Importance of Disturbance in Habitat Management

October 2006 *Fish and Wildlife Habitat Management Leaflet* *Number 37*

Introduction

Any event that disrupts an ecosystem or plant or wildlife population structure and changes its resources, substrates, or physical environment is called a disturbance. Disturbances are natural components of virtually all of the world's ecosystems and can include fires, floods, droughts, storms, herbivory, and disease outbreaks. Disturbances are critically important for maintaining healthy and productive ecosystem functions. For example, periodic disturbances are essential for early successional plants and animals, overall biotic diversity, enhancing the capacity of ecosystems to produce clean air and water, and allowing nutrient cycling to occur.

Disturbances interact in a complex manner with climate and soils to produce and maintain a plant community that is unique to that site. In a healthy ecosystem, the plant community is in a state of dynamic equilibrium, and there is variability in its species composition and successional stages following disturbance. This variability is desirable because such habitats can accommodate a diverse wildlife community adapted to different plant species and successional stages.

Fully functioning ecosystems have a natural resistance and resilience to disturbances. Resistance refers to the ecosystem's ability to retain its plant and animal communities during and after a disturbance. Resilience refers to the magnitude of disturbance an ecosystem can withstand and regain its original function after the disturbance. As an ecosystem is degraded, its resistance and resilience to disturbance weaken. In these cases, a disturbance can push an ecosystem past a certain threshold. Once that threshold is reached, ecosystem processes change, resulting in changes in the plant and animal communities. As these changes occur, the ecosystem is in a transition from its original state to a new state.

The purpose of this leaflet is to provide landowners with an improved understanding of natural disturbances and their ecological importance. Three examples of disturbance-adapted systems are used to demonstrate the importance of disturbance on the landscape. Disturbance management options are discussed, with suggestions for incorporating disturbance into management plans.

Wes Burger, Mississippi State University

Oak savannahs maintained by periodic fire

Fire-adapted systems

Fire has historically been an integral factor in maintaining native prairies, shrublands, and forests across North America. While fire frequency and severity vary by region and ecosystem type, all fires are influenced by the plant community and climate of a site. In turn, the severity and frequency of a fire influences the plant community that will recolonize a site and the wildlife species that will inhabit it during the successional stages following the fire.

The flora and fauna in native prairies, shrublands, and forests have lived with periodic fire for thousands of years. Many plant species have specific adaptations that allow them to continue to survive in a post-fire environment. Cottonwoods and oaks exhibit epicormic sprouting, which means that new branches resprout if old ones are burned. Other trees, such as willows, have the ability to resprout from their roots after a fire. Some trees, such as the ponderosa pine, have thick bark, which protects them from fire. Many plants actually depend on fire to complete their life cycles. For example, many pine trees have cones that will not open until heated by fire; blueberries exhibit fire-enhanced flowering and fruit production.

Fire releases nutrients and uncovers bare soil. The blackened, bare soil warms quickly, which stimulates soil microbial activity, nutrient cycling, and plant growth. In forests, fire opens up part of the canopy to sunlight, which allows sun-loving plant species to recolonize the site. In prairies, fire can remove dead vegetation that hinders new growth, reduce invasive plants, encourage native species, and create wildlife habitat.

Following fires, plant communities go through successional changes. Many native wildlife species and popular game species, such as bobwhite quail, white-tailed deer, and wild turkey, are dependent on periodic fire to create and maintain suitable habitat. Surface fires can stimulate the growth of herbaceous foods for deer, elk, moose, and hares, and can enhance berry production for black bears and other wildlife. Small mammal populations generally increase in response to new vegetation growth, providing a food source for carnivores. Fire can also reduce internal and external parasites on wildlife.

Fire suppression has been widespread throughout North America since European settlement. Fire suppression causes fuels to accumulate and can result in high-intensity, more destructive fires. Many native plant and animal species find it difficult to adapt to fire suppression. Fire intolerant species are able to invade and displace native species in areas protected from fire. In the Pacific Northwest, increased disease and insect outbreaks appear to be related to fire suppression. However, the benefits of wildfire are becoming better known and fire suppression has given rise to managed fires in many areas.

Herbivory-adapted systems

Herbivory is an important disturbance in many rangeland ecosystems. Before European settlement, bison, elk, prairie dogs, and other herbivorous wildlife grazed the North American rangelands. Today, livestock have replaced native herbivores in many rangeland ecosystems. So, past and present herbivores exert a strong influence on a site's plant community.

