

Birds in *green ribbons*

best management practices for riparian areas to benefit birds in Wyoming

Like the canary in the coal mine that protected miners, birds can tell the health of the land to those who read it. Riparian areas that have many layers of vegetation provide critical habitat for a score of bird species. From low grasses and flowering plants to mid-sized shrubs and small trees to a canopy of tall trees, these narrow bands of green that tell us a constant source of water is nearby provide food, water, nest sites, and shelter for more than their share of birds. As a matter of fact, riparian areas make up only about 2% of the land surface in the semi-arid West, but provide habitat for myriad bird species, either as stopover habitat during migration or nesting habitat during the breeding season. When reading the land, one can easily see the connection between a healthy riparian area and a host of birds, found in the treetops, on the ground, and every place in between.

Managing riparian habitat for birds also ensures plant growth that can be beneficial to those who make a living from the land. Well-planned land uses can be compatible with riparian habitat management for birds, if successful partnerships are developed and goals and objectives are compatible.

Every autumn, more than 350 species of birds leave the United States and Canada on their migratory journey for Mexico, the Caribbean, Central America, and South America, some traveling thousands of miles to their winter homes. These are the Neotropical (New World tropics) migratory birds. The list includes hawks like the Swainson's Hawk, owls like the Burrowing Owl, shorebirds like the Killdeer, and a long list of songbirds including warblers, sparrows, hummingbirds, swallows, thrushes, flycatchers, vireos, tanagers, and orioles. Ducks, geese, and resident species such as grouse are not included in the list of Neotropical migratory species (also referred to as "landbirds").

About 155 Neotropical migrant species spend part of their lives in Wyoming, and many of these nest in the state. Most of the Wyoming Neotropical migrants are songbirds that we see in our yards, on our public lands, and on our farms and ranches from spring to fall. All of us eagerly await their melodious announcement of spring each year.



PHOTO BY LURAY PARKER, WYOMING GAME AND FISH DEPARTMENT

Data collected for more than 30 years by scientists and amateur bird watchers clearly show that many migrant bird populations are being devastated by certain human influences. The primary cause for population loss is the destruction of natural habitats on breeding and wintering grounds and along migration routes. By studying years of long-term Breeding Bird Survey data, this alarming decline has been tracked by the U.S. Fish and Wildlife Service and the U.S. Geological Survey, Biological Resources Division.

Over 70 of Wyoming's avian species have been identified as using riparian habitats. Some of these, such as the Yellow-billed Cuckoo and the Willow Flycatcher, are among the most imperiled of the migratory species in Wyoming and the western United States.

Partners In Flight—an international, volunteer organization of federal and state agencies, the forest products industry, academia, and non-governmental organizations from Canada to Argentina—is working to help these migratory bird species. Wyoming Partners In Flight has developed a set of recommended Best Management Practices (BMPs) for riparian habitats that can be used to protect and enhance populations of both Neotropical migratory birds and resident birds that call Wyoming home year-round.

riparian ecology

Riparian areas—lands adjacent to creeks, streams, rivers, ponds, and lakes where the vegetation is strongly influenced by the presence of water—are both ecologically and economically important. Water quality, biological diversity, wildlife habitat, agricultural and ranching productivity, timber production, water and power sources, recreation, and basic aesthetics are all vital functions of riparian areas. In the western United States, riparian habitat covers only about 2% of the land surface, but it is the single most productive type of wildlife habitat and benefits the greatest number of species. For example, more than 75% of all wildlife species in southeastern Wyoming depend on riparian habitats, and in the western United States, more bird species rely on riparian habitats than all other western rangeland vegetation types combined. Besides providing crucial wildlife habitat, healthy riparian areas provide many important ecological functions—they store water and recharge aquifers, filter chemical and organic wastes, trap sediment, build and maintain streambanks,



PHOTO BY BILL DYER FOR THE CORNELL LABORATORY OF ORNITHOLOGY

Found mainly in eastern Wyoming, Yellow-billed Cuckoos require low, shrubby thickets near water for nesting

reduce soil erosion, and produce plants. Water, soil, vegetation, and landform are components of the riparian area that must be considered for successful management. In a healthy riparian ecosystem, the four are in balance and mutually support one another.

From the birds' perspective, healthy riparian areas are critical as nesting, wintering, and migratory habitat. As a matter of fact, the number and diversity of birds in riparian areas is a direct indication of ecosystem health. The best way to help the largest number of birds in Wyoming is to maintain or improve the condition of vegetation in riparian areas to represent diverse, healthy plant communities. Riparian areas that have many layers of vegetation will provide critical habitat for a score of bird species, including food, water, nest sites, and shelter.

Healthy riparian areas also help maintain water quality and reduce soil erosion, and provide forage for livestock as well as wildlife. Well-planned land uses can be compatible with riparian habitat management for birds if objectives are carried out with a landscape approach in mind.

how to help

Many of the Best Management Practices for riparian areas fall into major categories of land use such as Grazing, Forestry, Engineering, Recreation, etc. The recommended BMPs are broken out into categories for convenience, although some are general enough to cross into other categories. Even if you practice only some of these recommendations, you will make a difference for birds in your area.

