WETLAND WILDLIFE HABITAT MANAGEMENT SPECIFICATIONS

NATURAL RESOURCES CONSERVATION SERVICE

To reduce annual levee maintenance costs, muskrat (*Ondatra zibethicus*), beaver (*Castor candensis*), nutria (*Myocastor coypus*) and other rodent populations should be legally controlled.

CRAWFISH (*Procambarus* species)

The life cycle of crawfish can be manipulated to fit a variety of management requirements and can be integrated into an agricultural crop rotation. There are two basic types of crawfish ponds: permanent and rotational. Permanent ponds are described by having a continuous management scheme applied year after year. Rotational refers to the practice of rotating the annual sequence of crops grown in the pond or rotating the physical location of the pond to another field.

Permanent Crawfish Ponds. The three principal types of permanent pond include single crop ponds, naturally vegetated ponds and wooded ponds. The following crawfish culture cycle is applicable to each of the three pond types.

April – May	Stock 50 – 60 pounds of adult crawfish per acre (new ponds only)
May – June	Drain pond over 2 – 4 week period
June – August	Plant crawfish forage crop or manage natural vegetation
October	Re-flood pond (based on air temperature)
November – May/June	Harvest crawfish
May – June	Drain pond and repeat cycle without restocking crawfish

Single Crop Crawfish Pond. These ponds are constructed and managed solely for the purpose of cultivating crawfish. During the summer (May-August), a forage crop is allowed to grow. Crawfish can be harvested in single crop ponds one to two months longer than rotational systems because there is no overlap with planting, draining and harvesting schedules of other crops. Pond design is often optimized to improve production by using baffle levees and re-circulation systems.

Naturally Vegetated Ponds. This term refers to marsh impoundments and agricultural lands that are managed to encourage the growth of naturally occurring vegetation. These are typically constructed in wetland areas containing high amounts of organic matter in the soil. This often lowers water quality, decreasing crawfish production. Although these ponds may be managed exclusively for crawfish, production is often sporadic.

Wooded Ponds. These ponds are typically built on heavy clay soils in forested (cypress-tupelo swamp) areas. Production is limited by the inability to manage water effectively. Wooded ponds have poor stands of vegetated forage and water temperatures tend to be lower because of shading. Leaf litter provides the bulk of forage, but rapid leaf fall can cause poor water quality. Water flow and crawfish harvest are difficult because trees hinder water movement and obstruct boat access. Some positive aspects of wooded ponds include low initial start-up costs and the potential for waterfowl hunting.

Rotational Crawfish Ponds. The most common crawfish-agronomic crop rotations are rice-crawfish-rice, rice-crawfish-soybeans, rice-crawfish-fallow and field rotation. In the rice-crawfish-rice rotation,

rice and crawfish are double cropped annually. In the rice-crawfish-soybeans rotation, farmers have the opportunity to produce an additional grain crop during the rotation. In the rice-crawfish-fallow rotation, farmers can leave the field fallow for the control of weeds and crawfish overpopulation. In the field rotation culture system, crawfish and an agronomic crop are rotated in the same field for a certain number of years.

Rice-Crawfish-Rice Ponds. Rice fields offer the most readily adaptable area for expanding crawfish culture. Rice farmers are capable of using the same land, equipment, pumps and farm labor already in place. After the grain is harvested, the remaining stubble is fertilized, flooded and allowed to re-grow (ratoon). This ratoon crop serves as a forage base for crawfish. Total production is sometimes decreased because rice culture practices take precedence over crawfish production. Problems include conflicts regarding pesticide use and poor water circulation. Ponds are usually drained early (March 1 – April 1) to replant rice. This greatly shortens the crawfish harvest season and the potential crawfish yield.

March – April	Plant rice
June	At permanent rice flood (rice 8 – 10 inches high), stock 50 to 60 pounds of adult crawfish per acre
August	Drain pond and harvest rice (later in north Louisiana)
October	Re-flood rice field
November – April	Harvest crawfish
March – April	Drain pond and replant rice

Rice–Crawfish-Soybeans. This rotation allows for the production of three crops in two years. It also has the advantage of a longer crawfish harvest season than the rice-crawfish-rice rotation. Pesticide use is an important management consideration.

March – April	Plant rice
June	Stock 50 to 60 pounds of adult crawfish per acre at permanent flood
August	Drain field and harvest rice
October	Re-flood rice field
November – May	Harvest crawfish
Late May – June	Drain pond and replant soybeans
October – November	Harvest soybeans
November – March	Re-flood pond and harvest crawfish
March – April	Plant rice (restocking crawfish is probably necessary)

Rice-Crawfish-Fallow. This rotation allows the farmer to leave the land fallow for a certain period. This is a common practice in the rice-producing region in southwest Louisiana. This fallow period allows the farmer to break the cycle of certain weeds and also prevents the overpopulation of crawfish.

March – April	Plant rice
June	Stock 50 to 60 pounds of adult crawfish per acre at permanent flood
August	Drain field and harvest rice
October	Re-flood rice field
November – June/July	Harvest crawfish
July	Drain pond
August – March	Fallow
March – April	Plant rice

Field Rotation. After several years in production, rotational ponds may develop stunted crawfish populations from over population. One method of overcoming this problem is to rotate the location in which the crawfish are grown. Once a stunting problem has been verified, mature crawfish from the affected pond may be used to stock a new pond that will be used in a crawfish-agronomic rotation. The affected pond is simply left dry during the normal part of the cycle that crawfish would be harvested. By reducing the density of reproducing females, stunting is reduced.

Pond Location. Crawfish ponds should be located in flat, open areas, and the soils should have sufficient amounts of clay to support the burrowing and hold water.

Pond Construction. Perimeter levees should have a core trench cleared of debris to prevent seepage. The minimum perimeter levee base should be in accordance with NRCS standards and specifications on Dikes (356) to prevent leakage from burrowing activities. Typically, a levee system should be designed to contain 8-12 inches in rotational ponds and 18-22 inches in permanent ponds to cultivate crawfish. The land should have no more than a six-inch fall between perimeter levees. Otherwise, the area should be leveled or divided into two or more ponds. Ponds with steep elevation differences restrict water management and reduce harvest efficiency. Interior ditches reduce circulation and areas away from the channel may be low in dissolved oxygen. This reduces the effective production area and makes complete drainage difficult. Any areas difficult to drain may serve as refuge for predatory fish. Interior or baffle levees are constructed to guide water through the pond for proper aeration and to assist in maintaining water quality. Baffle levees should be approximately six feet wide at the base. They should extend a minimum of six inches above the water level after substantial settling. Baffle levees should be spaced 150 to 300 feet apart to facilitate water circulation. Core trenches in baffle levees are not necessary. Land-water interface afforded by levees is important for the burrows used by crawfish broodstock. A re-circulation canal outside the perimeter levee, and a re-lift pump or paddlewheel aerator will aid in water circulation and minimize water discharge.