Underbrush in various successional stages after fire at Tall Timbers Research Station in Florida

Steve Dinsmore

Steve Dinsmore

Steve Dinsmore

Woody plants, for example, cannot establish themselves in areas that are moderately or heavily grazed. Instead of woody plants, grasses and forbs make up most of the plant community in rangeland ecosystems. Herbivores influence ecosystem properties such as nutrient cycling and productivity by compacting soils and adding organic material to them.

Native rangeland plants have adapted to grazing by developing extensive root systems or an ability to resprout quickly. In turn, many wildlife species have adapted to grassland plant communities and are highly dependent on rangeland ecosystems for their habitat needs. Rangeland plant communities provide food, escape, nesting, and brood-rearing cover for many mammals, birds, and reptiles. For example, the bunching nature of native grasses provides excellent nesting habitat for ground nesting birds, such as the northern bobwhite quail. Rangeland grasses and forbs support a wide variety of insects, which serve as food for many grassland bird species.

Rangeland ecosystems are adapted to a certain level of grazing; however, overgrazing can be severely detrimental to these ecosystems. If a site is overgrazed, a threshold is reached and ecosystem processes may change. The subsequent loss of vegetation, redistribution of nutrients, and dispersal of exotic plant species can increase erosion, degrade water quality, and alter the hydrology, fire regime, and plant and animal community of a site. Conversely, if grazing were completely removed from rangeland ecosystems, the plant community would go through a number of successional stages, leading to a dominance of woody plants. Woody encroachment in rangelands reduces their attractiveness for grassland-dependent wildlife species.

U.S. Fish and Wildlife Service

North American bison

Flood-adapted systems

The interface between water and land can be subject to daily, seasonal, and long-term changes. Plants found within this dynamic zone must be tolerant of short- to long-term inundation, have sufficient structure to withstand the physical force of moving water, or be capable of rapidly colonizing flood-prone areas between events.

In river and stream ecosystems, floods move water and sediment through the channel and onto the flood plain. High water flows maintain ecosystem productivity and diversity by removing fine sediments that would otherwise fill the interstitial spaces in productive gravel habitats. Floods bring leafy and woody material into the channel, which creates structure and provides detrital foods for aquatic species. Many temporary habitats, such as river bars and riffle-pool sequences, are formed and maintained by high flows.

Animals associated with areas subject to flooding have adapted to varying flow regimes, including seasonal flooding and droughts, and long-term, more intense flood events. The timing of floods is important because the life cycles of many aquatic and riparian species are timed to either avoid or exploit floods and/or droughts. For example, the seed release of riparian trees such as willows and cottonwoods is synchronized with the timing of spring-flood recession to maximize dispersal efficiency. Native fish in desert streams avoid being affected by flash floods by sensing higher flow speeds and moving to sheltered areas within the stream. Stoneflies and other aquatic insects enter their diapause stage (a period during which growth or development is suspended and physiological activity is diminished) during the drought season. Several species of fish exhibit seasonal movement to escape drought or post-flood spawning. Adaptations such as these allow plants and animals to persist in seemingly harsh floods and droughts.

The natural flow regimes of river and stream ecosystems have been important in the evolution of the plants and animals therein. However, these natural flow regimes have been severely altered by the use of rivers for transportation, waste disposal, and hydroelectricity, intensive agriculture, flood-control projects, and other human activities. In the United States, only 2 percent of rivers remain in their natural, unmodified condition. The natural functions of large river-flood plain ecosystems have practically disappeared, principally because of human efforts to contain flooding. The alteration of flow regimes by human activity has resulted in species extirpations, fishery closures, ground water depletion, declines in water quality and availability, invasions by nonna-

Cycle of drying (a and b) and reflooding (c) for a pothole in central Minnesota

(a)

Bill Hohman, NRCS

(b)

Bill Hohman, NRCS

(c)

Bill Hohman, NRCS

tive species, and more frequent and intense flooding. However, many river restoration projects are increasingly attempting to return to a more natural flow regime.

Many of the important and highly productive depressional wetlands (prairie potholes) of the upper Midwest have been altered or destroyed due to increased agricultural and commercial development. As a result, only an estimated 40 to 50 percent of the region's original prairie pothole wetlands remain today. More than 78 percent of the remaining wetlands are smaller than one acre in size. These potholes, which seasonally flood with snowmelt and rain, are home to more than 50 percent of North American migratory waterfowl, with many species dependent on the potholes for breeding and feeding.