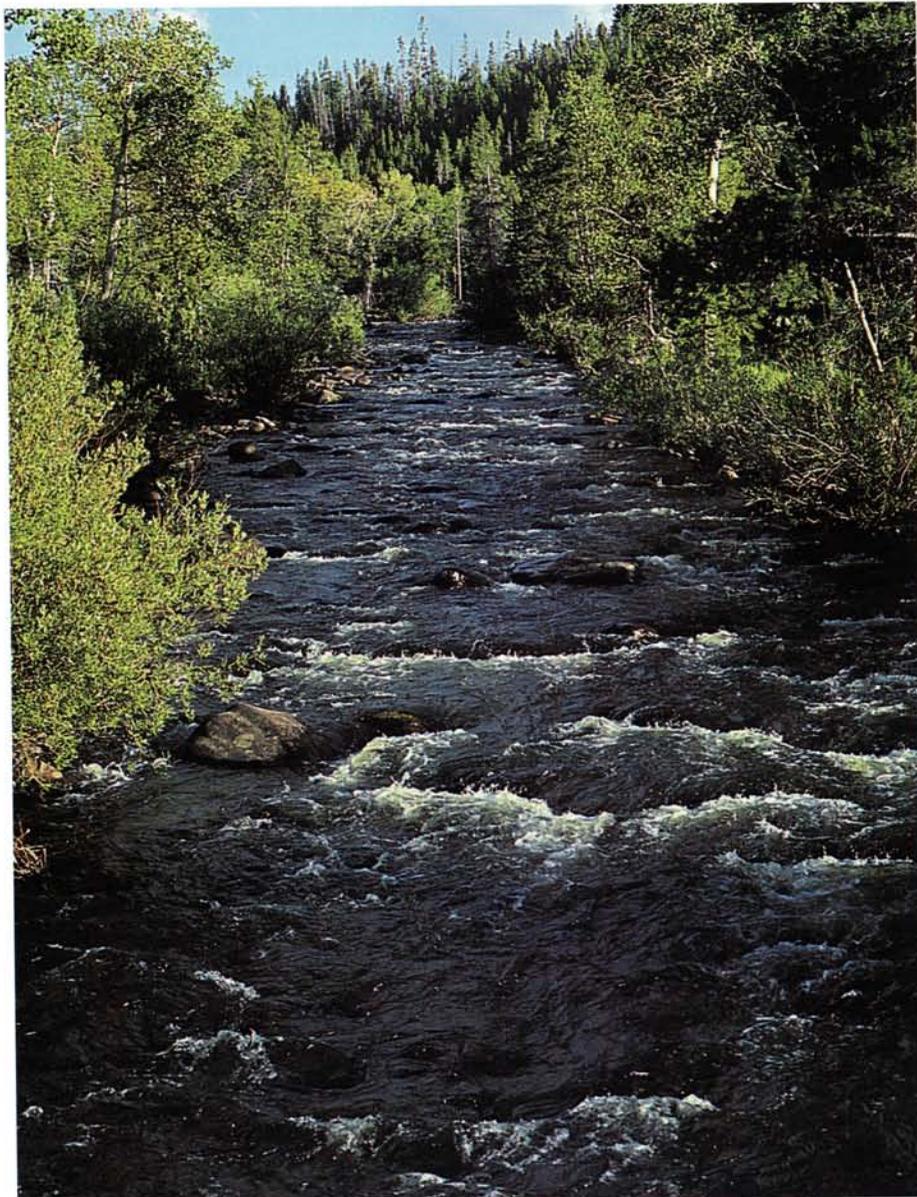


PHOTO BY LURAY PARKER, WYOMING GAME AND FISH DEPARTMENT

This riparian habitat provides multiple layers of plants, or “vertical vegetation structure”, for bird species that nest near the ground, in shrubs, or in trees.

- Manage riparian areas for stable, non-eroding banks; good water quality; stable, year-round flows; and sustainable use without abuse over the long term.
- Manage riparian areas from a watershed perspective. Ensure that riparian areas are continuous along the entire drainage and are as wide as the soil and water table will allow riparian vegetation to exist. This will reduce habitat fragmentation, which will help ease predation and nest parasitism by cowbirds.
- Implement riparian monitoring programs to establish baseline data and identify changes in habitat quality (both positive and negative) through time.
- Consider both long- and short-term impacts and/or benefits of any activities within or adjacent to riparian areas. Recreation, development, and improper grazing in riparian areas can reduce the multi-aged, multi-layered structure, including snags (standing dead trees) and diseased trees, most beneficial to birds.
- Provide multiple layers of plants, or “vertical vegetation structure”, in woody riparian habitats. Many bird species nest and forage within 10 feet of the ground, so it is critical to have sufficient amounts of vegetation at that level. Healthy woody riparian areas have young trees and shrubs that provide this layer.
- Manage for a stable or increasing population of native woody species. Ensure that all age classes are present (seedling, young, mature, and decadent), with more seedlings present than decadent plants, and more young plants than mature ones.
- Manage for a variety of locally native plants. Different plant species host different insect populations, which provide food for a variety of bird species.
- When planting trees, select native species and avoid Russian olive and tamarisk (salt cedar). These exotic woody plants are vigorous species that can be established easily in many areas, but they out-compete native plants and host relatively few insect species. Most birds avoid foraging in Russian olive and tamarisk trees, so they have little value as wildlife habitat and can quickly degrade existing native wildlife habitat.
- Develop conservation partnerships between landowners, land managers, and private organizations. While landowners need to derive income from the land, this can often be compatible with maintaining regional biological diversity, depending on how the land is used and what land management tools are employed. Identify the habitat needs of the birds in the area and the economic needs of the landowner so a baseline need is established. Important habitat on private land can be protected with conservation easements. In some cases, landowners can derive income from hunters, birders, and naturalists who visit the region.