Ponds designed to re-circulate water are important in areas where the quality of the surface water supply fluctuates or where well water must be pumped from great depths. Drains should be matched with the pond size, pumping capacity and projected rainfall. Ponds must allow vehicle access in wet and dry conditions and allow efficient use of harvesting equipment. Refer to NRCS standards and specifications on Dikes (356), Water Control Structures (587) and Access Road (560).

Water Supply. Surface and subsurface water are acceptable for crawfish farming. Wells provide predator free water, but have limited discharge capacity, higher pumping costs and must be oxygenated. Well water often contains soluble iron and hydrogen sulfide that must be removed before the water enters the pond. Surface water is desirable if it is pollution free and fish can be screened out.

Water Quantity. A pumping capacity of 70 to 100 gallons per minute per surface acre is recommended for intensive management. This rate is needed to exchange all the water in the pond over a four to five day period.

Re-circulating and/or flushing the pond with fresh, oxygenated water maintains satisfactory water quality.

Water Quality. Dissolved oxygen is an important water quality parameter in crawfish production. Temperature has a major effect on oxygen level in ponds. Warm water cannot hold as much oxygen as cold water. Higher temperatures also increase biological activity, which consumes oxygen. Low dissolved oxygen is a critical problem in crawfish production, especially during the first two to six weeks after initial flood-up. Dissolved oxygen should be maintained above three parts per million (ppm). Dissolved oxygen should be measured regularly, especially during warm, cloudy weather. Dissolved oxygen is lowest in the morning so this is when it should be checked.

The water pH should range from 6.5-7.5 at dawn, and both total hardness and alkalinity should range between 50-250 ppm as calcium carbonate. Agricultural limestone can be incorporated into the pond bottom to increase these parameters if needed.

Un-ionized ammonia and nitrate are toxic to crawfish at concentrations exceeding 2 and 4 ppm respectively. Concentrations this high are not likely to occur in crawfish ponds because production intensity is low and ammonia is rapidly taken up by aquatic plants. Iron and hydrogen sulfide are toxic to crawfish at concentrations often found in subsurface well water; however, the two compounds are lowered to non-harmful concentrations when well water is oxygenated. Where iron and hydrogen sulfide concentrations are high, it may be necessary to place a flume ditch between the well and crawfish pond to allow the iron to precipitate out.

Crawfish producers in coastal regions should also monitor tidal influenced surface water during drought periods. Adult crawfish can tolerate salinity as high as 35 parts per thousand (ppt) for a very short term, but spawning is affected at 12-15 ppt. Newly hatched young die at 15 ppt. Salinity also affects the type of vegetation grown for forage.

Re-Circulation. Aerated water must be transported through the pond to reach the crawfish to achieve maximum survival, growth and yield. Water should be guided through the pond by a series of small, internal baffle levees, which direct the flow of water throughout all areas of the pond (*Figure 1*). Mechanical paddle-wheeled type aerators, ¼ to $^{1}/3$ horsepower per surface acre can be used to aerate and circulate the crawfish pond water with more cost effectiveness than water replacement by pumping.

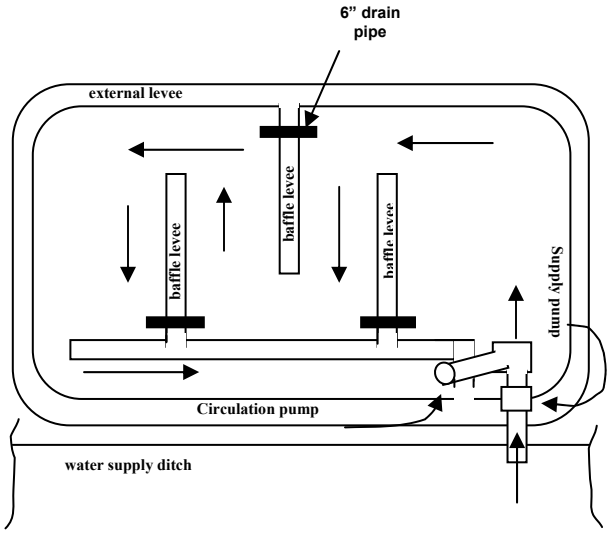

Figure 1. Construction plan for a crawfish pond showing a perimeter levee and baffle levees with recirculation capabilities.

Forages. Although some type of vegetation must be utilized for forage, the main role of green vegetation is to furnish the material for decay, which becomes detritus. As organic matter (vegetation) decomposes, bacteria, other microorganisms and small animals (invertebrates) aid in decomposition. These organisms increase the nutritional quality of the vegetative forage. Crawfish production requires that the forage provide materials to the underwater food web throughout the growing season. Premature depletion of the vegetative forage can be a limiting factor for crawfish production. Vegetative forage must continually and consistently provide adequate amounts of material to the detrital system for the duration of the nine-month production season. Two basic forage systems are used for crawfish production. They are 1) the use of planted and cultivated forage crops and 2) the use of voluntary natural vegetation.

Planted and Cultivated Forages. Cultivated forages provide a controlled detrital based system that result in good crawfish yields. Planting a cultivated agronomic crop is the most dependable method at providing suitable crawfish forage. It allows the farmer to control the type and amount of available forage. Forage density is more predictable with an agronomic crop because cultural practices are well established. The preferred forage to plant for crawfish is rice (*Oryza sativa*). Rice is grown for forage in most crawfish ponds in Louisiana. Rice has less of a negative impact on water quality than terrestrial plants because of its semi-aquatic nature and resistance to lodging. Rice can be planted for grain production with the post-harvest residue (stubble) and re-growth (ratoon) serving as crawfish forage, or it can be planted solely as crawfish forage. Even when rice is not grown for grain, it is necessary to provide fertilizer to assure growth and development.

Sorghum-sudangrass (*Sorghum* sp.) should be used only in ponds where forage is to be planted in late summer solely for crawfish. Because of its growth potential, target-planting dates should be early August through early September. Planting should not be postponed too long since cooler weather and short days of early fall may inhibit plant establishment growth. Early plantings will result in tall, mature plants at flooding. If planted early, vegetation should be cut to one or two inch stubble in early to mid-August to allow for re-growth. The harvested sorghum-sudangrass can be baled and left in the pond. Also, if planted too early, sorghum-sudangrass is likely to reach physiological maturity before flood-up and can be detrimental to water quality when plants lodge or large numbers of leaves slough off into

the water. Fertilizers can significantly increase growth and vegetative biomass of sorghum-sudangrass. In some fertile soils, no additional fertilizer will be necessary. Fertilizer application should be based on soil test results. The sorghum hybrids are typically sensitive to low soil pH, but no problem has been observed with soils that average a pH as low as 5.5.