Disturbance management

When managing ecological sites, it is important to recognize the historical disturbance regime of the site, their importance, and how they continue to influence the ecosystem. The goal of disturbance management should be to restore ecosystem processes (e.g. energy flow, nutrient cycling, or water cycling) to support sustainable use of the land. When management actions are focused on restoring these processes, the outcome will be an ecosystem in sustained, dynamic equilibrium, with natural interactions among disturbances, soils, and the plant and animal community.

Prescribed burning

From a biological and ecological perspective, the only known substitute for wildfires is prescribed burning. Prescribed burning is an inexpensive way to restore ecosystems and landscapes to their historical levels of biological diversity and productivity. Prescribed burning is a necessary management tool for maintaining wildlife habitat in forestlands, shrublands, and grasslands, including successional habitat for some endangered or threatened species such as the lesser and greater prairie-chickens. Using prescribed burning, landowners can suppress nonnative or invasive species, improve forage production and palatability, improve timber production by reducing logging debris and leaf litter, control diseases and parasites in livestock and wildlife, reduce the risk of wildfires, and enhance ecosystem productivity and biodiversity.

To be safe and effective, prescribed burning must be planned carefully. Burn plans will vary greatly, based on climate and weather, vegetation type and desired response, topography, proximity to homes or utilities, and management goals. Consultation with fire management specialists is highly recommended (and is often required by law); they can help landowners develop a customized burn plan and ensure that landowners are operating within state and local laws. Local NRCS or Conservation District offices can offer assistance in developing a prescribed burn management plan to meet specific objectives.

Burns are generally not conducted every year. The frequency of prescribed burns varies among forestlands, grasslands, and shrublands, depending on the historical fire regimes of the ecological site. Within grassland systems, frequency of burning increases with annual moisture from 2 to 4 years in tallgrass prairies to over 10 years in shortgrass prairies. The frequency of burns also depends on management goals. To control sprouting woody plants such as oak, elm, mesquite, osage orange, blackberry, or sagebrush, burning every 2 years is necessary. To control nonsprouting woody plants, such as eastern red cedar or Ashe's juniper, burning every 5 to 10 years is sufficient.

The burn season varies depending on management goals. Some prefer to burn as late as possible in the spring, when warm-season grasses are initiating growth. However, waiting until late spring can result in destruction of ground nesting bird and mammal nests, so late winter or early spring is often better. However, summer or fall burns may be needed for specific vegetation management problems. Many prescribed burns are conducted during cool, moist conditions to reduce the chance of the fire spreading out of control. Landowners should not burn during a drought, or if there is a forecasted frontal passage or wind shift within 12 hours. The 60:40 rule states that burns should be conducted when the air temperature is less than 60 degrees Fahrenheit, the relative humidity is greater than 40 percent, and the wind speed is 5 to 15 miles per hour, measured at 6 feet above the ground.

Firebreaks are used to contain the fire within the boundary of the burn unit and to assist with reducing fuel along the boundary. Firebreaks vary in type and can include mowed, disked, plowed, or dozed areas, roads, or bodies of water. The best firebreak method will be determined by the characteristics specific to the land area that is to be burned. In general, the width of the firebreak on the downwind side of the fire should be 10 times the height of flammable vegetation. The firebreak should be prepared at least 6 months ahead of the burning date.

Grazing

Rangeland ecologists consider herbivory to be a key natural disturbance in the evolution of rangeland ecosystems. While the numbers of large herbivorous wildlife have decreased substantially in the last two centuries, this natural disturbance can be replicated using livestock as the primary grassland grazers. In the absence of livestock or other herbivores, haying and/or mowing can be used to simulate the effects of grazing.

NRCS

Prescribed burning

When planning a grazing program, landowners should determine the carrying capacity of the land, that is, the amount of forage that can be grazed before degrading the ecosystem, losing soil to erosion, or losing biodiversity. If livestock graze at a rate higher than the carrying capacity, then production of desirable forage species will decline, livestock production will decline, and the necessity for supplemental feed and weed control will increase.

Planned grazing systems provide opportunities to optimize harvest efficiency, as well as periodic rest to allow plants to recover from grazing. A rotational grazing system, allowing plants a periodic rest from grazing during the growing season, is most beneficial to rangeland vegetation. Two, three, or four pasture systems allowing a rest for plants in the early growing season (May, June) or the late growing season (August, September) are improvements over continuous grazing. If enough land is available, the same herd of livestock could rotate through eight or more paddocks, although fewer paddocks will work. As the number of paddocks increases, the total rest for each paddock increases.