grazing

Livestock grazing is one of the most extensive human-caused influences on riparian areas in the western United States. Proper stocking levels and grazing regimes can be effective habitat management tools and compatible with riparian area maintenance and improvement. However, improper grazing practices in riparian areas can eliminate vegetation and associated wildlife, widen stream channels, cause soil erosion, increase sediment load in the stream channel, increase stream water temperature, encourage invasion of noxious plants, change streambank configuration, and lower surrounding water tables. The degraded condition of many riparian areas and watersheds in the West is from uncontrolled grazing that occurred in the late 19th and early 20th centuries; today's successful manager can learn from past mistakes. Grazing systems, like deferred-rotation, rest-rotation, high intensity-low frequency, and short-duration, combine periods of use with nonuse, and can be effective management tools to increase animal productivity and achieve habitat objectives. From a management perspective, vegetation is

usually the component over which the manager has the most control, that is the easiest to manipulate, and that responds the fastest to human influences. Birds typically do not respond to the presence of livestock, but rather to the impacts that livestock grazing has on vegetation. These Best Management Practices for grazing focus on protecting riparian areas during crucial growing periods.

- Grazing management plans should be developed and evaluated on a case-by-case basis by the managing agency or landowner because no single grazing strategy will fit all situations. Include riparian area management as an integral part of each grazing management plan. Determine site-specific riparian area objectives and tailor the grazing management plan to help meet the objectives. Consider the site's specific factors of concern, such as bank instability or loss of woody plants; the site's potential and capability; its suitability for grazing livestock and the type of stock best suited to the area; and the ideal grazing strategy, including the time, place, amount, duration, and intensity of grazing. Monitor the effects of each grazing strategy on the riparian area check progress toward the objectives. Record how



PHOTO BY MICHAEL HORNIAK FOR THE CORNELL LABORATORY OF ORNITHOLOGY

Common in brushy riparian areas, populations of Yellow Warblers increase where a reduction in grazing and herbicides leads to regrowth of riparian vegetation.

key riparian plant species, the overall riparian ecosystem, and key upland plant species respond to grazing management (annual photographs taken from the same point are helpful).

- Maintain proper stocking rates and livestock distribution to protect riparian ecosystems. Incompatible grazing can have harmful long-term effects on survival and regeneration of tree and shrub seedlings; can negatively influence the species, structure, and health of riparian vegetation; and can cause soil compaction, bank trampling, and degraded water quality from waste materials and excessive soil in the water. Manage grazing intensity at a level that will maintain the composition, density, and vigor of desired plants and will not damage riparian soils, streambanks, or water quality.
- Limit the amount of time livestock spend in pastures with riparian areas. This can be a significant factor in the condition of the riparian area. Base the length of the grazing period within a riparian zone on the areas livestock are actually using, not the entire pasture. If needed, add more rest to grazing cycles to increase plant vigor, allow streambanks to regenerate, or encourage more desirable plant species composition.

- Sagebrush that grows up to the edge of an existing or historical stream channel is evidence of chronic problems. If grazing is the cause, livestock should be managed more intensively to remove the negative impacts, or other interventions should be considered until the water table has been restored and mesic (moisture-loving) plant species reestablish themselves on the site. At that point, grazing may be used as a management tool. Both birds and livestock will ultimately benefit.
- Exclude livestock from riparian areas with high risk and poor recovery potential when there is no practical way to protect those riparian areas while grazing adjacent uplands.
- Fencing can isolate riparian areas into one or a few pastures; other pastures should be exclusively uplands. This can simplify management intended to protect riparian areas. If animal movement can be controlled by herding, turning water on or off, or some other method, fencing may not be necessary. However, fencing may be the best alternative for rapid restoration of riparian ecosystems. When fencing riparian areas to exclude livestock, make sure all riparian plant community types are included in the enclosure. Fences that parallel a stream should be located well outside the riparian zone so that animals



PHOTO BY LURAY PARKER, WYOMING GAME AND FISH DEPARTMENT

Swainson's Hawks nest in the cottonwoods, willow, and shrubs of the plains/basin riparian areas of Wyoming.



Broad-tailed Hummingbirds nest in riparian thickets and feed on nectar from a variety of flowers. The loss of flowering plants due to incompatible grazing and recreation may reduce hummingbird populations.

trailing along the fence will not be impacting the streambanks and riparian vegetation.

- If riparian areas are fenced to exclude livestock, provide access to a short, straight, stable section of stream with a gentle bank as a livestock watering site (water gap). Avoid installing water gaps where streambanks bend and curve; this is where the water flow puts additional pressure on the banks, and livestock trampling Wyoming have declined as a result of reduced stream flow, damming, and incompatible livestock grazing, and excessive sediment in the waterway.