Natural Vegetation. When flooded, voluntary terrestrial vegetation usually decomposes rapidly. This reduces water quality and provides short-lived detrital sources. Aquatic and semi-aquatic plants such as alligatorweed (*Alternanthera philoxeroides*) and smartweeds (*Polygonium* sp.) are superior to terrestrial vegetation because they continue to live when flooded. But, like terrestrial grasses, the aquatic plants may not supply sufficient food to sustain high crawfish yields. Alligatorweed may cover an entire pond, providing high biomass, but crawfish production is unpredictable because much of the plant material is above the water and not available to the food web.

Three major disadvantages of using natural vegetation are:

(1) Stand density varies with location, time of the year and is unpredictable from one year to the next,

(2) Cultural practices for natural plant species are not well understood and

(3) Many natural plants are considered noxious and are unwanted where agronomic crops will be grown in subsequent years.

Two major advantages of using natural vegetation include:

(1) There are no costs associated with planting

(2) and there can be reduced pumping costs in some instances with alligatorweed ponds.

Pesticides. Crawfish are very sensitive to most chemicals and as a result of careless application, production can be eliminated in a short period. Always be safe and read the label of any chemical or compound before using it in or near crawfish ponds.

Stocking. New ponds should be stocked with red swamp crawfish (*Procambarus clarkii*) broodstock beginning April 15th, at the rate of 50-60 pounds of seasonally mature crawfish per acre. Stocking later can be more difficult because the supply of broodstock is less certain. Mature brood crawfish should be stocked within two to three hours after capture. Avoid using crawfish that have been in cool storage because mortality can be high. Broodstock should be transported in a covered vehicle to avoid exposure to wind and sunlight. Stocking other species such as white river crawfish (*Procambarus zonangulus)* is strongly discouraged due to lack of demand and management limitations. The sex ratio should be close to 50% males and 50% females. Size of the broodstock has no impact on the size of the young crawfish produced. When crawfish ponds are initially studied in the spring, the ovaries (located in the head) of females should be observed to determine their stage of maturity. Ideally, about 20% of the females should have tan to darker colored eggs. Crawfish should be stocked in ponds adjacent to baffle or perimeter levees. When stocking a new pond without forage, encourage burrowing by spreading hay along the edge of the pond to provide cover for burrowing and escaping from predators. After an acclimation period of one to two weeks, drain water slowly over three to four weeks to stimulate the crawfish to burrow. There are usually adequate mature crawfish remaining after a production season to supply juveniles for the next season. Restocking is usually not necessary in permanent ponds or when the physical location of the pond does not change.

Timing of Flood-Up. Ponds should not be flooded until the daytime high air temperatures average in the low 80^{o}F range and nighttime lows average 65^{o}-70^{o}F. Flooding green rice or sorghum sudangrass before October 1 may be possible if close attention to oxygen levels is observed and corrective actions (recirculation) is taken when necessary. An early flood in harvested rice fields or naturally vegetated ponds with terrestrial grasses is very risky because the amount of organic matter present. It is better to flood a little later with the possibility of late crawfish than flooding early and losing the young crawfish because of low oxygen conditions.

It is not necessary to put the full amount of water in a pond (8-12 inches in rice/crawfish rotational ponds or 18-22 inches in permanent ponds) during the initial flood-up unless birds or other predators are a problem. Four to six inches of water is usually sufficient. Less water in the pond reduces pumping and there is less water to aerate and replace. Also, less vegetation is exposed to the water column, reducing the amount of decomposition. About 7-10 days after the initial flood, if indicated by low oxygen determinations, it may be necessary to flush or replace the pond water. To flush a pond, drain it down to three inches before pumping unless predators are a problem. The fresh aerated water will flow through the pond, pushing the bad water out the overflow. Results are better if the ponds are constructed with interior baffle levees. Ponds should be flooded every 7-10 days or as indicated necessary by low oxygen levels until temperatures fall below 65^{o}F and oxygen levels stabilize. When oxygen levels increase with cooler air, the water level should be gradually brought up to full depth generally by early to mid December.

Trap Density and Spacing. The number of traps set per acre (density) and spacing between traps are important factors to consider before harvesting. Research indicated that 20-25 traps per acre are the optimum number for efficient harvesting in ponds with a moderate to high standing crop of harvestable crawfish. To achieve this density, the distance between rows should be about 40 feet and distance between traps should be about 50 feet. The distance between traps is critical to the efficiency at which traps can be baited and emptied.

Trapping Frequency. Traps are baited and emptied three to six days per week, depending on the catch, price structure for crawfish and market demand. Most baiting regimes are based on a 12-hour or 24-hour trap set. A 12-hour set entails baiting late in the afternoon and emptying the traps the next morning. A 24-hour set entails baiting one day and emptying and re-baiting the trap 24 hours later. Fewer crawfish escape from the traps on a 12-hour set and more crawfish are caught, but more labor and bait costs are involved. Daily crawfish catch is cyclic and influenced by many factors including water temperature, water quality, weather, forage type and quality, crawfish growth, recruitment patterns, trap design, baits and harvesting intensity. The major factor influencing catch is density of harvestable crawfish in the pond. Daily catch rates typically range from ¼ to 3 pounds per trap per day. Premium prices offered for late fall to early winter crawfish have caused many farmers to try to manage for an early harvest. Some crawfish ponds will be ready to fish as early as mid-November. At this time, catches are usually small (1/4 to 1 pound per trap), and are made up of holdover adults, large juveniles that did not mature in the previous year and the rapidly growing juveniles. There is usually a gap between the catch of holdover crawfish and the juveniles. Before harvesting early, consider egg development, population density, pounds per trap harvested, cost of harvesting and the current price per pound.

De-Watering (Draining) Ponds. No specific date is considered the perfect time to drain a crawfish pond. There are a number of factors to consider before draining. The existing crawfish population should be evaluated before making a final decision to drain. In a normal situation, draining and/or releasing the water could begin when at least 20% of the female crawfish shows signs of egg development. Ponds should be drained over a 10 to 14 day period for older, established ponds. Two important issues when draining a pond include: 1) making sure 20% of the females are in the tan or brown eggs stage or burrowing is beginning, and 2) to drain off the water slowly 1 to 1½ inches per day except where crawfish are stunted. Draining a crawfish pond early (March) to plant a rice crop often forces immature crawfish to burrow into the levees. This could delay next year's harvest. Waiting until late (May-June) to drain a pond will allow a higher percentage of crawfish to reach maturity and ensure that a larger number of crawfish will burrow. If the decision is made to cease harvesting, and the pond population is dominated by immature young, a different draining scheme should be used. In this situation, drop the water level quickly to 8-10 inches, then hold until the water temperature increases. Dropping the water and allowing the water temperature to rise will induce the crawfish to mature quickly and begin burrowing activity.

