolerance for fire, to outgrow the less tolerant competition. The frequency of burning can vary depending on the severity of problems and type of livestock operation. In general, two consecutive burns in five years is sufficient. However, if planting is for an annual hay production, burn only often enough to control competitive vegetation, approximately once every three to five years. On the other hand, if the planting is for maximum livestock production, an operator may want to burn more frequently to take advantage of the 10-12% greater gains per head the year of the burn (Missouri Conservation Department, 1984).

The Missouri Conservation Department recommends a rotational grazing schedule for a mixed warm-season and cool-season system:

CSG: Green-up to June 1
WSG: June 1 to September 1
CSG: September 1 to November 1

Most operators leave their cattle on a CSG pasture over winter. This basic guideline might be combined with several rotations during each annual period in order to prevent the over utilization of the grassland. Such a system is undergoing study at the Chase Lake Prairie Project in North Dakota. There they move

cattle through different pastures frequently during the growing season. Some pastures are grazed heavily for short periods while others are allowed to rest and grow additional forage. The results reveal benefits for cattle and plants, as well as waterfowl and other wildlife. By incorporating wetland areas into the rotation, they have protected the wetlands, increased beef tonnage, and increased the number of ducks by 39%. The system consists of four pasture units. One unit is grazed 20 days followed by a 60-day rest. The rotation is then repeated, for a 160-day cycle of grazing.

The project sponsors estimate that if rotational grazing systems could be put on 25% (579,452 acres) of the rangeland and CRP grasslands (when they expire) in their project area it would increase beef production 25% per acre. Over 579,452 acres, this translates into 8.35 million additional pounds of beef or 6.26 million additional dollars. The expansion of the grazing system also would increase waterfowl production by 15.5 ducks per 100 acres. Over 579,452 acres, 89,000 more ducks would be produced each year, along with other wildlife species whose habitat would be improved.

The major cost of implementing a grazing system results from fencing pastures into units and from any wetland enhancement. To offset the initial costs of creating a grazing system which incorporates a wetland, the acreage could be put under the Conservation Reserve Program. Although the land would have to be set aside from production for ten years, the program qualifies participants who wish to plant native grasses on set aside land

for assistance assistance from the U.S. Soil Conservation Service in land-use planning and 50% of the costs of planting the grasses from the U.S. Agriculture Conservation and Stabilization Service. In the interim, the grasses can become established and wildlife benefits enjoyed.

Native grasses are beneficial for a number of reasons:

- 1) They are extremely well adapted to natural conditions. Native grasses provide dependable forage and hay despite fluctuations in weather; furthermore, disease and insect populations have less of an effect, especially on mixed stands.
- 2) Maintenance is low. They do not require pesticides or herbicides, and fertilizer is not necessary unless the stand is intensively managed. Under proper management, stands of native grasses can produce indefinitely.
- 3) They increase soil fertility. Ninety percent of the humus produced by native grasses is from regeneration of the root system and, therefore, is incorporated directly into the soil. Complete regeneration of the entire rootstock occurs every three to four years.
- 4) They are useful for projects requiring minor mitigation to offset adverse environmental impacts. Native grasses remove nutrients and sediments, slow flood waters, and control erosion.
- 5) They increase livestock gains. Native grasses provide nutritious grazing during hot summer months which allows livestock to gain weight throughout the summer. Experimental rotational grazing systems incorporating WSG pastures by the SCS in Nebraska showed that steers gained an average of 70 pounds per head more than steers on a rotational system containing only CSG pastures.
- 6) They provide wildlife habitat. Native grasses provide cover

for nesting areas, and mixed stands provide a diversity of seeds and insect populations for birds during the summer. In the winter, the grasses remain upright, providing protection for many wild animals. 7) They are attractive. These grasses are not only pleasing to look at in the field, but they are an excellent addition to dried flower arrangements. In addition, prairie cordgrass is sometimes used to make archery targets.

ADDITIONAL SOURCES OF INFORMATION ON NATIVE GRASSES

Steve Clubine, Grassland Biologist
Missouri Department of Conservation
Clinton Office
(816) 885-6981

U.S. Soil Conservation Service or Conservation Department
Brochures:

- "Establishing Native Warm-Season Grasses"
- "Native Grasses"
- "Native Grasses for Wildlife"
- "Native Warm-Season Grasses for Missouri Stockmen"

Erline T. Jacobson, Plant Materials Specialist
Lincoln, NE
(402) 437-5355

Soil Conservation Service
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(913) 539-8761

Soil Conservation Service
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Elsberry, MO 63343
(314) 898-2012

IV: HERBS

Alternative crops such as herbs and spices are an excellent way to supplement income and diversify a farming production. The variety of markets is virtually limitless, depending upon one's imagination and ambition, while production can be successful on either a small or large scale. The U.S. Department of Agriculture defines herbs as "plants not used solely as vegetables or ornaments. They serve partly or mainly for culinary, cosmetic, industrial, medicinal, landscaping, decorative, and incense or fragrance-emitting purposes" (Holcomb, 1988). Here, the discussion of herbs will be divided into four main marketing categories: culinary herbs, medicinal herbs, herbs in cosmetics, and dried or cut herbs. Each division contains plants that naturally grow in wet areas, thus providing alternative profitable uses for those areas that otherwise would be drained to support more traditional crops.

CULINARY HERBS

This category is quite broad, including both fresh and dried herbs used for many purposes, some of which are spices, teas, jellies, wines, bread and soups. Many of the herbs can also be eaten alone as unconventional foodstuffs. With the recent trend towards more exotic spices and foods, plants in this category are highly marketable to retail chains, natural food stores, roadside stands and farmers' markets. Table 17 is a list of some wetland herbs useful for culinary purposes.

Table 17: CULINARY HERBS

Acer sp. (maple)
Acorus Calamus (sweet flag)
Alisma Plantago-aquatica (water plantain)

Table 17: Culinary Herbs (continued)

Allium canadense (wild garlic)
Allium schoenoprasum (chives)
Althaea officinalis (marshmallow)
Amaranthus sp. (amaranth)
Amelanchier arborea (serviceberry)
Anethum graveolens (dill)
Angelica archangelica (angelica)
Angelica sp. (angelica)
Anthriscus cerefolium (chervil)
Apios americana (groundnut)
Apium graveolens (celery)
Arisaema triphyllum (Jack-in-the-pulpit)
Armoracia rusticana (horseradish)
Asarum canadense (wild ginger)
Asclepias sp. (milkweed)
Asimina triloba (pawpaw)
Asperula odorata (sweet woodruff)
Atriplex sp. (orache)
Barbarea orthoceras (wintercress)
Barbarea vulgaris (wintercress)
Brassica nigra (mustard)
Caltha palustris (marsh marigold)
Campaula sp. (bellflower)
Capsella bursa-pastoris (shepherd's purse)
Cardamine bulbosa (spring cress)
Cardamine pennsylvanica/parviflora (bittercress)
Carya illinoensis (pecan)
Carya laciniosa (shellbark hickory)
Carya ovata (shagbark hickory)
Celtis accidentalis (hackberry)
Cirsium vulgare (bull thistle)
Crataegus sp. (hawthorn)
Cryptotaenia canadensis (honestwort)
Cyperus esculentus (chufa)
Diospyros virginiana (persimmon)
Epilobium angustifolium (fireweed)
Fragaria virginiana (virginia strawberry)
Galium aparine (goose grass/bedstraw)
Gymnocladus dioica (Kentucky coffeetree)
Helianthus sp. (sunflower)
Helianthus tuberosus (Jerusalem artichoke)
Hemerocallis lilioasphodelus (day lily)
Heracleum lanatum (cow parsnip)
Humulus lupulus (hops)
Juglans cinerea (butternut)
Juglans nigra (black walnut)
Lactuca canadensis (wild lettuce)
Lindera benzoin (spicebush)
Melissa officinalis (lemon balm)
Mentha piperita (peppermint)