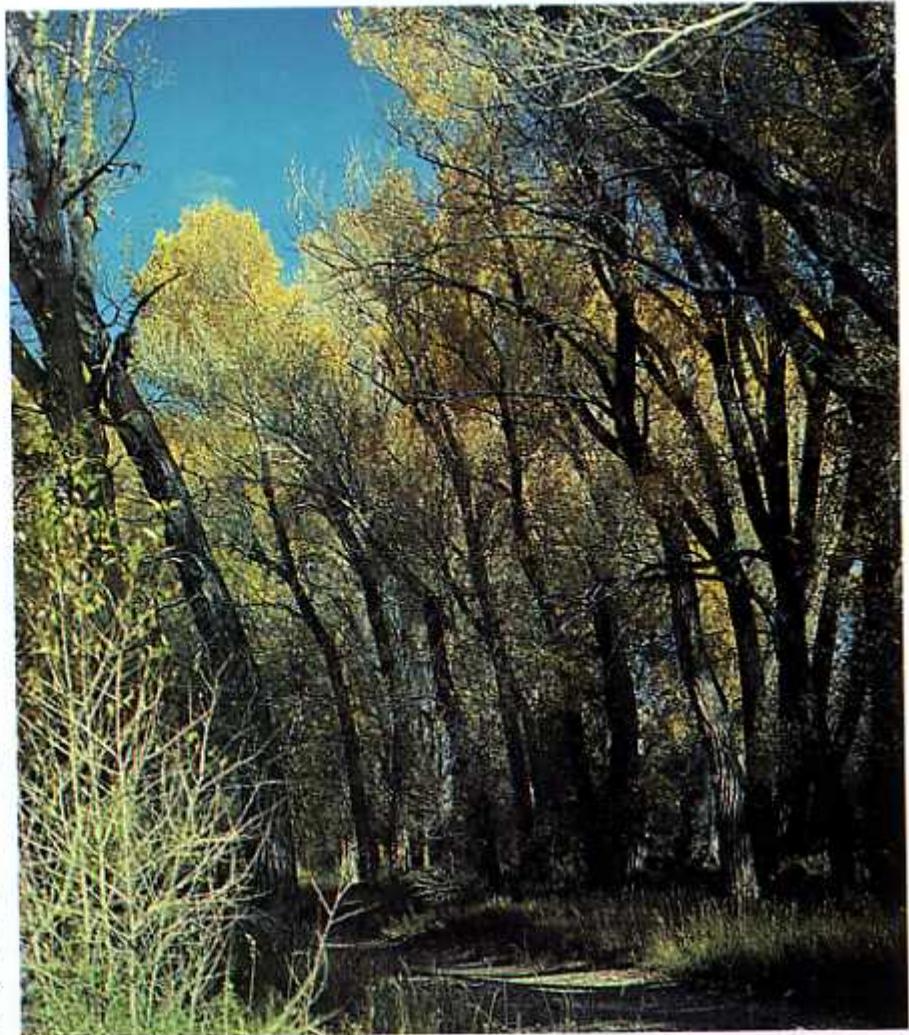


PHOTO BY MICHAEL HORVAK FOR THE CORNELL LABORATORY OF ORNITHOLOGY

The densities and abundance of cottonwood forests in the riparian areas of Wyoming have declined as a result of reduced stream flow, damming, and incompatible livestock grazing.

- Manage pastures with riparian habitat as separate units in a rotation grazing system. Where feasible, use a deferred-rotation or rest-rotation system, whereby no pasture is grazed the same season (spring, summer, or fall) two years in a row. A year of rest for each riparian pasture every three to four years is beneficial for long-term riparian habitat maintenance. In some areas, use of these pastures late in the grazing season by cows with calves will produce the best use of upland forage resources and reduce impacts on riparian areas.
- Control the timing of grazing to keep livestock off streambanks when they are most vulnerable to damage (when the ground is saturated) and to coincide with the physiological needs of target plant species. Also, sheep may be favored in areas prone to bank damage, since sheep are lighter-weight and cause less damage to streambanks.
- Ensure adequate residual vegetation cover is left after grazing; this is essential for maintaining riparian ecosystem health. Instead of focusing on how much vegetation can be removed, focus on how much and what type of vegetation should be left to ensure that the riparian area is able to perform its functions (reducing water flow speed, trapping sediment, bank building, and erosion protection). The vegetation present at the end of the growing season or at the end of a grazing period, whichever comes last, is what will be available during the next runoff period. (Projections of residual vegetation should also consider seasonal wildlife use prior to runoff.)
- Spring grazing may increase the herbaceous component of the understory, which is very important for ground foraging and seed eating birds, and reduce browsing pressure on woody species, which are essential for maintaining riparian functions.



PHOTO BY LARRY PARKER, WYOMING GAME AND FISH DEPARTMENT

Red-headed Woodpeckers inhabit riparian forests along the major rivers of Wyoming and require snags (standing dead trees) for the nesting cavities they provide.

However, grazing must be completed in time for the plants to regrow, at least 60 to 75% of current growth should be retained (no more than 25 to 40% removed), and at least six inches of stubble height should remain (special situations, such as critical fisheries habitats or easily eroded streambanks, may require leaving stubble heights greater than six inches). Spring grazing may be beneficial where livestock can be attracted to the uplands by succulent herbaceous plants, when cool temperatures may not drive livestock into riparian areas and may discourage loitering in the cooler riparian zone, where saturated soil in the riparian area may discourage livestock from entering, or where well-drained soils reduce the risk of compaction. Spring grazing may be detrimental where wet soils increase the potential negative impacts of soil compaction, bank trampling, and erosion; when repeated grazing of the area occurs, which may reduce plant vigor and change plant composition; and where grazing can adversely affect birds and other wildlife in the area.

- Hot season grazing (mid- to late summer) in riparian areas should be avoided. During this period, livestock are especially likely to concentrate in riparian areas and can seriously degrade the vegetation and stream



PHOTO BY HAL BROWN FOR THE CORNELL LABORATORY OF ORNITHOLOGY

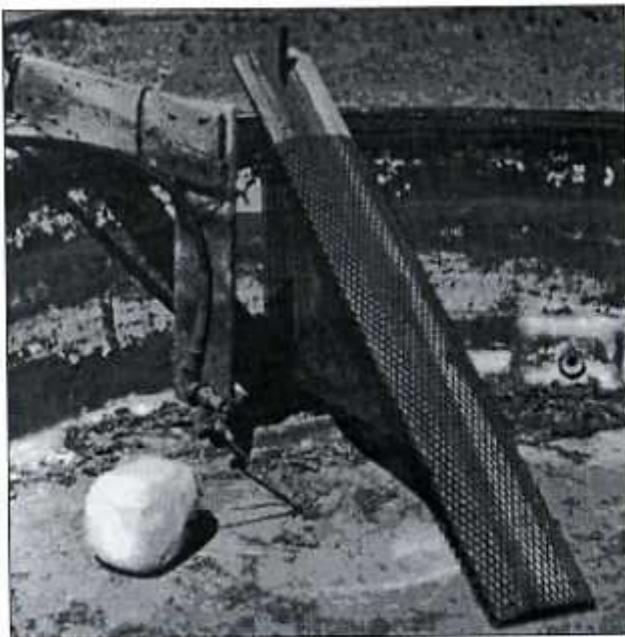
Willow Flycatchers are closely tied to the river bottoms of Wyoming's mountains.

channel. Once the upland forage cures, livestock should be moved to a pasture without riparian areas or regularly herded out of riparian areas.