Patch burning/rotational grazing without fencing

In many ecosystems, natural disturbances interact with each other. Historically, rangeland ecosystems have been shaped by two major natural disturbances: fire and grazing. This type of interactive disturbance is re-created with a process called patch burning, also known as rotational grazing without fencing. Patch burning systems vary the season, frequency, and severity of fires, as well as the size and location of graz-

NRCS
Rancher practices rotational grazing

ing areas, resulting in an uneven distribution of grazing and fire that is similar to what occurred before European settlement. Patch burning re-creates the natural disturbance pattern on the landscape, increasing biodiversity and wildlife habitat. This management tool can also improve livestock production by increasing the diversity of forage species that livestock consume.

Patch burning uses prescribed fire, rather than fences, to control livestock herbivory. When using patch burning, spatially discrete fires are applied to a portion of total grazing area each year. Though they have access to the entire area, livestock will focus their grazing on recently burned patches due to the high-quality regrowth after fire. New portions of the pasture are burned periodically, and grazing animals shift to more recently burned patches. As grazing shifts, successional processes lead to changes in the plant community, which will eventually return to the preburn state, ready to be burned again. Patch burning creates a landscape that is always changing, but always includes heavily disturbed communities, moderately disturbed communities, and undisturbed communities. Ideal patch size and fire-return intervals depend on management goals and the amount of time required for patches to recover. For example, in North American tallgrass prairies, a landowner could burn one-third of a pasture each year (half of the third in the summer and half in the spring), which allows an interval between burns of 3 years.

Restoring natural flow regimes

Every aquatic system has a unique natural flow regime that is characterized by flow quantity, timing, and variability. Variability can take place over hours, days, seasons, years, or longer, and it is this variability that is critical to healthy aquatic ecosystem functions and biodiversity. When managing aquatic ecosystems, such as wetlands or rivers and their flood plains, the most important management goal should be to reestablish natural flow regimes. This may involve removing dams and spillways, reducing irrigation, or safeguarding against upstream development and land uses that alter runoff and sediment in the waterway.

The first step in reestablishing a natural flow regime is to determine what that flow regime actually is. Once the natural flow regime has been defined, management actions to restore it can take a number of forms. Some systems may need a restoration of low flows, while others may require a return to historical timing, magnitude, and duration of peak flows. Unfortunately, it is not always possible to define a system's natural flow regime, due to human alterations of the system or a lack of historical data. If this is the case, landowners should consult with natural resource professionals to design the most appropriate flow regime management plan based on the site's climate, hydrology, and plant and animal community.

Landowner assistance

Landowners may require additional information (about permits, regulations, historical fire and/or water regimes, local best management practices) before undertaking a disturbance management plan. Landowners may also need financial assistance to manage disturbance on their properties. There are a number of governmental agencies and other organizations willing to provide assistance to landowners wishing to manage disturbance. Landowners are encouraged to begin their disturbance management activities by contacting these organizations. State and/

Bill Hohman, NRCS
Grasses resprout quickly after prescribed burning

or local contacts for a number of relevant government agencies can be found by visiting the Web sites listed in table 1 or by consulting the local telephone directory. Table 2 lists programs that can provide technical and/or financial assistance for disturbance management practices.

Conclusion

Until recently, land managers have not recognized the value of natural disturbances and have often suppressed these disturbances. However, natural disturbance such as fires, floods, and herbivory are critical in maintaining valuable ecosystem functions and creating and restoring wildlife habitat. With assistance from conservation and governmental organizations, landowners can learn to recognize natural disturbances and re-create them on their properties.

Table 1 Organizations providing assistance for disturbance management

Organization	Web site
Farm Service Agency	http://www.fsa.usda.gov/edso/statedefault.htm
Natural Resources Conservation Service	http://offices.sc.egov.usda.gov/locator/app
State Fish and Wildlife Departments	http://www.lib.washington.edu/fish/fandg/fandglist.html
U.S. Fish and Wildlife Service	http://www.fws.gov/offices/directory/listofficemap.html
Wildlife Habitat Council	http://www.wildlifehc.org