Table 17: Culinary Herbs (continued)

Mentha pulegium (pennyroyal)
Mentha spicata (spearmint)
Monarda didyma (bergamot)
Morus alba (mulberry)
Myrrhis oderata (sweet cicely)
Nasturtium officinale (water cress)
Nelumbo lutea (American lotus)
Nepeta cataria (catnip)
Nuphar lutea (yellow pond lily)
Nymphaea alba (white water lily)
Oxalis europaea (yellow wood sorrel)
Petroselinum crispum (parsley)
Phytolacca americana (pokeweed)
Podophyllum peltatum (mayapple)
Polygonatum canaliculatum (solomon's seal)
Polygonum hydropiper (marshpepper smartweed)
Potentilla anserina (silverweed)
Prunella vulgaris (heall-all)
Prunus serotina (black cherry)
Prunus virginiana (choke cherry)
Pyrus sp. (crabapple)
Quercus sp. (oak)
Rhus trilobata (sumac)
Ribes setosum (gooseberry)
Ribes sp. (currant)
Rosa gallica officinalis (apothecary's rose)
Rosa palustris (swamp rose)
Rubus sp. (blackberry and raspberry)
Rumex sp. (dock and sorrel)
Sagittaria sp. (arrowhead)
Salicornia sp. (glasswort)
Salix sp. (willow)
Sambucus canadensis (elderberry)
Sium suave (water parsley)
Smilacina racemosa (false solomon's seal)
Smilax sp. (greenbrier)
Sonchus sp. (sowthistle)
Stellaria media (chickweed)
Strophostyles helvola (trailing wild bean)
Taraxacum officinale (dandelion)
Tilia americana (American basswood)
Trifolium sp. (clover)
Trillium sessile (wake robin)
Typha latifolia (broadleaf cattail)
Urtica dioica (stinging nettle)
Uvularia grandiflora (bellwort)
Vaccinium myrtilloides (sourtop blueberry)
Valeriana officinalis (valerian)
Viburnum trilobum (cranberry bush)
Viola sp. (violet)
Vitis sp. (grape)
Zizania aquatica (wild rice)

MEDICINAL HERBS

Medicinal herbs refer to herbs used in both traditional and nonconventional drugs and pharmaceuticals. Natural food stores carry materials that include such things as stinging nettles, rose hips, dandelion, catnip, and comfrey for various health purposes. Often these herbs are gathered strictly from the wild. In addition, according to Harper and Miller (1989), "There is interest in expanding pharmaceuticals manufactured from plants because extraction can be less expensive than synthesization. And many drugs used today cannot yet be synthesized." Table 18 lists some of the wetland herbs with medicinal properties.

Table 18: MEDICINAL HERBS

Alisma Plantago-aquatica (water plantain)
Alnus rugosa (alder)
Althaea officinalis (marshmallow)
Anemone canadensis (white anemone)
Angelica archangelica (angelica)
Anthriscus cerefolium (chervil)
Armoracia rusticana (horseradish)
Asclepias sp. (milkweed)
Asperula odorata (sweet woodruff)
Atriplex sp. (orache)
Brassica nigra (mustard)
Caltha palustris (marsh marigold)
Capsella bursa-pastoris (shepherd's purse)
Cephalanthus occidentalis (buttonbush)
Chamaemelum nobile (chamomile)
Cirsium vulgare (bull thistle)
Cypripedium calceolus (yellow lady's slipper)
Epilobium angustifolium (fireweed)
Eupatorium perfoliatum (boneset)
Eupatorium purpureum (joe-pye weed)
Galium aparine (goose grass/bedstraw)
Helianthus sp. (sunflower)
Humulus lupulus (hops)
Juglans cinerea (butternut)
Lactuca canadensis (wild lettuce)
Levisticum officinale (lovage)

Table 18: Medicinal Herbs (continued)

Lindera benzoin (spicebush)
Lobelia cardinalis (cardinal flower)
Lysimachia Nummularia (moneywort)
Melissa officinalis (lemon balm)
Menispermum canadense (moonseed)
Mentha pulegium (pennyroyal)
Monarda didyma (bergamot)
Nepeta cataria (catnip)
Nuphur lutea (yellow pond lily)
Nymphaea alba (white water lily)
Petroselinum crispum (parsley)
Phytolacca americana (pokeweed)
Polygonatum canaliculatum (solomon's seal)
Potentilla anserina (silverweed)
Potentilla erecta (erect cinquefoil)
Prunella vulgaris (heal-all)
Rosa gallica officinalis (apothecary's rose)
Rubus sp. (blackberry and raspberry)
Rumex sp. (dock and sorrel)
Salix sp. (willow)
Sambucus canadensis (elderberry)
Stellaria media (chickweed)
Symphytum officinale (comfrey)
Taraxacum officinale (dandelion)
Typha latifolia (broadleaf cattail)
Urtica dioica (stinging nettle)
Vaccinium myrtilloides (sourtop blueberry)
Valeriana officinalis (valerian)

COSMETIC/DOMESTIC HERBS

This is an expanding industry due to the recent interest in adding natural ingredients to cosmetics. Oils and essences are added to perfumes, lotions, soaps, and shampoos. In addition, this category includes such things as alternative pesticides, clothing dyes, and potpourris. Wreaths, potpourris and candles are among the many popular items made from dried herbs and sold at gift and craft shops. Table 19 provides a sample of herbs with potential cosmetic and domestic uses.

Table 19: COSMETIC/DOMESTIC HERBS

Acorus Calamus (sweet flag)
Alnus rugosa (alder)
Althaea officinalis (marshmallow)
Angelica sp. (angelica)
Anthriscus cerefolium (chervil)
Asperula odorata (sweet woodruff)
Chamaemelum nobile (Chamomile)
Galium aparine (goose grass/bedstraw)
Helianthus sp. (sunflower)
Juglans cinerea (butternut)
Levisticum officinale (lovage)
Lysimachia Nummularia (moneywort)
Melissa officinalis (lemon balm)
Mentha pulgium (pennyroyal)
Mentha sp. (mint)
Monarda didyma (bergamot)
Myrris odorata (sweet cicely)
Nepeta cataria (catnip)
Nuphar lutea (yellow pond lily)
Nymphaea alba (white water lily)
Petroselinum crispum (parsley)
Potentilla anserina (silverweed)
Potentilla erecta (erect cinquefoil)
Rosa gallica officinalis (apothecary's rose)
Salix sp. (willow)
Sambucus canadensis (elderberry)
Symphytum officinale (comfrey)
Taraxacum officinale (dandelion)
Typha latifolia (broadleaf cattail)
Urtica dioica (stinging nettle)
Vaccinium myrtilloides (sourtop blueberry)
Viola sp. (violet)

CUT/DRIED FLORALS

Along with the rise in interest in exotic foodstuffs, the market for unusual or wild flowers for floral arrangements has grown dramatically. "Consumers are developing more sophisticated tastes. They want varieties other than carnations, mums and roses" (Young, 1988). Both cut and dried flowers, leaves, and grasses are being incorporated into floral arrangements, and native plants are potentially very marketable due to both their hardiness and uniqueness. "From the grower's perspective, the

interest in different varieties offers an opportunity to market items for which there may be less competition from imports, such as native flowers. Recent trends include increased interest in field-grown flowers, which often have a more casual look" (Young, 1988). Recently, supermarkets have taken a major role in the cut flower industry. An estimated 80% of the nation's supermarkets sell floral products. Kroger sells \$100 million a year alone in floral products. While one half of their supply comes from wholesale and overseas suppliers, an equal amount comes from local growers. "Foliage and bedding plants are supplied mostly by local growers. An increasing number of supermarkets are establishing contracts with cut flower growers" (Young, 1988). Table 20 offers a few of the wetland varieties that would do well in floral arrangements. However, just about anything goes as long as it is relatively long-lasting.