Post Season Care. In summer, minor levee work around a crawfish pond can be performed. Ten to twelve inches of loose soil can be added to the top of the burrows without causing serious crawfish mortalities, but the less soil added, the better. When levee work is necessary, if at all possible, use

soil from outside the pond. The fewer disturbances to the interior portion of the levee where crawfish burrow, the better the crawfish survival rate. Preparing a seedbed in a crawfish pond to plant forage can be done with little or no effect on crawfish that have already burrowed. Land leveling or major levee repair will increase crawfish mortality. Severe compacting of soil by heavy equipment may not allow crawfish to escape burrows and will result in death. In these cases, 10-15 pounds of mature broodstock should be added to the pond after leveling or major repair**.**

WATER FOWL

Migratory Ducks. Louisiana winters a large portion of the ducks utilizing the Mississippi Flyway. These ducks basically can be divided into two major groups – diving ducks and dabbling ducks.

Diving Ducks. Examples of diving ducks include: redhead (*Aythya americana*), canvasback (*Aythya valisineria*), ring-necked duck (*Aythya collaris*), greater scaup (*Aythya marila*), and lesser scaup (*Aythya affinis*). Common goldeneye (*Bucephala clangula*), bufflehead (*Bucephala albeola*), ruddy duck (*Oxyura jamaicensis*), and scoters (*Melanitta* sp.) are deepwater ducks which are often labeled diving ducks. Diving ducks cannot walk well on land. They generally dive to feed off the bottom or on submerged plants and run along the surface of the water to become airborne. They usually congregate in large flats and frequent lakes, rivers, coastal estuaries and large impoundments. Diving ducks consume approximately ten percent of their body weight in food daily, meeting their nutritional requirements by eating a variety of aquatic invertebrates, plants and seeds. Although wintering diving ducks in Louisiana do utilize shallow water areas, large, somewhat deeper impoundments with adequate water quality providing vast plant life are needed. This factor limits management capabilities, however, reducing erosion, sedimentation, pollution and overall protection of water quality and conservation of these large wintering habitats will provide requirements needed by these species.

Dabbling Ducks. Dabbling ducks, also called puddle ducks, include mallards (*Anas platyrhynchos*), black ducks (*Anas rubripes*), gadwall (*Anas strepera*), northern pintail (*Anas acuta*), green-winged teal (*Anas crecca*), blue-winged teal (*Anas discors*), cinnamon teal (*Anas cyanoptera*), northern shoveler (*Anas clypeata*), and American wigeon (*Anas americana*). Dabbling ducks can walk well on land. They “tip” to feed rather than dive, and can take off vertically from land or water. Their preferred feeding habitats are flooded (6-12 inches) agricultural lands, forested areas, marsh and riverine wetlands. Dabbling ducks eat about ten percent of their body weight in food each day. They commonly feed on small grains (i.e., rice, corn, soybeans, etc.) in addition to utilizing seeds and other parts from a variety of vegetation and aquatic invertebrates**.**

Habitat for migratory dabbling ducks can be created, restored, and/or enhanced by providing essential wintering life requirements (water, food and security). Refer to NRCS standards and specification on Shallow Water Management for Wildlife (646).

Agricultural Lands. Rice fields are among the most economical areas to flood for waterfowl because the existing levees and water control structures can be utilized. However corn, soybean and grain sorghum residue along with rice stubble can be flooded for wintering habitat. The waste grain and decomposing vegetative matter, which increases invertebrates, provides waterfowl foods. Rice stubble can be lightly disked, rolled or water buffaloed prior to flooding. The procedure of manipulating rice stubble prior to flooding aids in decomposition, which increases invertebrate populations and makes shallow water areas more visible. Agricultural fields should be flooded slowly as soon as possible after harvest coinciding with the arrival of early migratory waterfowl. Flooded areas should be at least three acres in size and as far as possible from human disturbance. At least ten percent of the area should be flooded in early September (or as soon as harvest is complete) to a depth of 2-6 inches. Water levels should then be gradually increased rather than immediately inundating the entire area. By increasing water levels in four to six-inch increments, new areas are flooded and additional food sources gradually become available. This procedure conserves food for

later in winter and provides a range of water depths, which benefit a wider array of waterfowl and other wetland dependent wildlife species. Fields should be completely flooded by December 15th. If controlled flooding is not available, agricultural fields should be made to hold water (close structure) as soon as harvest is complete. Flood-up should be maintained until the following year just prior to seedbed preparation. When de-watering the area, it should be completed gradually (increments of less than six-inches) to concentrate invertebrate food resources.

Moist Soil Areas (Natural Vegetation). Dabbling ducks often concentrate on wet areas where natural foods are abundant. Foods that attract waterfowl are produced regularly on exposed mudflats after a controlled drawdown or when surface water disappears from natural wetlands in spring or summer. Naturally occurring seeds from plants associated with wetlands regularly survive flooding several months or even years, whereas grains such as corn, Japanese millet, domestic rice and soybeans deteriorate rapidly when flooded continuously for 90 days or more. Viable seeds of wetland plants readily germinate in moist habitats when favorable conditions occur. This is usually when moisture is at or slightly below field capacity. An important factor that determines the species composition of moist-soil plants that pioneer on exposed mudflats is the composition of seeds in the soil at the site. Most soils contain ample seeds to produce dense stands of desirable moist soil plants native to the site. Two important factors that determine plant responses to moist-soil manipulation are 1) the timing of annual draw downs and 2) the stage of succession (the number of years since the area was disturbed by disking, plowing, controlled burning, etc.). Mid to late-season drawdowns generally favor millets (*Echinochloa* and *Leptochloa* species) and preferred grasses (*Panicum* sp.). Total seed production, however, is generally greater when impoundments are drained early to mid-season. Early drawdowns occur within the first forty-five days of the growing season, mid-season drawdowns occur within the second forty-five days of the growing season and late season drawdown occur within the remainder of the growing season. While slow drawdowns typically produce diverse vegetative cover, fast (less than two weeks) drawdowns are more likely to result in a stand of similar vegetation. To maximize benefits, units should be drained at varying times and rates if possible. For maximum seed production, native plant communities must be maintained in an early successional stage. The percentage of non-food producing plant species generally tends to increase in each consecutive year the area is not disturbed. Soil disturbance greatly affects the response of native plants to different management techniques. Impoundments should be treated at two to three year intervals to set back succession and control the invasion of undesirable plants. Vegetative succession manipulations should not be more frequent than every two years unless problems with undesirable plants begin. Manipulations every year have the potential to reduce beneficial food plant communities as does the lack of manipulation over several years, allowing the area to move toward a climax state. Plants such as cocklebur (*Xanthium* sp.), coffeeweed (*Sesbania* sp.), cattail (*Typha* sp.), willow (*Salix* sp.), Chinese tallow tree (*Sapium sebiferum*) and other hardwood tree or shrub saplings can out-compete desirable plants. If undesirable plants invade fifty percent or more of the managed area, control by either approved herbicides, disking, shredding, flooding and/or prescribed burning is warranted.