Table 2 Assistance programs for disturbance management

Program	Description	Land eligibility	Opportunities for disturbance management	Contact
Conservation Reserve Program (CRP)	Up to 50% cost-share for establishing permanent cover and conservation practices, and annual rental payments for land enrolled in 10- to 15-yr contracts. 50% cost-share for management activities	Highly erodible land, wetland, and certain other lands with cropping history, stream-side areas in pasture land	Annual rental payments may include an additional amount up to $5/a/yr as an incentive to perform certain maintenance obligations, including disturbance management activities	NRCS or FSA State or local office
Environmental Quality Incentives Program (EQIP)	Cost-share and incentive payments for conservation practices in accordance with 1- to 10-yr contracts	Cropland, range, grazing land, and other agricultural land in need of conservation	Incentive payments may be provided for up to 3 years to encourage producers to carry out management practices, including disturbance management practices, that may not otherwise be carried out	NRCS State or local office
Grassland Reserve Program (GRP)	Financial incentives, technical assistance, and cost-share for enhancement and restoration of grasslands in permanent or 30-yr easements or rental agreements	Restored, improved or natural grassland, rangeland, pastureland, shrubland, and certain other lands	Participants must follow a site-specific grassland resources conservation plan, which can include disturbance management practices for the sustainability of forage health and habitat enhancement for declining populations of grassland dependant wildlife	NRCS State or local office
Partners for Fish and Wildlife Program (PFW)	Up to 100% financial and technical assistance to restore wildlife habitat under a minimum 10-yr cooperative agreement	Most degraded fish and/or wildlife habitat	Restoration projects may include restoring wetland hydrology or performing prescribed burning to restore natural disturbance regimes	U.S. Fish and Wildlife Service local office
Waterways for Wildlife	Technical and program development assistance to coalesce habitat efforts of corporations and private landowners to meet common watershed level goals	Private lands	Can provide State-specific advice and/or contacts for prescribed burning, managed grazing, restoration of flow regimes, or other disturbance management practices	Wildlife Habitat Council
Wetlands Reserve Program (WRP)	Technical and financial assistance to address wetland, wildlife habitat, soil, water, and related natural resource concerns in an environmentally beneficial and cost-effective manner; 75% cost-share for wetland restoration under 10-yr contracts and 30-yr easements; 100% cost-share on restoration under permanent easements	Previously degraded wetland and adjacent upland buffer, with limited amount of natural wetland and existing or restorable riparian areas	Can provide technical and financial assistance for disturbance management, provided these activities are consistent with the protection and enhancement of the wetland	NRCS State or local office
Wildlife at Work	Technical assistance on developing habitat projects into programs that allow companies to involve employees and the community	Corporate lands	Can provide State-specific advice and/or contacts for prescribed burning, managed grazing, restoration of flow regimes, or other disturbance management practices	Wildlife Habitat Council
Wildlife Habitat Incentives Program (WHIP)	Technical assistance on developing habitat projects into programs that allow companies to involve employees and the community	High-priority fish and wildlife habitats	Technical assistance is provided to help the participant maintain wildlife habitat, which may include disturbance management activities	NRCS State or local office

References

Success stories

American Rivers, Friends of the Earth, and Trout Unlimited. 1999. Dam removal success stories. Available at: *http://www.foe.org/res/pubs/pdf/successstories.pdf*.

U.S. Department of the Interior, National Park Service, Canaveral National Seashore. 2003. Fire management. Titusville, FL. Available at: *http://www.nps.gov/fire/download/pub_fir03_cana_scrubjay.pdf*.

U.S. Department of the Interior, National Park Service, Southern Plains Fire Park Group, Meredith National Recreation Area. 2003. Fire management: prescribed fire. Fritch, TX. Available at: *http://www.nps.gov/fire/download/pub_fir03_lamr_spfpg.pdf*.

U.S. Department of Interior, National Park Service. 2003. Redwood uses prescribed fire to manage cultural landscapes. Available at: *http://www.nps.gov/fire/public/pub_fir03_redw_cultural.html*.

Online sources

Forest Health Protection. n.d. The role of disturbance in ecosystem management. *http://www.fs.fed.us/r10/spf/fhp/role_disturb.htm* [Accessed 21 February 2005].

Printed sources

Bayley, P.B. 1995. Understanding large river flood plain ecosystems. BioScience 45: 153–158.

Bidwell, T.G. Grazing management on rangeland for beef production E–926. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, Oklahoma State University.

Bidwell, T.G., D.M. Engle, J.R. Weir, R.E. Masters, and J.D. Carlson. Fire prescriptions for maintenance and restoration of native plant communities. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, Oklahoma State University.