Table 20: DRIED/CUT FLORALS

Achillea sp. (yarrow)
Allium schoenoprasum (chives)
Anethum graveolens (dill)
Caltha palustris (marsh marigold)
Desmanthus illinoensis (prairie bundleflower,
 prairie mimosa, or Illinois bundleflower)
Eupatorium sp. (joe-pye weed)
Iris versicolor (blueflag iris)
Liatris sp. (blazing star or gayfeather)
Lobelia cardinalis (cardinal flower)
Monarda didyma (bergamot)
Nelumbium/Nelumbo sp. (lotus)
Rosa sp. (rose)
Typha latifolia (broadleaf cattail)

To maximize the life of cut flowers, immediately after cutting, put stems into a clean bucket of warm water, cut them in the

morning or evening, slice stems cleanly and recut them underwater, choose newly opened flowers or those still partially in bud, and cut off all foliage that will be below the surface of the water to prevent decay (Coit, 1988).

Drying flowers can be done by several different techniques including air drying, drying by pressing, drying with desiccants (either silica gel or sand), and drying in the microwave (Joosten, 1988). Air drying is the simplest and least expensive of these methods. To do this, cut the flower with as long a stem as possible and strip off all the leaves. Then gather the flowers in small bunches with rubber bands or clips and hang them, upside down for two to three weeks in a cool, dry place (Doscher, 1988).

The raising of wetland plants and seeds is also a growing industry. Many individuals or corporations want a more natural-looking landscape that includes water-gardens or low-lying areas of the garden that remain swampy and are ideal for growing perennials that naturally occur along stream banks, the margins of ponds or lakes, or in low-lying boggy places. Besides providing attractive landscaping, these plants control erosion along stream banks, and aquatic plants in ponds or streams keep the water clear and healthy; "they purify the water, release vitally needed oxygen into the air and water, provide shade from the sun's rays in warm weather, and bind the bottom soils. It is very seldom that a pond or lake will remain muddy if it contains plants" (Kester, 1985). In addition, these plants provide seeds, nuts, tubers, fruit and foliage to young fish, waterfowl, upland birds and mammals for food and cover. They

also support insects, plankton, and crustaceans which are eaten by fish and waterfowl.

Not only are the wetland plants sold for landscaping, but so are their seeds which are often preferred, especially for individuals who cannot afford the expense of buying full grown plants. This is an area that could be easily developed into a mail order business, particularly for those growers in rural areas with readily accessible markets. Yepsin (undated) cites a man who established a mail order business by collecting seeds of native wild herbs and then packaging them for sale. A mail order clientele might be identified through ads in local or national publications, especially of the farm and garden variety. A list of some of the perennials useful for aquatic landscaping is given in Table 21.

Table 21: PERENNIALS FOR WET PLACES

A. Moist Soil to Shallow Water

Acorus Calamus (sweet flag)
Arisaema triphyllum (jack-in-the-pulpit)
Caltha palustris (marsh marigold)
Eupatorium purpureum (joe-pye weed)
Filipendula palmata (meadowsweet)
Filipendula ulmaria (queen-of-the-meadow)
Helianthus tuberosus (Jerusalem artichoke)
Iris sp. (iris)
Ligularia sp. (ligularias)
Lobelia cardinalis (cardinal flower)
Lysimachia punctata (loosestrife)
Panicum virgatum (switchgrass)
Peltiphyllum peltatum (umbrella plant)
Phalaris arundinacea (Reed canary grass)
Primula sp. (primroses)
Ranunculus repens (butter daisy)
Sanguisorba canadensis (Canadian burnet)
Spartina pectinata (prairie cordgrass)
Zantedeschia aethiopica (calla lilly)

Table 21: Landscaping Perennials for Wet Places (Continued)

B. Water 1-10 inches

Nasturtium officinale (watercress) (moving/flowing water)
Typha latifolia (broadleaf cattail)
Sparganium sp. (burreed)
Polygonum amphibium (water smartweed)

C. Water 4-6 inches

Nelumbo lutea (American lotus)

D. Water 4-6 inches

Sagittaria latifolia (broadleaf arrowhead)
Scirpus sp. (bulrush)
Zizania aquatica (wild rice)

E. Water 1-2 feet

Nymphaea sp. (water lilies)

F. Water 1-3 feet

Potamogeton sp. (pondweed)
Vallisneria sp. (wild celery)

G. Water 1-6 feet

Anacharis sp. (elodea)
Ceratophyllum sp. (coontail)
Najas sp. (naiad)
Spirodela polyrhiza (ducks meat)

Appendix 3 describes some of the wetland growing herbs that have various culinary, medicinal, cosmetic, or esthetic uses.

Other areas for marketing wetland-grown plants are herb or craft shops, roadside stands, plant shops, nurseries, and contract growing. For example, wine and beer-making shops carry such things as hops, dandelion, elderberries and elder flowers, blackberries, raspberries, and rose hips, all of which can be grown in wet areas. Hops, mostly imported from Yakima, Washington are sold in both loose and pelleted forms. Sample prices for pellets

are \$3.95 for 3 ounces, or \$.98 for half an ounce. The loose leaf form may sell for \$2.40 for 4 ounces or \$.98 an ounce, depending on the store. These sample retail prices were obtained from stores in Kansas City and St. Louis. In addition, dandelions sold for \$2.05 per two ounces at one store and another one sold 4-5 ounces for \$2.00. Like hops, dandelions are mostly imported from the West Coast, as well as England.

As with all the herbal products, local growers may be able to find market opportunities with retailers who want quality material without the added transportation costs. Thus, developing a contract with such stores makes a wetland profitable while preserving its natural state and native vegetation.

ADDITIONAL SOURCES OF INFORMATION ON HERBS AND WILDFLOWERS

Ozarks Regional Herb Growers and Marketers Association
Jim Long, President
Route 4, Box 730
Oak Grove, AR 72660
(417) 779-5450

The Herb, Spice and Medicinal Plant Digest
L.E. Craker
Stockbridge Hall
University of Massachusetts
Amherst, MA 01003
(413) 545-2347

The Ozarks Herbalist
Route 4, Box 730
Oak Grove, AR 72660

Herbalgrass
Herb News
P.O. Box 12602
Austin, TX 78711

Herb Business Bulletin
P.O. Box 32
Berryville, AR 72616

The Herb Market Report
1305 Vista Drive
Grants Pass, OR 97527

The Herb Magazine
6660 Cardale
Lakewood, CA 90713
(bimonthly magazine)

American Herb Association
P.O. Box 353
Rescue, CA 95672
(916) 626-5046

Midwest Herb Association
Route 1, Box 161
Dearborn, MO 64439
(816) 685-3252

International Herb Growers and Marketers Association
Liz Roberts, Executive Secretary
P.O. Box 693
Greenfield, IN 46140
(317) 462-7007

American Herbal Products Association
215 Classic Court
Rohnert Park, CA 95928

Flowers that Last Forever
by Betty E. M. Jacobs
Garden Way Publishing, 1988
Storey Communications, Inc.
Pownal, VT 05261

The Complete Book of Everlastings
by Mark and Terry Silber
Published by Alfred A. Knopf, 1987

Flower Drying with a Microwave
by Titia Joosten
Lark Books, 1988
50 College Street
Asheville, NC 28801

The Book of Dried Flowers
by Malcom Hillier and Colin Hilton
Simon and Schuster, Publishers, 1986

Herb Research Foundation
1007 Pearl Street, Suite 200F
Boulder, CO 80302
(303) 449-2265

National Wildflower Research Center
2600 FM 973 North
Austin, TX 78725
(512) 929-3600