- Light fall grazing can help maintain functioning riparian areas if at least 60 to 70% of plant growth remains (use is no more than 30 to 40%), no significant consumption of willows and other shrubs occurs, and stubble heights of four to six inches are retained (special situations, such as critical fisheries habitats or easily eroded streambanks, may require leaving stubble heights greater than six inches). Fall grazing may be beneficial when riparian vegetation consists of herbaceous (grass/forb) species rather than woody (tree/shrub) species; where cool season grasses provide palatable forage in upland areas; when off-stream water is available near forage; or when cooler temperatures draw livestock out of riparian areas. Fall grazing may be detrimental when it negatively impacts woody species; when regrowth does not occur until the following spring, which may affect the ability of the vegetation to fulfill their riparian functions during spring runoff; and when incentives to draw livestock away from riparian areas are not available. Advantages of fall grazing include less impact on wildlife habitat, reduced conflicts with ground

nesting birds, and less soil compaction and stream-bank trampling due to drier soils. Also, since most plants have completed their growth cycle by this time, grazing will not adversely affect plant development.

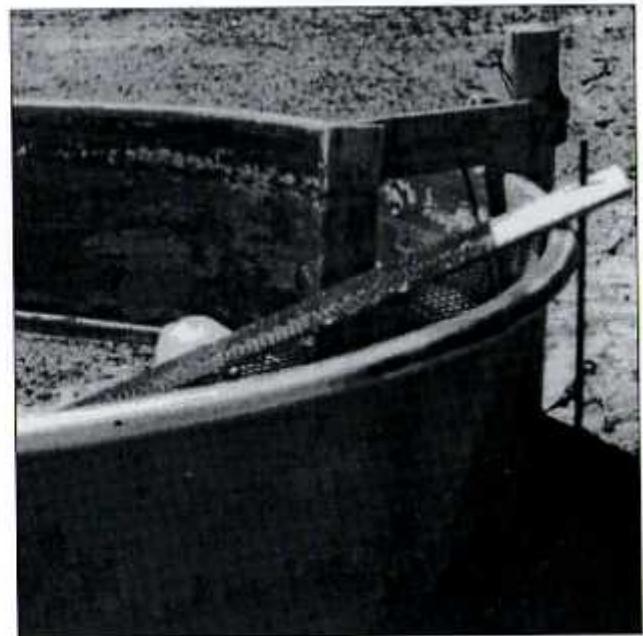
- Winter grazing may be the least detrimental to riparian health and may improve livestock distribution and plant response. This strategy focuses on plants when they are dormant so it allows total rest during the growing season, which promotes plant vigor and production of seed and roots. Winter grazing may be beneficial where soil type makes compaction and stream-bank trampling during other seasons likely; when the pasture is large enough to supplemental feed and water livestock well away from the stream; where drainages are colder than surrounding uplands or open, south-facing slopes are available, which decrease riparian area use by livestock; and where recovery of deteriorated uplands and riparian areas is needed. Winter grazing may be detrimental where damage to woody species can occur from browsing, rubbing, or trampling; and where grazing of dead standing vegetation can reduce riparian functions the following spring.
- Allow time for plants to rest and regrow between grazing periods to ensure they remain vigorous and productive. Plants that are continuously grazed during the growth period will lose their vigor and stop producing seeds, and their roots will die back, eventually causing a change in the plant community from more productive, palatable species to less productive and less palatable plants.



PHOTOS BY MARK GONKES, BUREAU OF LAND MANAGEMENT

Place escape ramps in stock tanks and troughs to prevent small birds and mammals from drowning.

- Discourage trailing along streambanks by placing logs across trails, perpendicular to the stream channel.
- Herding on horseback can be an effective tool for managing livestock in riparian areas. Make sure riders know the reasons behind herding and what is expected of them; poorly conducted riding can cause more damage to the riparian zone and to livestock performance than having the livestock remain in the riparian area.
- Improve livestock distribution and forage use by using salt and mineral blocks, but avoid placing them within riparian areas (keep them at least $\frac{1}{2}$ mile from the stream) or in immediately adjacent uplands.
- Improve adjacent upland forage to lure livestock out of riparian areas.
- If needed, add more pastures to increase management flexibility and rest for riparian vegetation.
- The presence of off-stream water is an important management tool to encourage livestock to move away from riparian areas. Develop shade and water (wells, windmills, guzzlers, or water piped from the stream) in upland areas to help spread grazing pressure. Keep in mind, however, that small birds can drown when they fall into stock tanks and troughs while drinking. Provide escape ramps to prevent drowning (see photographs below).