Forested Areas. Lowland hardwood forested areas have been leveed and equipped with water control structures to facilitate flooding to make foods such as acorns, pecans, other seeds and invertebrates available to waterfowl. These areas are often called green-tree reservoirs because flooding occurs during the dormant season. Trees are intended to survive the period of dormant flooding and when floodwaters are withdrawn, they continue to develop foliage and survive the growing season. Long term productivity has often been compromised as a result of modifications in the natural flooding regime. Early and prolonged flooding to greater depths during the dormant season and flooding into the growing season are associated with vegetation changes, lack of regeneration, decreased mast production, tree disease and mortality. Maintaining productivity and producing quality habitat require mimicking natural water regimes. This often requires either short-term shallow flooding, or in some years, no flooding at all. Tree vigor and age are known to influence seed production. Most red oak species begin to produce acorns at 20 to 25 years and production tends to fall off during the latter stages of a tree's life. Lowland forests typically have a variety of woody species that are adapted to different flooding regimes. Each of these species has different

level of tolerance to the timing, depth and duration of flooding. Areas containing species such as bald cypress (*Taxodium distichum*), overcup oak (*Quercus lyrata*), Nuttall oak (*Quercus nuttallii*) and water hickory (*Carya aquatica*) tolerate deeper and longer flooding duration than species such as water oak (*Quercus nigra*), sugarberry (*Celtis laevigata*) and willow oak (*Quercus phellos*). Waterfowl that exploit lowland hardwood forest have diverse requirements for survival, and these forested systems provide many life cycle requirements. Waterfowl are well adapted to respond to fluctuating water where they consume foods that are constantly changing in abundance and availability. No single food source or wetland type provide all the resources required by waterfowl as they progress through the natural annual cycle of biological events. Forested wetland areas should be a portion of the wetland complex that provides diverse food resources in order to provide maximum benefit to waterfowl.

Food Plantings. Within moist soil areas, forested wetland openings, shallow water areas or mudflats, areas can be planted to cultivated domestic crops or native plant food items. A reliable source of water is necessary for this practice. Areas to be planted should be at least three acres in size except in forested openings where ½ acre is acceptable. Slopes should be one percent or less. Most plantings will require de-watering for germination. On freshwater sites, which can be completely de-watered during the growing season, browntop millet (*Panicum ramosum*), dove proso (*Panicum miliaceum*), Japanese millet (*Echinochloa frumentacea*), corn (*Zea mays*), chufa (*Cyperus esculentus*), smartweed (*Polygonium* sp.) and/or delta duck potato (*Sagittaria latifolia*) can be established. In existing intermediate and brackish water ponds, wigeon grass (*Ruppia maritima*) can be transported and transplanted. Wigeon grass grows well when water is fairly cool in early spring and fall. Also, for use in brackish marshes, Saltmarsh bulrush (*Scirpus robustus*) can be established. Seeds should be collected in the fall, stored dry at room temperature and planted in the spring. Tubers also can be dug and transplanted like delta duck potato. The area should be partially flooded (1 to 2 inches per day) by October 15 and completely flooded by December 15. Keep flooded until time to prepare the seedbed for the following year's plantings. Also beware of current migratory bird baiting regulations when planting or manipulating waterfowl foods if the area will be hunted.

Other Ducks

Wood Duck (*Aix sponsa*). Wood ducks nest in woodland areas along lakes, rivers and vegetated wetland areas. During the winter months, wood ducks inhabit bottomland hardwood wetlands, beaver ponds, river outflows, backwaters and other inland freshwater, forested wetland areas. High quality wood duck habitat is intricately linked to preservation and management of overly mature hardwood timber along river and perennial stream corridors and the availability of suitable nesting sites and brood rearing habitat.

Food. The early diet of ducklings largely consists of insects, aquatic invertebrates, small fish and other high protein animal matter. After six weeks of age, the young switch to plant foods until their diet consists of approximately ninety percent vegetative materials, primarily aquatic plants such as algae (*Chlamydomonas* sp., *Phacus* sp., *Cosmarium* sp, etc.), watershield (*Brasenia schreberi*) and duckweed (*Lemna minor*). Adult wood ducks feed on a variety of nuts and fruits, aquatic plants and seeds, and aquatic insects and other aquatic invertebrates. Insects and aquatic invertebrates are particularly important food items of adult hens during egg laying in spring. Acorns and other forest mast are important fall and winter foods. Seeds of native sweet pecan (*Carya illinoesis*), cypress, hickory, (*Carya* sp.) sweetgum (*Liquidambar styraciflua*), buttonbush (*Cephalanthus occidentalis*), domestic and wild rice, soybeans, corn and sorghum are also common fall/winter foods. Wood ducks feed primarily in shallow water areas, but will also forage on the forest floor for seeds, acorns and nuts. Protecting, restoring and enhancing floodplain timber and riparian habitats and eliminating competition for food items from livestock within these habitats is needed to provide food requirements for wood ducks. Refer to NRCS Standards and Specifications on Tree and Shrub Establishment (612), Forest Stand Improvement (666), Riparian Forest Buffer (391) and Access Control (472).

While the normal brood size for wood ducks is 10 to 15, nests have been found to contain 30 eggs or more. These extra eggs are the result of intraspecific brood parasitism or “dump nesting”. Dump nesting occurs when a female, frequently a first year breeder, follows another hen to nest sites during the egg-laying period. The visiting bird is stimulated to lay her eggs in the nest of the other hen. In the wild, this impulse is kept in check because wood ducks normally nest in isolated locations. Artificial nesting structures are often mistakenly erected close together and/or in highly visible locations. This creates a situation where dump nesting is common and overall reproductive success decreases. Because of this, it is critical to locate nest boxes in isolated locations mimicing naturally occuring tree cavities. Although it may take nesting pairs longer to locate these types of nest boxes, nesting success should be high when found. Also, nest boxes should be placed 600 feet apart and should not be visible to one another. Once a nest box program has been started, a regular annual inspection should be made during early winter (December) and/or well after the nesting season has ended in late summer. Old egg shells, wasp nests, any unhatched eggs, etc., should be removed and general repairs to the box and the predator guard should be done. Nesting litter (coarse sawdust) should be replaced at least every other year. Disturbance of the hen during nesting season (February through June) may cause her to abandon the nest. It is a violation of federal migratory bird statutes to destroy or disturb the nests or eggs of migratory birds.

Brood-Rearing Cover. Wood duck broods require shallow water for foraging on invertebrates and aquatic plants that contain some protective cover from predators. A ratio of fifty to seventy-five percent cover to fifty to seventy-five percent open water is preferred as brood rearing (and breeding) habitat. Cover may be provided by trees or shrubs overhanging the water, flooded woody vegetation and herbaceous emergent vegetation. Ideal shrub cover is provided by mature shrubs that provide a dense canopy about two feet above the water surface. Buttonbush is an important species in the majority of Louisiana, due to the brushy growth form, providing brood cover, and its prolific seed production, used heavily by foraging adults. Reliance on permanent, deeper water bodies for brood habitat should be avoided to minimize duckling mortality from aquatic predators such as snapping turtles and large fish. Adult molting cover requirements are generally met by suitable brood rearing habitat. Permanent water, cover and food are the key elements of molting habitat.