USDA Cooperative State Research Service
Office for Small-Scale Agriculture
Washington, D.C. 20250-2200

The Business of Herbs
Published by Paula and David Oliver
North Wind Farm, Rt. 2, Box 246
Shevlin, MN 56676
(bimonthly newsletter)

The Herbarist
published by the The Herb Society of America
2 Independence Court
Concord, MA 01742
(annual magazine)

National Wholesale Herb Market Report
USDA Agricultural Marketing Service
Fruit and Vegetable Division
536 S. Clark Street, Room 942
Chicago, IL 60605
(312) 353-0111
(weekly publication)

Missouri State Florist Association
Lois Benson, Executive Vice President
412 W. 60th Terrace
Kansas City, MO 64113
(816) 333-7187

Society of American Florists
1601 Duke Street
Alexandria, VA 22314
(703) 836-8700

Association of Specialty Cut Flower Growers
c/o Judy Laushman, Executive Director
155 Elm Street
Oberlin, OH 44074

The Flower Market
780 North 4th Street
San Jose, CA 95112
(408) 293-5201
(monthly trade journal)

V: RECOMMENDATIONS FOR FURTHER STUDY

After this cursory examination of the alternative usages of wetlands, it appears that it would be beneficial to pursue many of these ideas further, as well as some others not previously mentioned. Firstly, landowners must know the legal bounds within which they can pursue the alternative wetland uses and the amount of aid they can expect to receive, or the amount of subsidies they may lose, depending on their particular course of action. A more complete inventory of the federal and state natural resource regulations and conservation programs is needed to identify those which apply directly to wetland uses. For instance, the Missouri Department of Agriculture operates an alternative loan program. They offer low-interest loans (minimum \$500, maximum \$15,000) to Missouri farmers for the development and operation of an alternative agricultural enterprise which would include many of the alternatives mentioned in this paper.

Secondly, created wetlands have been used successfully for the treatment of sewage from cities for over a quarter of a century. The processes of such an operation also can be applied to small-scale operations such as feedlot waste treatment in existing wetlands. Specific plant species best suited for removing nutrients and waste products from the water, however, need further study.

Thirdly, if more time were available, a more exhaustive list of the uses of wetland herbs could be prepared. Herbs that occur in wetlands have the potential to be profitable crops, either for their culinary, medicinal, cosmetic or aesthetic value. Little known or unique species can more readily be entered into the market because of the absence of competition. In addition, diversification of

conventional farming is a good way to insure the stability of the farm income. Wetland areas often remain productive despite flooding and drought which may harm the other crops on the farm. "Aquatic macrophytes can be grown on waterlogged or swampy land which is at present underutilized since it is not suitable for either conventional agricultural crops or (intensive) aquaculture" (Edwards, 1984).

There is little data available on the market value of these wetland herbs, although much has been written on their potential value. Therefore, marketing must be pursued according to one's own location, creativity and energy, as well as soil type, and flooding conditions. It must be kept in mind that as the number of wetland products increases in a geographically concentrated area with a limited market, the value of these products will decrease. Thus, information is also needed on the feasibility of pursuing larger regional or national markets.

The development of wetland plant nurseries needs to be pursued in order to provide some of these useful wetland plants, create more interest in this area, and be a source of information. A nursery in Jefferson City, Missouri sells some wetland species. Wetland species for landscaping, such as wet areas around lakes, also could prove to be profitable. Similarly, more demonstration farms with wetland crop production, like the U.S. Soil Conservation Service's Plant Materials Center in Manhattan, Kansas, are needed to continue the necessary research and provide easily accessible information to interested landowners. Owners of wetlands require the same amount

of information on how to use their wetlands that is currently available on how to convert their wetlands to upland uses.

Finally, it appears that many of the wetland usages examined here could be profitable, but the exact economic values are difficult to obtain. More accurate costs and returns of the alternative usages of wetlands must be obtained in order to compare them with the costs and returns of the converted land. For a proper benefit-cost analysis to determine the best use of the wetland, the benefits from harvesting natural wetland products must be weighed against the costs of foregone profits from harvesting agricultural products on preexisting wetlands, and the cost of converting the wetlands by methods such as leveeing, ditching, or diking. If quantifiable values could be placed on the wildlife, ecological and social benefits from wetlands, they should be included in the benefit-cost analysis as well. However, because most of this information is unavailable and perhaps unattainable, an economic analysis is not very reliable. Perhaps the decision of whether or not to convert a wetland comes down to a combination of several factors, including those just mentioned, as well as one's ability to comply with federal and state wetland regulations, and the degree of personal satisfaction achievable from utilizing a wetland and its values to its fullest potential.

When the profits from increased beef production, furbearer pelts, or herbal products, are added to the socio-economic values of these wetlands, such as flood and storm damage protection, erosion control, groundwater discharge and recharge, and water quality improvements, wetlands may become a far more valuable resource than that provided by its conversion to upland uses.

Appendix 1

COMMON WILDLIFE FOOD/COVER

Scientific Names: Spirodela polyrhiza
Lemna trisulca

Common Name: Ducks Meat, Duck Weed

Habitat: Fresh, slightly acidic or hard water; takes nourishment from the water; withstands fluctuating water levels.

Wildlife Uses: Entire plant eaten by ducks, especially black ducks, mallards and other marsh ducks; produces food early in June for young and nesting ducks; increases duckling survival ratio.

When to Plant: Plant fresh plants from June - October.

How to Plant: Six bushels/acre of fresh plants among rushes, brush, timber, sheltered bays of lakes or streams and open water of ponds or sloughs; plant in water 1-6 feet deep.

Cost to Plant**: \$32.00 - \$90.00/BU***
\$30.00 - \$50.00/25 lbs.

Miscellaneous: Annual; produces a lot of food for a lot of ducks; good for landscaping.

*See Appendix 4 for a list of reference materials used to collate Appendices 1-3.

**Note: Prices of seeds, plants and roots in Appendices 1-3 were taken from several nurseries and catalogues in the region.

***BU = bushel

Scientific Name: Zizania aquatica

Common Name: Giant Wild Rice

Habitat: Fresh water streams, lakes, ponds, and sloughs having a change of water; a soft mud bottom is best with 6 inches to 3 feet of water.

Wildlife Uses: Best food for mallards, black ducks, widgeon, teal, pintail and canadian geese; used by ducks in the Spring to hide their nests and rear their ducklings; most popular food for shallow water feeding ducks.

When to Plant: During fall before freeze or in the spring.

How to Plant: Broadcast seeds 1-2 bushels/acre.

Cost to Plant: 1 lb. - \$ 3.95
10 lbs. - \$30.00
25 lbs. - \$70.00

Miscellaneous: Annual; seeds are harvested in late August or early September for human consumption or for selling to seed companies; seeds will naturally resow themselves.

Scientific Name: Nelumbo lutea

Common Name: American Lotus

Habitat: Bays, sloughs and ponds with 1 - 3 feet fresh water and a soft mud bottom; withstands fluctuating water levels.

Wildlife Uses: Mallard food, food and cover for game fish, and muskrats eat the tubers.

When to Plant: Spring or fall

How to Plant: Place the seed in a vice and cut a slit (scarify) in the hard shell. Then sow by broadcasting 500 seeds/acre in water 4-6 inches.

Cost to Plant*:

25 seeds -	\$ 3.75
50 seeds -	\$15.00
100 seeds -	\$11.00
250 seeds -	\$50.00
500 seeds -	\$48.00

Miscellaneous: Perennial**; attractive in water gardens; dried seed pod sold for dried floral arrangements.

*Price variance reflects purchase price of seed from different sources.