- Locate livestock-handling facilities and collection points outside of riparian areas. Branding, loading, and other handling efforts should be limited to areas and times that do not harm soils and plants in riparian zones.
- Changing from cattle to sheep, or vice versa, may help with implementing some of the suggested grazing BMPs.
- Conversion to agriculture is the greatest threat to birds in this habitat type. Efforts to maintain ranching and compatible grazing regimes as the dominant economic force and land use in riparian habitat will benefit birds. The Conservation Reserve Program has helped bird habitat, but permanent easements on important riparian areas could be significantly more beneficial.
- Play an active role in managing riparian areas. Success in maintaining or improving riparian health depends on the degree of operator involvement.
- Leave a buffer of uncultivated grasses, shrubs, and trees along all waterways, including rivers, streams, ditches, drains, etc. Cultivating up to the edge of a waterway removes important vegetative filters, increases sedimentation, accelerates siltation, and shortens irrigation pump life. Re-establish woody and herbaceous vegetation through plantings and, if necessary, fencing.
- Avoid driving tractors and other equipment in riparian areas.
- Protect ditch banks and streambanks from burning. The vegetation along banks reduces erosion, filters runoff, maintains water quality, and provides wildlife habitat.
- Maintain large patches of riparian habitats; fragmented habitats result in increased predation and increased nest parasitism by cowbirds.
- Prevent chemical runoff into streams and rivers. Agricultural chemicals can harm downstream riparian vegetation and wildlife.
- Prevent soil from eroding into adjacent waterways. Increased sedimentation reduces the quality of aquatic habitat.

agriculture

These recommendations for agricultural practices will benefit birds and other wildlife, and will also help protect water quality and reduce soil erosion.



PHOTO BY DORE AND ESTHER PHILLIPS FOR THE CORNELL LABORATORY OF ORNITHOLOGY

MacGillivray's Warblers are found throughout most of Wyoming's mountains. They use low, dense shrubs and shady, damp thickets for nesting.



PHOTOS BY LUPEL PARKER, WISCONSIN GAME AND FISH DEPARTMENT

Wood Ducks nest in riparian forests and require snags (standing dead trees) for the nesting cavities they provide, although they will readily use artificial nest boxes.

- When irrigating, avoid depleting ground water and diverting streams outside their natural stream channels. These actions can kill moisture dependant riparian plants by leaving them high and dry. Avoid converting native habitat to agriculture, especially in areas too dry to farm without irrigation. Irrigating in arid and semi-arid regions can concentrate salts in soil and water, causing severe production and environmental problems (about 30% of the contiguous United States has potential for soil and water salinity problems).
- It is best for birds (and cats!) if cats are kept indoors. However, if you have domestic "barn" cats, spay or neuter them, and keep pet food and food bowls indoors so predators like raccoons and feral cats do not have an additional food source. Never intentionally feed feral cats. Cats (even well fed domestic cats) can be devastating to local songbird populations. Natural predators, like owls and hawks, are very efficient at controlling rodent pests, even around human dwellings.
- Avoid converting existing riparian areas to agriculture; this is the greatest threat to birds in this habitat type. Permanent easements on important riparian areas could benefit both landowners and wildlife. Develop conservation partnerships between landowners, land managers, and private organizations. While landowners need to derive income from the land, this can often be compatible with maintaining regional biological diversity, depending on how the land is used and what