Winter Cover. In Louisiana, areas where resident and migratory wood ducks winter are similar to brood-rearing habitat. Bottomland hardwood wetlands and quiet river backwaters and streams with an abundance of flooded timber, shrubs and woody debris provide wintering habitats. Winter persistent herbaceous emergent vegetation that has shrubby form (i.e., cattail, softrush (*Juncus* sp.), cutgrass (*Zizeniropis miliacea*), etc. may also provide adequate winter cover. Security provided by overhead woody cover is the key element of good wood duck roosting habitat.

Interspersion of Habitats. In order for successful wood duck reproduction and survival to occur, all the habitat components must be available in relative proximity to one another. Since wood ducks are highly mobile during winter, the most critical aspect of habitat interspersion, or the mix of different habitat types, is the proximity of brood-rearing habitat to nesting habitat in the spring. The highest quality nesting habitat is of little use if the nearest brood-rearing habitat is more than a mile away. Also, the best brood-rearing habitat will not support wood duck broods if there is no nesting habitat in the vicinity. The best habitats consist of a complex of forested wetland habitat that include some non-flooded hardwood forests, green-tree reservoirs, rivers, oxbows, riparian corridors, beaver ponds, shrub-scrub and dense emergent herbaceous wetlands. Because wood ducks are able to nest some distance from brood-rearing habitat, no reasonable estimate of minimum nesting habitat size

exists. In addition, no good estimates for minimum wintering habitat area are available due to the high mobility of wintering birds. However at least ten acres of wetland or other aquatic habitat in a contiguous unit, or, in isolated parcels separated by no more than 100 feet of upland, is needed in close proximity to nesting habitat to support brood-rearing.

Mottled Duck (*Anas fulvigula*). The mottled duck is unique in that it is the only duck north of Mexico that does not migrate. It may move 100 miles or more along the coast, but it is likely to spend summer and winter on the same marsh. Because it inhabits the same habitat throughout the year, its fate rests in the hands of those responsible for the existence and quality of the coastal wetlands.

Wintering Habitat. Mottled duck wintering habitat needs are similar to the many migratory dabbling ducks that annually utilize Louisiana's gulf coastal wetlands. Improvements and management criteria listed for these species can be utilized to benefit the wintering requirements of the mottled duck.

Nesting Habitat. Being a resident of the Louisiana coastal marsh and prairie area, habitats and requirements with other dabbling duck species cease with the pairing of mottled ducks in February, but coincide with other waterbirds such as fulvous tree ducks (*Dendrocygua bicolor*) and members of the Rail (*Rallidae*) family. The peak nesting period is March, April and May. In February and March, mated pairs of mottled ducks explore fallow rice fields, grassy meadows and cordgrass ridges along the edge of the marsh looking for suitable nest sites. Mottled duck nests are found in varying habitat situation, but by far the most commonly used habitat type is an association of marshhay cordgrass (*Spartina patens*) and gulf cordgrass (*Spartina spartinae*) dominant over other grasses. Areas with highest nest densities are well drained cordgrass ridges located immediately adjacent to permanently wet marsh. Other productive nest habitats include rice fields, cattle pastures and other prairie sites dominated with smutgrass (*Sporobolus indicus*), paspalums and bluestems (*Andropogon* sp.). Improved pastures featuring coastal bermuda offer little to mottled duck production.

Brood-rearing Habitat. Food, shallow water and escape cover are prerequisites for adequate brood-rearing habitat. Mottled ducks nesting in cattle pastures and rice production areas rely on overgrown ditches. Densely vegetated flume ditches or small ponds support vertabrate and inverbrate life along with grasses and other aquatic plants. Mottled ducks nesting near coastal marsh utilize nutria/muskrat "eat-out" ponds or marsh that was opened previously by fire that left scattered patches of cordgrasses in shallow open-water. Salinity does not appear to be a limiting factor in mottled duck production.

Habitat Management. The most serious problem facing mottled ducks is the dwindling and deteriorating habitat. This is compounded by periodic dry weather conditions to further reduce surface water across the prairie and marsh range. Practices which maintain, conserve and preserve a healthy coastal marsh environment are paramount. Marsh and prairie habitats should be protected against any extensive drainage, conversion or other deteriorating measures. Also, furbearers and alligators should be controlled through legal means. Racoons, skunks, mink and alligators are effective predators of mottled ducks and pose serious population impacts when allowed to thrive at or above carrying capacity.

Migratory Geese. Louisiana winters a significant portion of the geese utilizing the Mississippi Flyway. This includes blue and white morphs of the snow goose (*Chen caerulescens*), the white-fronted goose (*Anser albifrons*), and to a lesser extent, the Ross' goose (*Chen rossii*) and the Canada goose (*Branta canadensis*).

Habitat for migratory geese can be created, restored and/or enhanced much the same as for migratory dabbling ducks, however geese tend to require larger open areas and commonly tolerate dry or only shallowly flooded habitats.

Agricultural Lands. Large open rice fields, soybean fields and pastures provide much of the needed security geese require. Although grain is utilized, geese are primarily grazers. All geese eat tender shoots, leaves, roots and tubers of plants. Commonly utilized agricultural plants include rice, rice sprouts, annual rye, ryegrass, wheat and clovers. The establishment of these plants should coincide with the first arrival of geese, typically by late October. Although there is no minimum size field utilized by geese, the larger the better. With excellent vision, geese utilize wide open spaces for security. Tall vegetation within fields is also undesirable. Burning of cropland and rank vegetation within fields promotes new growth and increases visibility. Burns should be conducted approximately three weeks prior to arrival and should be conducted if enough acreage is available. Be aware of current migratory bird baiting regulations when planting or manipulating waterfowl foods if the area will be hunted.

Marsh. Much of the same activities which enhance agricultural lands for geese will enhance marsh. The burning of fresh, intermediate and brackish marsh from September to February favors the production of tender young shoots and clears the ground of heavy rank vegetation so that geese have access to roots, tubers and new growth of marsh vegetation. Burning sets back vegetative succession and encourages beneficial plants such as Olney bulrush (*Scirpus olneyi*), leafy three-square (*Scirpus maritimus*) and American bulrush (*Scirpus americanus*). Prescribed burns should be made two to three weeks before their arrival. A series of these burns two to three weeks apart can be spread over the winter months to keep tender vegetation available.

Although geese commonly utilize dry habitats, the presence of fresh water is needed daily. Shallow (two inches or less) floods on portions of the feeding habitat or open water in association with feeding habitat enhance the area for use.