**Perennials, unlike annuals, do not need to be replanted each year.

Scientific Name: Potamogeton pectinatus

Common Name: Sago Pond Plant

Habitat: Any hard, clear water, either quiet or moving: lakes, streams, landlocked ponds, including fresh, marl, alkali and brackish.

Wildlife Uses: Eaten by over 20 kinds of ducks, as well as geese and swans. Early in the season, seeds eaten by Teal, and Mallards. Later tubers eaten by diving ducks. The plants also support snails, minute insects and other aquatic life for fish to feed on as well as providing shelter for game fish.

When to Plant: March - June, late fall.

How to Plant: Plant weighted tubers, 1000/acre at 1 1/2 foot intervals or more in 1 1/2 to 8 feet of water

Cost to Plant: Preweighted* Tubers
 \$ 19.00 - \$ 25.00 (100)
 - \$ 54.00 (300)
 \$120.00 - \$150.00 (1000)

Miscellaneous: Perennial; good landscaping plant

*Plantings are preweighted to plant in areas where flowing water or wave action might affect the establishment of the plants in that area.

Scientific Name: Vallisneria spiralis

Common Name: Wild Celery

Habitat: Grows in 1 1/2 to 8 or 10 feet of hard, fresh clear-changing water on muddy, sandy, or coarse silt bottom. Withstands waves and currents. Water should contain some lime.

Wildlife Uses: Attracts marsh and diving ducks such as red heads, and canvas backs, and wood ducks such as widgeon, pintail, bufflehead, whistler, teal, and mallard, as well as geese, swans and coots; one of the finest fish food and cover plants; protects small fish from enemies.

When to Plant: March - May

How to Plant: Roots or winter buds weighted and planted in 3 foot intervals at 1000/acre. Seed planted by mixing with sticky clay, making mud-balls and scattering them into water. Use 30 lbs. of seed/acre; plant in water 1-3 feet deep.

Cost to Plant:	100	-	\$ 30.00
	300	-	\$ 69.00
	1000	-	\$200.00

Miscellaneous: Perennial

Scientific Name: Sagittaria latifolia

Common Name: Broadleaf Arrowhead, Wapato Duck Potato

Habitat: Marshy places, mud flats in water up to 1 1/2 feet deep. Withstands drought and fluctuating water levels. Will not grow in alkaline water.

Wildlife Uses: Tubers, seeds and runners eaten by geese, swans and practically all wild ducks; the tubers are the best muskrat food available.

When to Plant: Fall before freeze-up or Spring

How to Plant: Plant tubers by wading in the water and push them into the substrate in up to 18 inches of water. Plant 1000/acre in 1 1/2 foot intervals.

Cost to Plant:

<u>Weighted Tubers</u>	<u>Unweighted Tubers</u>
\$ 22.00 - \$ 25.00 (100)	\$ 18.00 (100)
\$ 54.00 - (300)	\$ 65.00 (500)
\$ 75.00 - (500)	\$115.00 (1000)
\$133.00 - \$150.00 (1000)	

Miscellaneous: Perennial

Scientific Name: Sparganium eurycarpum

Common Name: Giant Bureed

Habitat: Muddy or marshy spots on shores or low lands in shallow water with a sand, mud or clay bottom. Does best in less than 1 1/2 feet of water but survives flooding, drought and complete drying.

Wildlife Uses: The seeds are an attractive food and the plants provide cover for 20 species of ducks and wild geese, especially mallards and black ducks; roots are one of the best muskrat foods; eaten by pheasants.

When to Plant: Fall or spring

How to Plant: Shove the roots in the bottom 1 1/2 feet apart for 1000 roots per acre in water 1-10 inches deep

Cost to Plant: Weighted
 \$ 16.50 - \$ 22.00 (100)
 \$ 46.00 - (300)
 \$ 65.00 - (500)
 \$110.00 - \$125.00 (1000)

Miscellaneous: Holds banks and stops erosion; perennial

Scientific Name:	<u>Potamogeton nodosus</u> (<u>Potamogeton americanus</u>)
Common Name:	Long-leaf Pond Plant
Habitat:	Fresh water lakes, streams and ponds with muddy or sandy soils and 1 to 6 feet of water; withstands flooding and drought.
Wildlife Uses:	Diving ducks feed on the tender roots, while marsh ducks feed on the seeds at the water's surface.
When to Plant:	Spring or fall
How to Plant:	Drop the preweighted roots 3 feet apart for 1000 per acre.
Cost to Plant:	<u>Preweighted Roots</u> 1000 - \$200 300 - \$ 69 100 - \$ 30
Miscellaneous:	Perennial

Scientific Name: Acorus Calamus

Common Name: Sweet - Flag

Habitat: Grows in damp soil or in shallow waters in fresh or soft water, and on acid soils.

Wildlife Uses: Ducks eat the seeds, an important cover and nesting site for waterfowl, and the finest food and cover for muskrats.

When to Plant: Spring or fall

How to Plant: Press roots into the soil by hand if the soil is soft or with a trowel for solid soils. Plant at a rate of 1000 per acre in damp to muddy soil.

Cost to Plant: Weighted Roots
 \$ 21.00 - \$ 28.00 (100)
 \$ 63.00 - (300)
 \$ 92.50 - (500)
 \$165.00 - \$180.00 (1000)

Miscellaneous: Perennial; attractive in water gardens

Scientific Name: Typha latifolia

Common Name: Broadleaf Cattail

Habitat: Marshy, muddy, or sandy spots where there is some moisture or up to 1 foot of water.

Wildlife Uses: One of the most important food and cover plants for muskrats. The roots or runners are eaten and foliage is used for house building material. Excellent cover plant for waterfowl and one of the best for blinds.

When to Plant: Spring; April, May, or early June

How to Plant: Roots are shoved into the soil by hand or spade, 1000 per acre in water 1-10 inches deep.

Cost to Plant:

<u>Weighted Roots</u>	
\$ 27.00 - \$ 28.00	(100)
\$ 63.00 -	(300)
\$115.00 -	(500)
\$180.00 - \$210.00	(1000)

Miscellaneous: Perennial; very useful for humans - culinary, medicinal, and domestic uses; attractive addition to water gardens

Scientific Name: Polygonum amphibium
(Polygonum muhlenbergii)

Common Name: Marsh Smartweed

Habitat: Grows in marshy soil and shallow waters and thrives in fresh or mildly alkaline water on mud, clay or sandy bottom. Withstands both flooding and drought well.

Wildlife Uses: Seeds eaten by mallards, black ducks, pintails and other waterfowl.

When to Plant: April, May, early June, October, and November

How to Plant: Roots are shoved in by hand 1 1/2 feet apart for 1000 per acre in water 1-10 inches deep.

Cost to Plant:	<u>Preweighted</u>	<u>Weighted</u>
	1000 - \$125	100 - \$ 16
	300 - \$ 46	500 - \$ 65
	100 - \$ 22	1000 - \$110

Miscellaneous: Perennial

Scientific Name: Anarchis canadensis

Common Name: Elodea

Habitat: A mud or sandy loam bottom is preferred, in 1 to 10 feet of water. Grows in quiet ponds, bays, sloughs or sluggish streams and lakes in hard, clear fresh water.

Wildlife Uses: Ducks eat the seeds and leaves, especially redheads, mallards, widgeons and scoups throughout Summer and Fall; excellent fish food and cover.

When to Plant: May - October

How to Plant: Place a few plants on the water and shove them down into a soft bottom with a forked stick or paddle. Plant 10 bushels per acre.

Cost to Plant: 1 BU - \$28
3 BU - \$78

Miscellaneous: Annual; carp resistant; good water purifier

Scientific Name: Polygonum pensylvanicum

Common Name: Pennsylvania Smartweed, Giant Smartweed

Habitat: Grows in fields, moist margins, banks, muddy spots left by receding water, and shallow areas a few inches deep.