Bidwell, T.G., J.R. Weir, J.D. Carlson, M.E. Moseley, R.E. Masters, R. McDowell, D M. Engle, S.D. Fuhlendorf, J. Waymire, and S. Conrady. 2003. Using prescribed fire in Oklahoma. Oklahoma Cooperative Extension Service, Division of Agricultural Sciences and Natural Resources, Oklahoma State University; USDA Natural Resources Conservation Service; Oklahoma Department of Agriculture, Food, and Forestry; and Oklahoma Department of Wildlife Conservation.

Dwire, K.A., and J.B. Kauffman. 2003. Fire and riparian ecosystems in landscapes of the western USA. Forest Ecology and Management 178: 61–74.

Fuhlendorf, S.D., and D.M. Engle. 2004. Application of the fire-grazing interaction to restore a shifting mosaic on tallgrass prairie. Journal of Applied Ecology 41: 604–614.

Fuhlendorf, S.D., and D.M. Engle. 2001. Restoring heterogeneity on rangelands: Ecosystem management based on evolutionary grazing patterns. BioScience 51: 625–632.

Higgins, K.F., A.D. Kruse, and J.L. Piehl. 1989. Prescribed burning guidelines in the Northern Great Plains. U.S. Fish and Wildlife Service, Jamestown, ND. Available at: *http://www.npwrc.usgs.gov/resource/tools/burning/burning.htm*.

Lotan, J.E., and J.K. Brown. 1985. Fire's effects on wildlife habitat–symposium proceedings: Missoula, Montana, March 21, 1984. Intermountain Research Station, Forest Service, U.S. Department of Agriculture, Ogden, UT.

Lytle, D.A., and N.L. Poff. 2004. Adaptation to natural flow regimes. Trends in Ecology and Evolution 19: 94–100.

Miller, D., C. Luce, and L. Benda. 2003. Time, space, and episodicity of physical disturbance in streams. Forest Ecology and Management 178: 121–140.

Pickett, S.T.A., and P.S. White. 1985. The ecology of natural disturbance and patch dynamics. Academic Press, Orlando, FL.

Poff, N.L., J.D. Allan, M.B. Bain, J.R. Karr, K.L. Prestegaard, B.D. Richter, R.E. Sparks, and J.C. Stromberg. 1997. The natural flow regime: A paradigm for river conservation and restoration. BioScience 47: 769–84.

Reice, S.R. 2001. The silver lining: the benefits of natural disasters. Princeton University Press, Princeton, NJ.

Stringham, T.K., P.J. Mieman, and L.E. Eddleman. 2001. States, transitions, and thresholds: further refinement for rangeland applications. Special Report 1024, Agricultural Experiment Station, Oregon State University, Corvallis, OR.

Swanson, F.J., S.L. Johnson, S.V. Gregory, and S.A. Acker. 1998. Flood disturbance in a forested mountain landscape. BioScience 48: 681–689.

U.S. Department of Agriculture, Natural Resources Conservation Service. 2003. National range and pasture handbook. Washington, D.C.

Natural Resources Conservation Service

Mailing address:

P.O. Box 2890
Washington, DC 20013

Street address:

14th and Independence Avenue SW
Washington, DC 20250

The Natural Resources Conservation Service provides leadership in a partnership effort to help people conserve, maintain, and improve our natural resources and environment.

www.nrcs.usda.gov

Wildlife Habitat Council

8737 Colesville Road, Suite 800
Silver Spring, Maryland 20910

(301) 588–8994

The mission of the Wildlife Habitat Council is to increase the amount of quality wildlife habitat on corporate, private, and public land. WHC engages corporations, public agencies, and private, nonprofit organizations on a voluntary basis as one team for the recovery, development, and preservation of wildlife habitat worldwide.

www.wildlifehc.org

Primary author: **Raissa Marks**, Wildlife Habitat Council. Drafts reviewed by **Rob Pauline**, Wildlife Habitat Council; **William Hohman and Pat Graham**, Natural Resources Conservation Service; **Jim Herkert,** The Nature Conservancy; **Roger Pederson,** Ducks Unlimited; **Tim McCoy,** Nebraska Parks and Game Commission; **Wes Burger,** Mississippi State University

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720–2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250–9410 or call (800) 795–3272 (voice) or (202) 720–6382 (TDD). USDA is an equal opportunity provider and employer.