NON-GAME BIRDS

Louisiana is home to a wide variety of wetland dependent non-game bird species. Depending on the species, habitat recommendations could be significantly different. Habitat requirements for one species may actually conflict with life requirements of another species. For example, the concept of increasing biological diversity by increasing the amount of transitional areas between habitats (edge-effect) has long been thought to provide richness in food, cover and other life requirements, especially for game species. However, some wildlife species (i.e., forest interior birds) appear to exhibit low reproduction success where edge habitats appear to concentrate the negative effects of nest predators.

Shorebirds are a morphologically diverse group that explore the shallowest end of the wetland complex. During migrations, shorebirds are associated primarily with shallowly flooded coastal, freshwater wetlands or intertidal mudflats with over seventy percent using water depths of less than four inches. Providing quality habitat for shorebirds requires correctly identifying relationships among species requirements, the time required to meet these needs and the availabilty of foods. Practices benefitting shorebirds should focus on developing a food base that will be continuously available. Sensitivity to disturbances caused by human activities should also be considered for all avian groups. Minor changes in water depth, timing and duration of drawdowns or reflooding within a wetland complex can provide beneficial habitat for several species. For specific recommendations pertaining to managing habitat for a target non-game species, contact a NRCS wildlife biologist.

Common Snipe (*Gallinago gallinago*). The common snipe is a migratory shorebird that is abundant in the fall, winter and spring in Louisiana. Snipe begin arriving in late August and may reside in Louisiana as late as June. Snipe frequent wet cropland fields, pastures, marshes, grassy meadows and lake shores. Snipe require open areas utilizing vision and distance for security. Tall vegetation is avoided. Snipe use their bill to probe wet soils for

invertebrates usually associated with decomposing vegetative material. Earthworms, insect larva and crustaceans make up the bulk of the snipe diet.

Agricultural Lands. Fields should be flat, low and of watertight soils (clay). Approximately ten acres is the minimum needed to consistently provide habitat requirements for snipe. A water control system (low levee and structure) is needed to establish a low flood (saturation to two inches) and enable the field to be drained to access with farm implements. Disk rice stubble or other crop residue, or chop native vegetation prior to flooding. Begin flooding fields in late August and early September and gradually increase flooding until the entire area is flooded by December 15th. This procedure conserves food for later in winter and provides a range of habitat conditions beneficial to several shorebirds, wading birds and wetland dependent wildlife species. If controlled flooding is not available, structures should be closed as soon as possible in late summer/early fall. De-watering the area should also be done gradually, as late as possible in the spring, just prior to seedbed preparation.

American Woodcock (*Philohela minor*). The American woodcock is somewhat common over the majority of the Louisiana landscape, except the coastal marshes, from mid-October to early February. Although a shorebird, the woodcock inhabits dense woodlands by day and feeds in fields at night.

Woodcock prefer areas of thick vegetation which offer little ground cover but dense overhead cover. The sparse ground cover allows this bird to move freely and probe wet soils for earthworms while the overhead cover provides protection from predators. Nocturnal field habitat comes in many forms – harvested soybean fields, sugarcane fields, pastures and in the pine dominated coastal plain - new clearcuts. The characteristics of a good nocturnal field are similar to those of a good daytime habitat. Adequate moisture and sparse ground cover are the most important requirements. Providing fields in close proximity to daytime habitat can enhance woodcock habitat. Prescribed burning can be used to create good nocturnal fields for woodcock. Burning removes layers of grass and dead vegetation while retaining scattered stalks and patches of cover that can provide desirable vertical structure. A low lying field containing scattered areas of saturated or shallowly ponded water throughout winter is the best site for nocturnal habitat. Wet fields dominated by broomsedge (*Andropogon virginicus*) and/or golden rod (*Solidago* sp.) provide excellent nocturnal habitat when prescribed burned. Mowing and controlled grazing can also be used to create nocturnal habitat. Portions of wet fields should be kept closely mowed or grazed throughout the winter months. Dwindling and deteriorating diurnal habitat is a problem facing woodcock populations. Practices which establish, maintain and conserve their hardwood overhead cover is essential especially adjacent to wet areas. Adequate woodland habitat should be protected against conversion or deteriorating measures

THEATENED AND ENDANGERED WETLAND WIDLIFE

There are several plants, invertebrate species, reptiles, birds, mammals and ecosystems associated with wetland habitats that have significantly declined. Careful consideration should be given toward the impacts to threatened and endangered species and ecosystems during the planning process. Management recommendations are specific to limiting factors associated with the species or ecosystem. To obtain planning information regarding habitat improvements for threatened or endangered species contact a NRCS wildlife biologist.

Wetland Habitat Preservation and Maintenance. Retention of existing wetland wildlife habitat by limiting agronomic, forestry, husbandry, urbanization, land use conversions, and negatively impacting disturbances and by applying necessary measures which thwart degradation is considered wetland wildlife habitat preservation and maintenance. For example, if a livestock producer is grazing one hundred fifty cattle on a marsh and reduces the herd by the necessary amount to improve the conditions for wildlife, this is considered

maintaining and preserving wetland wildlife habitat. Preservation and maintenance of wetland wildlife habitat is intended to continue to provide all existing habitat requirements. Neither the quality of the habitat nor the population need to acertain predetermined levels. The conservation plan must contain management measures specific to how the habitat will be maintained and preserved. The practice is acccomplished when:

1) The existing hydrology is maintained through limiting drainage, or operation and maintenance of water control structures to mimic the necessary conditions.

2) The area is not planned for intensive range or woodland management that would compromise the integrity of the habitat. However, limited use by domestic livestock, timber removal or the use of prescribed burning that does not significantly change the existing vegetative community, may be needed to maintain the existing beneficial habitat conditions.

REFERENCES

1993. M. K. Laubhan, L. H. Fredrickson. Integrated Wetland Management: Concepts and Opportunities. Specialn Session G. Wetland Management for Shorebirds and Other Species. Reprinted from Transactions of the 58the North American Wildlife and Natural Rsources Conferences.

1988. Stutzonbaker, E. D. The Mottled Duck, Its Life History, Ecology and Management. Texas Parks and Wildlife Department. Austin, Texas.

1993. Ducks Unlimited, Inc. Mississippi Cooperative Extension Service. Arkansas Game and Fish Commission. Waterfowl Habitat Management Handbook for the Lower Mississippi River Valley. Publication 1864.

1951. Martin, A. C., Zim, H. S., Nelson, A. L., American Wildlife and Plants – A Guide to Wildlife Food Habits. Dover Publications, Inc., New York.

1977. Halls, L. K., Southern Fruit-Producing Woody Plants Used by Wildlife, Southern Forest Experiment Station, Forest Service, USDA.

1988. Duncan, W. H., Duncan, M. B.,Trees of Southern United States. University of Georgia, Athern, Georgia.

1991. Ball, D. M., Hoveland, C. S., Lacefield, G. D., Southern Forages, Potash & Phosphate Institute and the Foundation for Agronomic Research. Williams Printing Complany, Atlanta, Georgia.