Wildlife Uses: Excellent puddle duck food late in the season, especially for mallards; very attractive to waterfowl when flooded during the duck season.

When to Plant: Spring or fall

How to Plant: Sow dry seed by broadcasting, using 20 lbs. per acre. Break up the soil where vegetation is growing

Cost to Plant: \$10.00/lb.

Miscellaneous: Annual

Scientific Name: Nasturtium officinale
Common Name: Water Cress
Habitat: Grows in shallow springs or spring-fed streams on a soft mud or sandy bottom, in hard water 2 to 10 inches deep.
Wildlife Uses: Provides year round food for ducks; eaten by freshwater shrimp which are food for fish and ducks; leaves eaten by muskrat and deer.
When to Plant: Spring or fall
How to Plant: Mix 1 oz of the fine seed with 1 quart of sand and scatter in protected shoreline areas.
Cost to Plant: 1 ounce - \$7.00
Miscellaneous: Edible for humans, especially as a salad green.

Appendix 2*

DESCRIPTION OF SOME WETLAND OCCURRING NATIVE GRASSES

Scientific Name: Andropogon gerardii

Common Name: Big Bluestem

Description: Native, warm season, perennial, tall grass with short scaly underground stems and roots that saturate the top two feet of soil and may reach depths up to 12 feet; growth begins in early April and seed stalks 3-8 feet appear from late August-October.

Habitat: Bottomland Sites

Forage: Few, if any of the prairie grasses can equal it in quality or quantity; relished by livestock and usually eaten in preference to other grasses in a mixture; most productive if never grazed shorter than 6-8 inches during the growing season.

Flowers: Purple in August-November; good cut or dried

Other: Attracts birds

Cost to Plant: Seeds

\$ 2.50	(1 oz.)
\$10.00-\$25.00/lb.	(1-3 lbs.)
\$ 8.50-\$22.50 lb.	(over 3 lbs.)

Plants

\$5.50	(1-12)
\$1.20	(13-24)
\$1.00	(25-49)
\$.95	(50-99)
\$.85	(100+)

PLS lbs.**

\$9.00 - \$12.15/PLS lb.

*See Appendix 4 for a list of reference materials used to collate Appendices 1-3.

**PLS lb. is percent pure live seed pound

PLS = % of purity x % of germination/100

Scientific Name: Panicum virgatum

Common Name: Switchgrass

Description: Native, warm-season, perennial, sod-forming tall grass (3-5 feet) with vigorous roots; reproduces from underground stems and seed.

Habitat: Best adapted to lower areas of moist soils; winter hardy and drought resistant; acid tolerant.

Forage: Very nutritious; eaten by all classes of livestock, either as green forage or hay.

Flowers: Purple in August-October; good cut or dried

Other: Attracts birds; good wildlife cover

Cost to Plant: Seeds (1 lb. covers 4200 square feet)

\$3.00 (1/2 oz.)

\$4.00 (1 oz.)

\$2.75/lb. - \$40.00/lb. (1-3 lbs.)

\$4.50/lb. - \$35.00/lb. (4-19 lbs.)

\$4.00/lb. - \$35.00/lb. (20+ lbs.)

Plants

\$5.50 (1-12)

\$1.20 (13-24)

\$1.00 (25-49)

\$.95 (50-99)

\$.85 (100+)

Note: The "Kanlow" variety of switchgrass is a late maturing, very coarse-leaved lowland variety. It is very flood tolerant and mainly used in stabilization plantings on shorelines, flood areas and high water tables (Clubine, 1989). The "cave-in rock" variety can also tolerate flooding.

Scientific Name: Spartina pectinata

Common Name: Prairie Cordgrass

Description: A native warm-season, tall (6-10 feet), coarse, perennial grass that forms a dense underground sod; propagates by woody, many branched, creeping rhizomes, and by seed.

Habitat: Often called "marsh grass" and "slough grass" because it grows on deep, heavy, wetland soils.

Forage: Eaten by livestock during early growth, but used primarily for hay; makes good hay if cut while young and tender before stems develop; can be mowed two or three times each season because it grows so quickly.

Flowers: Good cut or dried

Cost to Plant: Seeds (12 lbs./acre)

\$ 6.75/ 1/4 oz.

\$ 12.00/ 1/2 oz.

\$ 20.00/1 oz.

\$ 50.00-\$300.00/lb. (1-3 lbs.)

\$ 30.00-\$290.00/lb. (over 3 lbs.)

Plants

\$5.50 (1-12)

\$1.20 (23-24)

\$1.00 (25-49)

\$.95 (50-99)

\$.85 (100+)

Scientific Name: Tripsacum dactyloides

Common Name: Eastern Gama Grass

Description: Native, warm-season, perennial grass; grows in large clumps from 1-4 feet in diameter; spreads by thick, short, jointed rhizomes and produces seed from July-September on stems 3-9 feet tall.

Habitat: Grows on a variety of soils in low areas where additional run-in water and deeper soils favor its development.

Forage: Nutritious to all classes of livestock, especially cattle; a very productive hay grass.

Planting: Late April or May with a minimum soil temperature of 55° F.; plant 30,000-60,000 PLS per acre or 9.97 bulk lbs. per acre.

Other: Useful as a wildlife food planting

Cost to Plant: Pre-chilled gama grass seed

<u>Pounds</u>	<u>\$/Pound</u>
10 - 20	\$10.00
30 - 60	\$ 8.00
70 - 100	\$ 7.50
110 - 150	\$ 7.00
160 - 180	\$ 6.90
190 - 210	\$ 6.80
220 - 230	\$ 6.70
↓	↓
460+	\$5.50

Appendix 3*

DESCRIPTION OF SOME WETLAND OCCURRING HERBS

Scientific Name: Caltha palustris
Common Name: Marsh Marigold
Indicator Status¹: IA-OBL; NE-OBL
Habitat: Grows in small, rounded clumps in boggy areas; yellow flowers from mid-spring to early summer; propagation by division or seeds.
Culinary Uses: Edible cooked only; leaves and buds as pickles.
Medicinal Uses: Expectorant and pectoral.
Cosmetic Uses: NA²
Cut/Dried: NA
Miscellaneous: Excellent garden perennial.
Cost to Plant³: (per plant)
\$3.00 (1-12)
\$2.25 (13-24)
\$1.75 (25-49)
\$1.35 (50-99)
\$1.10 (100+)

*See Appendix 4 for a list of reference materials used to collate Appendices 1-3.

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1. Indicator status from National List of Plant Species that Occur in Wetlands: Iowa, Kansas, Missouri, Nebraska, U.S. Fish and Wildlife Service, 1988.
 2. Information unavailable
 3. Seeds/Plants available from regional nurseries.

Scientific Name: Lobelia cardinalis
Common Name: Cardinal Flower.
Indicator Status: IA-OBL; KS-OBL; MO-OBL
Habitat: Stream banks, lakeshores, marshy riverbanks;
bogs or shallow water 2-4 inches deep; red
flowers from July-September; propagates by
division or cuttings; space 1-1.5 feet apart.
Culinary Uses: NA
Medicinal Uses Cherokee Indians used the root to cure
syphilis and the flower was used by settlers
and native Americans as an emetic and
expectorant.
Cosmetic Uses: NA
Cut/Dried: Flowers good for cutting.
Miscellaneous: Good plant for landscaping.
Cost to Plant: \$5.95/plant or 3/\$15.00
\$1.00/packet of seeds
\$3.25/potted plant

Scientific Name: Monarda fistulosa

Common Name: Wild Bergamot

Indicator Status: IA-FACU; KS-FACU-; MO-FACU; NE-FACU-

Habitat: Grows in rich, moist soil, especially deciduous forests.

Culinary Uses: Tea made from fresh or dried leaves, fresh leaves for salads, garnishes, and sparingly in cheeses.