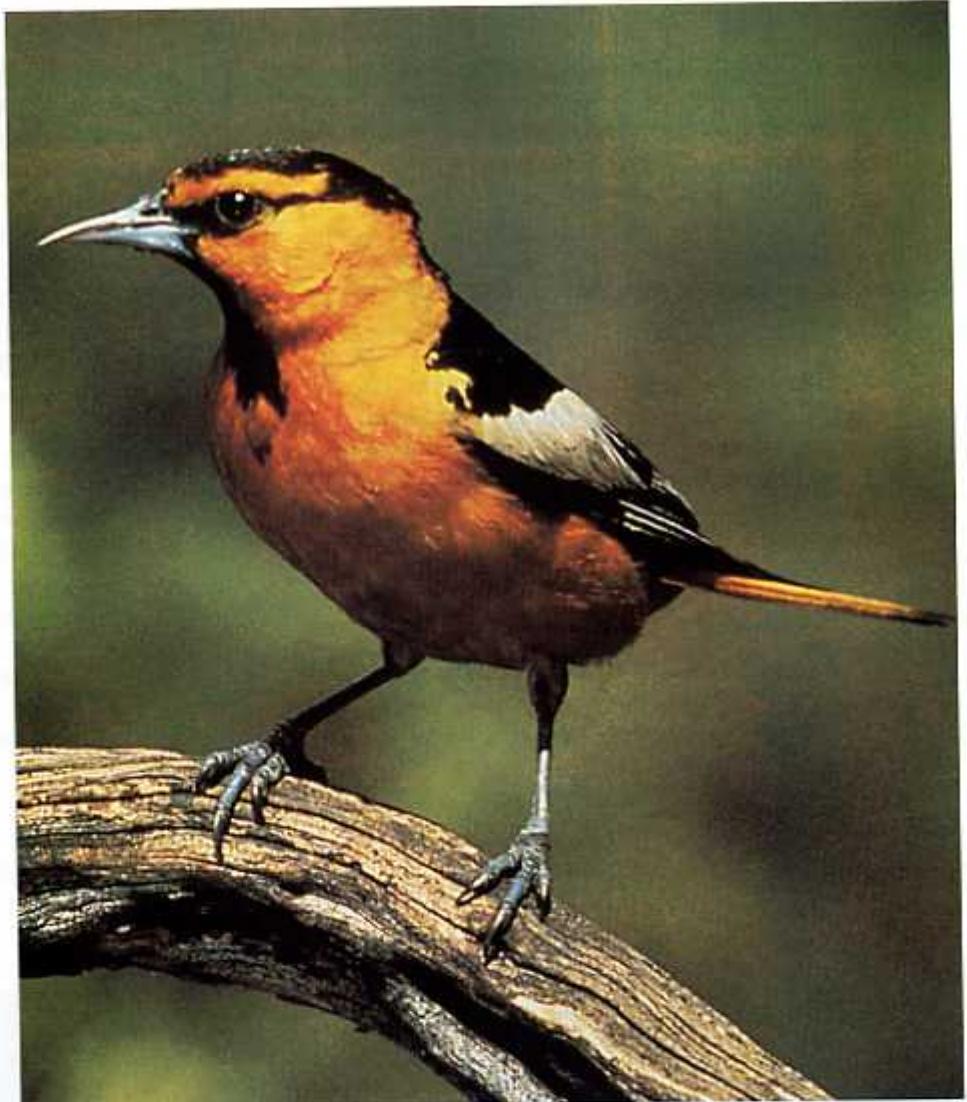


PHOTO BY S.B. HALL FOR THE CORNELL LABORATORY OF ORNITHOLOGY

Found in open riparian woodlands, Bullock's Orioles require tall deciduous trees for nesting and are attracted to trees and shrubs that provide berries.

land management tools are employed. Identify the habitat needs of the birds in the area and the economic needs of the landowner so a baseline need is established.

forestry

Timber harvesting, including firewood cutting, can negatively affect riparian areas by removing nesting trees and foraging sites from the riparian zone. Standing dead and live trees also trap sediments and nutrients, moderate water temperatures, and provide large organic debris. These recommendations can help reduce the impacts of forestry practices on riparian areas.

- To protect the stream channel and provide habitat for birds that depend on mature trees, retain a buffer zone in timber harvest and firewood cutting areas where no cutting is allowed. Other activities within these zones



PHOTOS BY LARRY PARKER, WYOMING GAME AND FISH DEPARTMENT

Maintain a shrubby understory in stands of trees adjacent to meadows and along stream courses to help birds that use the shrubs for nesting and feeding.

- should be modified to protect natural resources. Biologists with the Wyoming Game and Fish Department, U.S. Forest Service, or Bureau of Land Management can give advice on the appropriate buffer width for the area.
- Maintain mature stands of trees adjacent to meadows to help species like the Olive-sided Flycatcher. Maintain snags (standing dead trees) and dead-topped trees along perimeters of wet meadows and in stream corridors. These provide nesting cavities for birds and enhance the number of insects available for food. Snags eventually topple and become organic debris, so retain an abundance of mature trees to replace them over time.
 - Avoid locating landings, log decks, or skid trails in or through riparian areas.
 - Route helicopter flight paths away from riparian areas and locate helicopter landing sites more than $\frac{1}{2}$ mile from riparian areas, especially from May through July. Helicopters and other loud noises interfere with songbird breeding activity, which relies on singing and being heard.
 - Maintain a shrubby understory in stands of trees adjacent to meadows and along stream courses to

help species like the MacGillivray's Warbler and Yellow Warbler.

- Avoid operating heavy equipment through, along, or across riparian areas. If equipment operation is necessary, use tracked equipment rather than wheeled vehicles, and only during winter when the ground is frozen and less vulnerable to damage.
- During fire activities, locate incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities outside of riparian areas. Design fuel treatment and fire suppression strategies, practices, and actions to reduce disturbance of riparian vegetation. Keep chemical retardant, foam, or additives out of surface waters.

engineering

Damming or diverting streams and rivers can dramatically alter the hydrology of the watershed by trapping spring floodwater and releasing artificially steady and high summer flows. These changes directly affect the downstream vegetation. All potential upstream and downstream effects of dams and diversions should be addressed. Well-planned roads, stream crossings, and other engineering projects can help reduce disturbance

to riparian areas. Use the recommendations below to minimize impacts of engineering projects.

- Avoid building roads parallel to streams in riparian zones or through wet meadows. Stream crossings should be at right angles to minimize impacts on riparian vegetation, streambanks, soils, and water quality.
- Roads and rights-of-way often cross riparian corridors, which can fragment bird habitat and reduce its value. Combine all of these disturbances at one crossing site to decrease the area impacted.
- Design roads with adequate structures to prohibit vehicles from leaving the roads and off-roading in riparian zones or adjacent uplands.
- Construct new and improve existing culverts, bridges, fords, and other stream crossings to accommodate a 100-year flood, including associated bedload and debris, where those crossings could pose a substantial risk to riparian ecosystems.
- Maintain buffer zones between riparian areas and mining, oil, gas, sand/gravel, and geothermal activities, including structures, roads, and support facilities.
- Avoid straightening or diverting sections of stream channel. These activities increase stream velocity and erosion, reduce streambank stability, and negatively impact upstream and downstream habitat.
- Before altering water flows where cottonwood stands occur, develop a standardized environmental assessment program that describes historical patterns of cottonwood abundance; establishes an inventory of present cottonwood distribution, abundance, and age-class composition; and establishes long-term study sites to follow changes in the cottonwood forest. Regular monitoring of the water table and cottonwood abundance, mortality, and replenishment should provide indices of stress and decline. Establish control sites upstream from a dam or diversion structure to help detect downstream changes.
- Reduce cottonwood decline downstream from dams or diversions through mitigation. Water management plans and dam operations can reduce cottonwood mortality, improve seedling replenishment, and enhance seed germination by meeting moisture requirements at critical periods. Mitigation measures include enhancing river flows, altering summer flows, maintaining spring flooding, preparing or modifying a site to enhance