1996. Louisiana State University Agricultural Center, Louisiana Cooperative Extension Service. Crawfish Production Manual. Publication 2637.

1988. Fredrickson, L. H., Reid, F. A. 13.3.1 Invertabrate Response to Wetland Management, Waterfowl Managemanagement Handbook, Fish and Wildlife Leaflet 13, USDA, USFWS.

1974. Lowery, G. H., Louisiana Birds, Louisiana Wildlife and Fisheries Commission, Louisiana State Press, Baton Rouge, Louisiana.

Wildife Habitat Management Institute. Wood Duck (*Aix sponsa*). Fish and Wildlife Habitat Management Leaflet. USDA-NRCS.

PARTIAL LISTS OF PLANT MATERIALS BENEFICIAL TO WILDLIFE

Refer to Practice Code 612, 327, and/or 342 for specific establishment (e.g. seeding rates, dates, etc).

Note; seeding/planting rates may be adjusted to reflect occurrence of existing vegetation (e.g. interseeding, etc.) with recommendations from State Plant Materials, State Range Conservationist, State Forester, or State Wildlife Biologist as applicable.

Table 1. Partial List of Native Tree Species Beneficial to Wildlife (Refer to Practice 612 for specific rates and dates)

Hardwood Trees

Species

Nuttall oak (*Quercus nuttallii*)

water oak (*Quercus nigra*)

willow oak (*Quercus phellos*)

shumard oak (*Quercus shumardii*)

bald cypress (*Taxodium distichum*)

sugarberry (*Celtis laevigata*)

tupleo gum (*Nyssa aquatica*)

overcup oak (*Quercus lyrata*)

cherrybark oak (*Quercus pagoda*)

cow oak (*Quercus michauxii*)

laurel oak (*Quercus laurifolia*)

native sweet pecan (*Carya illinoensis*)

bitter pecan (*Carya aquatica*)

persimmon (*Diospyros virginiana*)

red mulberry (*Morus rubra*)

red maple (*Acer rubrum*)

cedar elm (*Ulmus crassifolia*)

American elm (*Ulmus americana*)

sweetgum (*Liquidambar styraciflua*)

black mangrove (*Avicennia germinans*)

Evergreen (Coniferous Trees)

Species

longleaf pine (*Pinus palustris*)

loblolly pine (*Pinus taeda*)

slash pine (*Pinus elliottii*)

spruce pine (*Pinus glabra*)

Table 2. Partial List of Introduced Tree Species Beneficial to Wildlife (Refer to Practice 612 for specific rates and dates)

Trees
Species
sawtooth oak (*Quercus acutissima*)
pear (*Pyrus communis*)
Japanese persimmon (*Diospyros kaki*)
Japanese plum or loquat (*Eriobtrya japonica*)

Table 3. Partial List of Native Shrub Species Beneficial to Wildlife (Refer to Practice 612 for specific rates and dates)

Shrubs
Species
buttonbush (*Cephalanthus occidentalis*)
deciduous holly (*Ilex decidua*)
mayhaw (*Crataegus opaca*)
roughleaf dogwood (*Cornus drummondii*)
elderberry (*Sambucus canadensis*)
swamp dogwood (*Cornus stricta*)
swamp privet (*Forestiera acuminata*)

Table 4. Partial List of Native Grass/Forb/Legume Species Beneficial to Wildlife (these species are typically utilized as diverse mixtures) (refer to Practice 327 for specific rates and dates)

Grass/Forb/Legume
Species
Indiangrass (*Sorghastrum nutans*)
switchgrass (*Panicum virgatum*)
Illinois bundleflower (*Desmanthus illioensis*)
sweet coneflower (*Rudbeckia subtomentosa*)
rattlesnake master (*Eryngium yuccifolium*)
eastern gamagrass (*Tripsacum dactyloides*)
plains coreopsis (*Coreopsis tinctoria*)
beggarweeds (*Desmondium* sp.)
Virginia wildrye (*Elymus virginicus*)

Table 5. Partial List of Native and Introduced Grass/Forb/Legume/ Species Beneficial To Wildlife Through Water Level, Soil and Vegetative Manipulations

Grass/Forb/Legume
Species
delta duck potato (*Sagittaria platyphylla*)
smartweed (*Polygonum* sp.)
coast cockspur (*Echinochloa walteri*)
dwarf spikerush (*Eleocharis parvula*)
American bulrush (*Scirpus americanus*)
leafy three-square (*Scirpus maritimus*)
three cornered grass (*Scirpus olneyi*)
small pondweed (*Potamogeton pusillus*)
bearded sprangletop (*Leptochloa fascicularis*)
sprangletop (*Leptochloa attenuata)*
sedge (*Carex/Cyperus* sp.)
barnyard grass (*Echinochloa crus-galli*)
red rice (*Oryza sativa*)
fall panicum (*Panicum dichotomiflorum*)
savannah panic grass (*Panicum gymnocarpon*)
broadleaf signalgrass (*Brachiaria platyphylla*)
rice cutgrass (*Leersia oryzoides*)
wigeon grass (*Ruppia maritima*)
saltmarsh bulrush (*Scirpus robustus*)
gulf cordgrass (*Spartina spartinae*)
marshhay cordgrass (*Spartina patens*)

Table 6. Partial List of Introduced Grass/Forb/Legume/ Species Beneficial to Wildlife (Refer to Practice 327 for specific rates and dates)

Grass/Forb/Legume Species
grain sorghum (*Sorghum bicolor*)
sorghum-sudan (*Sorghum* sp.)
soybean (G*lycine* sp.)
cow pea (*Vigna unguiculata*)
hairy vetch (*Vicia villosa*)
wheat (*Triticum aestivum*)
chufa (*Cyperus esculentus*)
corn (*Zea mays*)
crimson clover (*Trifolium incarnatum*)
red clover (*Trifolium pratense*)
white clover (*Trifolium repens*)
arrowleaf clover (*Trifolium vesiculosum*)
subterranean clover (*Trifolium subterraneum*)
oats (*Avena sativa*)
rye (*Secale cereale*)
ryegrass (*Lolium multiforum*)
singletary pea (*Lathyrus hirsutus*)
alyce clover (*Alysicarpus vaginalis*)
pearl millet (*Pennisetum glaucum*)
Japanese millet (*Echinochloa frumentacea*)
chiwapa millet (*Echinochloa frumentacea*)
dove proso (*Panicum miliaceum*)
browntop millet (*Panicum ramosum*)
Florida beggerweed (*Desmodium tortuosum*)
rice (*Oryza sativa*)

Table 7. Partial List of Native Vine Species Beneficial to Wildlife (Refer to Practice 342 for specific rates and dates)

Vine Species
greenbriar (*Smilax* sp)
blackberry (*Rubus* sp.)
dewberry (*Rubus* sp.)
rattan (*Berchemia scandens*)
muscadine (*Vitis rotundifolia*)