Medicinal Uses: Teas used for stomach trouble and inhaling vapor for bronchial congestion.

Cosmetic Uses: Used in suntan oils and creams, once used in hair preparations; oils used in soaps and perfumes.

Domestic Uses: Dried leaves for potpourris; oil used to perfume candles.

Cut/Dried
Florals: Good cut flowers.

Cost to Plant: (Per plant)
\$5.50 (1-12)
\$1.30 (13-24)
\$1.10 (25-49)
\$.90 (100+)

Scientific Name: Nelumbo lutea/Nelumbium sp.

Common Name: American Lotus/Lotus

Indicator Status: IA-OBL; KS-OBL; MO-OBL; NE-OBL

Habitat: Grows in water 6-9 inches deep; hardy as long as rootstock does not freeze; flowers rise as high as 6-8 feet on straight stems; propagates by division; buds emerge by the end of July and stand almost two feet above the pond. After a few days the petals fall and the pod and its seeds begin maturing and turning brown.

Culinary Uses: Young stalk and leaf are a good boiled vegetable; raw seeds are added to salads; dried and roasted seeds are a flour substitute or popped like popcorn; rootstock tubers baked like a potato.

Medicinal Uses: NA

Cosmetic Uses: NA

Miscellaneous: Roots are eaten by beaver and the seeds are eaten by some waterfowl; the large leaves afford shelter and habitat for fish; collect seeds July-November and roots autumn-spring.

Cut/Dried: Dried seed pods used in flower arrangements; \$1-\$3 retail price per pod.

Cost to Plant: \$25-\$60 per plant depending on variety.
50 seeds for \$15.00
250 seeds for \$50.00

Scientific Name: Nepeta cataria

Common Name: Catnip

Indicator Status: IA-FAC-; KS-FACU; MO-FAC-; NE-FACU

Habitat: Occurs in fields, open woodland and along streams; flowers from June to September.

Culinary Uses: Fresh leaves used to flavor sauces.

Medicinal Uses: Flowering tops used for colds, bronchitis; makes a soothing drink for sleeplessness, irritability and stress.

Cosmetic Uses: Repellent to rats; dried leaves used for stuffing in cat toys; attracts honeybees to their hives.

Cut/Dried: NA

Cost to Plant: NA

Scientific Name: Nymphaea sp.

Common Name: Water Lily

Indicator Status: IA-OBL; KS-OBL; MO-OBL; NE-OBL.

Habitat: Still or slow freshwater streams, lakes, rivers and marshes; full sun.

Culinary Uses: Seeds roasted or ground into flour for bread; rootstocks boiled or baked like potatoes; Indians ground rootstocks into flour; young leaves and buds good as potherbs (cooked vegetable).¹⁴

Medicinal Uses: Tanning and mucilage in plants have been used as demulcents for sore throats.

Cosmetic Uses: Rootstocks bruised and steeped in milk said to kill beetles and cockroaches; smoke of root-stocks drives away crickets.

Cut/Dried: NA

Miscellaneous: Good planting for water garden.

Cost to Plant*: \$20.00 to \$50.00 per plant, depending on variety.
 100 tubers**/\$30.00
 750 tubers/\$165.00
 1 root*** (yellow or white flowered species)/\$4.00-\$4.50

*Prices vary depending on nursery source.
 **Tubers take 2 years to bloom.
 ***Roots bloom first year.

Scientific Name: Taraxacum officinale

Common Name: Dandelion

Indicator Status: IA-FACU; KS-FACU; MO-FACU; NE-FACU

Habitat: Cold and temperate regions in open sun.

Culinary Uses: Young leaves and buds used cooked or in salads; roots edible boiled and peeled; leaves and flowers used for tea; roots for coffee; flowers for wine retail priced at \$2.05/2 oz.

Medicinal Uses: Tea used for heartburn, menstrual cramps, wounds, and as a diuretic.

Cosmetic Uses: Dye made from the root: magenta if combined with alum, and yellow to brown with iron.

Cut/Dried
Florals: NA

Miscellaneous: Causes flowers and fruits of neighboring plants to mature early because of ethylene production; good for compost heaps; fresh leaves as fodder for domestic rabbits.

Cost to Plant: NA

Scientific Name: Typha latifolia
 Common Name: Broadleaf Cattail
 Indicator Status: IA-OBL; KS-OBL; MO-OBL; NE-OBL.
 Habitat: Occurs in marshy and shallow water areas.
 Culinary Uses: Flowering stalks before pollen formation
 boiled like corn cobs; soups and purees;
 pollen used to make flour for pancakes, bread
 and pudding; tubers cooked as a vegetable or
 dried and ground into flour; young shoots
 boiled.
 Medicinal Uses: Blackfoot Indians used the down for burns.
 Cosmetic Uses: Fibrous stems used for making paper; down
 used for bedding, pillows and comforters.
 Cut/Dried: Good for dried floral arrangements.
 Miscellaneous: Good wildlife cover.
 Cost to Plant: 100 roots/\$20.00
 1,000 roots/\$180.00

Scientific Name: Urtica dioica

Common Name: Stinging Nettle

Indicator Status: IA-FAC+; KS-FACW; MO-FAC+; NE-FACW

Culinary Uses: Cooked young plants used in soups and purees; leaves for tea; high in vitamin A and C and protein.

Medicinal Uses: Increases blood circulation; stimulant; anemia remedy.

Cosmetic/Domestic Uses: Roots make a grey, yellow or orange dye.

Miscellaneous: Forage for livestock and poultry, and cures coccidiosis in baby chicks; cloth, twine or fishing line made from fibers of stems of older plants; pesticide for black flies, lice, moths and aphids, prevents cucumber downy mildew; enhances essential oils of plants such as valerium, marjoram, sage and pepper mint; stimulates humus formation; mutually beneficial relationship with fruit trees; fresh leaves used as a fertilizer, compost accelerator and insecticide.

Cost to Plant: NA

Scientific Name: Zizania aquatica
 Common Name: Wild Rice
 Indicator Status: IA-OBL; KS-OBL; MO-OBL; NE-OBL
 Habitat: Grows in quiet waters, freshwater marshes, tributary streams and river mouths with some water exchange.
 Harvest: Ripens in midsummer or early fall; harvest by shaking seeds into a container.
 Culinary Uses: Edible as a cereal food; \$4.00/lb. in retail stores.
 Medicinal Uses: NA
 Cosmetic/Domestic Uses: NA
 Miscellaneous: Attracts wildfowl.
 Cost to Plant:

<u>Seeds</u>	<u>Plants</u>
\$ 3.95/ 1 lb.	\$ 24.00/ 100
\$ 30.00/ 30 lbs.	\$ 51.00/ 300
\$ 70.00/ 25 lbs.	\$140.00/ 1000
\$250.00/ 100 lbs.	

Scientific Name: Asimina triloba
Common Name: Pawpaw
Indicator Status: IA-FAC; MO-FAC; NE-FAC
Habitat: Low bottom; woods and wooded slopes, along streams, ravines, base of bluffs.
Culinary Uses: Pie, pudding, jelly, marmalade, bread.
Medical Uses: NA
Cosmetic Uses: NA
Cut/Dried: NA
Miscellaneous: NA
Cost to Plant: NA

Scientific Name: Rumex sp.

Common Name: Dock

Indicator Status: IA, KS, MO, NE: FAC to OBL (depending on species)

Habitat: Grows in fields, waste ground, railroads, and near streams and ponds, with rich moist soil and full sun.

Culinary Uses: Useful as a substitute for spinach, cooked or raw; Indians made a meal from the seeds.

Medical Uses: NA

Cosmetic Uses: NA

Cut/Dried: Flowers often dried for winter bouquets

Miscellaneous Collect shoots from March-April and the seeds from July-winter.

Cost to Plant: NA

Scientific Name: Helianthus tuberosus
Common Name: Jerusalem Artichoke
Indicator Status: IA-FAC; KS-FAC; MO-FAC; NE-FAC
Habitat: Grows in moist thickets, the border of streams, ponds, moist and dry woods, prairie wet spots, ditches, fence rows, and roadsides.
Culinary Uses: The potato-like tuber can be eaten raw in salads, cooked, or pickled.
Medicinal Uses: NA
Cosmetic Uses: NA
Cut/Dried: NA
Miscellaneous: Collect the tubers from October-January; good food and cover crop for pheasant and quail; fodder for pigs
Cost to Plant: NA

Scientific Name: Prunus serotina
Common Name: Black Cherry
Indicator Status: IA-FACU; KS-FACU; MO-FACU; NE-FACU
Habitat: Grows in woods and along streams.
Culinary Uses: Excellent additive to rum in a cherry drink;
jelly; syrup.
Medicinal Uses: NA
Cosmetic Uses: NA
Cut/Dried: NA
Miscellaneous: Plant catnip under trees to attract cats to
scare birds away.
Cost to Plant: Seedlings
6- 9" - \$.45 (400)
9-12" - \$.55 (500)

Scientific Name: Helianthus sp.

Common Name: Sunflower

Indicator Status: IA, KS, MO, NE: FACU- to FACW

Habitat: Waste and cultivated ground, low meadows, prairies roadsides, railroads.

Culinary Uses: Shelled seed can be eaten roasted or ground and used as a meal; the roasted, crushed, boiled shells or the roasted, boiled seeds are used for a coffee substitute; retail price for raw seeds \$1.70/pound or \$1.95/pound for roasted and salted.

Medicinal Uses: NA

Cosmetic Uses: NA

Cut/Dried: NA

Miscellaneous: Attractive landscaping plants; seeds eaten by hampsters and birds; retail prices for bird food \$2.25/5 lbs., \$1.75/5 lbs. or \$1.50/5 lbs., depending on the variety; collect in the Fall.

Cost to Plant: (price per plant)

\$5.50	(1-12)	\$1.00	(50-99)
\$1.30	(13-24)	\$.99	(100 +)
\$1.10	(25-49)		

Scientific Name: Lindera benzoin
Common Name: Spice Bush
Indicator Status: KS-FACW; MO-FACW-
Habitat: Occurs in low or moist woodlands and thickets, along streams, valleys, ravine bottoms, base of bluffs, and wooded slopes; confined to the Southeast portion of Missouri.
Culinary Uses: The early flowers, tips of twigs, berries leaves or bark are used for making a tea; the dried berries when powdered are a substitute for allspice.
Medicinal Uses: The colonists used an extract of the leaves or bark to reduce fevers, as a tonic cure for intestinal worms, for dysentery, colds, and coughs; the distilled oil in the berries was used to produce a liniment for rheumatism and bruises; Indians made tea from the twigs to relieve menstrual cramps.
Cosmetic Uses: NA
Cut/Dried Uses: NA
Miscellaneous: A good landscaping shrub for wet areas; chewing on a twig relieves a dry mouth; collect plants from March-May.
Cost to Plant: NA

Scientific Name: Sambucus canadensis

Common Name: Elderberry

Indicator Status: IA-FACW; KS-FAC; MO-FACW; NE-FAC

Habitat: Grows in moist, fertile soil.

Culinary Uses: The flowering umbel can be fried into a fritter; the flowerlets can be rubbed off and used in pancakes, waffles or muffins, or used for pickling; the ripe berries are used for pies and jellies, while the dried berries are a good blueberry substitute in bread goods; the best elderberry wine is made from the ripe berries. Dried elderberries are retail priced at \$2.35/5 ounces for wine; elder flowers also used in wine and beer making sell for \$.98/oz.

Medicinal Uses: The flowers, fruit, leaves, bark and root used to induce vomiting; a tea with peppermint and yarrow is used for colds, rheumatism, sciatica and cystitis.

Cosmetic Uses: An elderflower water has been used for whitening and softening the skin, to remove freckles, as a face tonic and an eye lotion.

Cut/Dried: NA

Miscellaneous: Acts as a fly repellent; when mixed with alum is a lavender or violet dye; attracts beneficial insects for pollination of other plants; a good soil preparer around compost heaps; collect flowers June-July; green berries July, ripe berries August-September.

Cost to Plant: NA

Scientific Name: Diospyros virginiana

Common Name: Persimmon

Habitat: Occurs in rocky or dry open woods and prairies, as well as flood plain woods and valleys along streams.

Indicator Status: IA-FAC; KS-FACU; MO-FAC

Culinary Uses: The ripe fruit is delicious as is, but the pulp is also useful in cakes, breads, pies, butter, candy and jelly; the green or dried leaves make tea with a good source of vitamin C; the seeds can be roasted and ground for a caffeine-free coffee substitute.

Medicinal Uses: NA

Cosmetic Uses: NA

Cut/Dried: NA

Miscellaneous: NA

Cost to Plant: NA

Scientific Name: Cardamine bulbosa
Common Name: Spring Cress
Indicator Status: IA-OBL; KS-OBL; MO-OBL; NE-OBL
Habitat: Wet woodland, wet meadows, around springs,
moist ledges.
Culinary Uses: Use in salads for a hint of horseredish; The
bulb-like base of the stem can be grated,
mixed with vinegar and used as a substitute
for horseredish.
Medicinal Uses: NA
Cosmetic Uses: NA
Cut/Dried: NA
Miscellaneous: Collect March-June
Cost to Plant: NA

Scientific Name: Nasturtium officinale
Common Name: Water Cress
Indicator Status: IA-OBL; KS-OBL; MO-OBL; NE-OBL
Habitat: Cool waters of brooks, creeks, and springs.
Culinary Uses: Leaves good raw in salads or sandwiches, or as a cooked potherb.
Medicinal Uses: NA
Cosmetic Uses: NA
Cut/Dried: NA
Miscellaneous: Collect January-December; a waterfowl food; a rich source of iron, iodine, and vitamins A, B and C.
Cost to Plant: \$7.00/ounce of seed

Scientific Name: Polygonum hydropiper
Common Name: Marshpepper Smartweed
Indicator Status: IA-OBL; KS-OBL; MO-OBL
Habitat: Moist fields and pastures, moist ground near streams.
Culinary Uses: The white-flowering variety has leaves with a very peppery taste; may be used fresh or dried as a substitute for pepper; collect April-November.
Medicinal Uses: NA
Cosmetic Uses: NA
Cut/Dried: NA
Miscellaneous: Seeds eaten by waterfowl; leaves may cause a rash on some people, and sap may cause eyes to "smart" if it comes in contact with them.
Cost to Plant: Roots
\$ 16.00 - \$ 25.00/100
\$ 46.00 /300
\$ 65.00 /500
\$110.00 - \$125.00/1000

Scientific Name:	<u>Sagittaria</u> sp.
Common Name:	Arrowhead
Indicator Status:	IA-OBL; KS-OBL; MO-OBL; NE-OBL
Habitat:	Shallow water, edges of ponds, swampy ground.
Culinary Uses:	Potato-shaped tubers best eaten cooked; a constituent in several Japanese and Chinese meat dishes; protein content of <u>S. trifolia</u> may be 5 to 7%, more than twice the average value of other root crops; tubers are harvested August-November.
Medicinal Uses:	NA
Cosmetic Uses:	NA
Cut/Dried:	NA
Miscellaneous:	An attractive landscaping perennial; tubers eaten by many wildlife species, including ducks which also eat the seeds; fodder for pigs.
Cost to Plant:	<u>Tubers</u> \$ 25.00/ 100 \$ 54.00/ 300 \$150.00/1000

Appendix 4

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