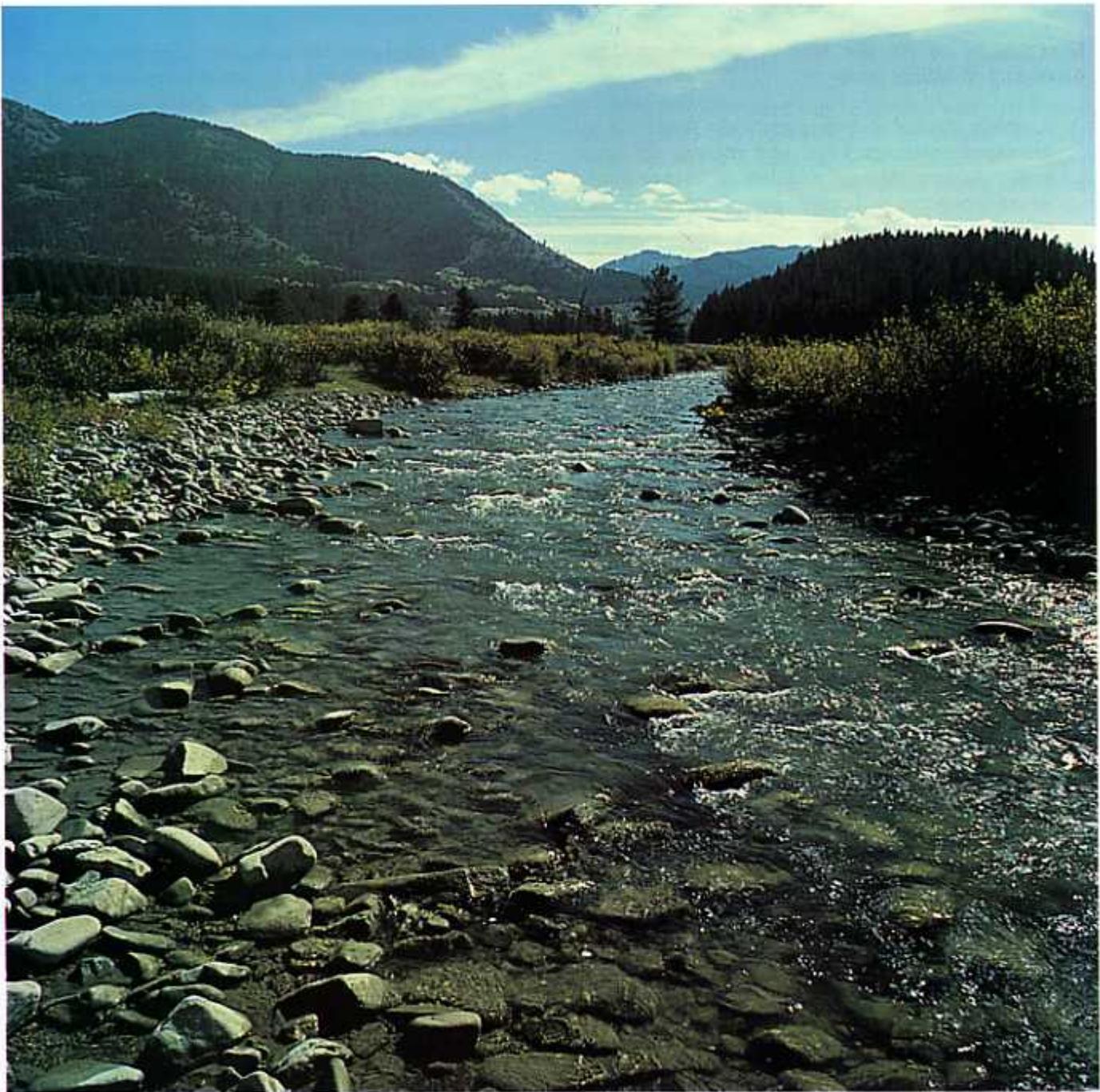
seedling growth, replanting from shoot or root cuttings, and using physical measures to enhance replenishment or prevent grazing damage.

- Restore disturbed areas with native vegetation, prevent grazing by livestock while plants recover, and eliminate the invasion of non-native plants during the reclamation period.

recreation

Unfortunately for birds, people also like to use healthy riparian areas and some recreational uses are not compatible with bird conservation goals. Recreation can affect birds by creating disturbances and habitat degradation, especially during the breeding season. Birds are also affected by vegetation trampling and firewood gathering. One study found that of 106 nonconsumptive uses, 73% of them negatively affected wildlife. The recommendations below can help minimize negative effects associated with recreation.

- Consider potential disturbances to birds and habitat (and other wildlife) when planning or locating camping sites, picnic areas, and other sites of human activity within riparian areas.
 - Locate new recreation sites outside of riparian areas wherever possible. If sites must be within riparian zones, concentrate them in one area, rather than spreading them throughout the riparian area, to limit negative impacts on breeding birds and habitat. Keep disturbance to soils and vegetation to less than 15% of the area within the developed site.
- Avoid constructing new trails along or parallel to riparian areas.
- Keep pets under control in recreation areas. Free-roaming dogs and cats can be devastating to birds that nest on or just above the ground.
 - Provide firewood at developed campgrounds to decrease the use of riparian areas as a wood source.
 - Promote "Tread Lightly" recreation ethics. Educate recreationists about problems humans can cause in riparian habitat and how they can avoid damaging these areas.
 - Manage or restrict all-terrain vehicles, bicycles, and horses in riparian areas and wet meadows because soil compaction and ruts caused by these uses can lead to the drying of these wet areas.
 - Reduce recreational disturbances, including bird watching, in riparian areas during the bird nesting season, especially where rare, sensitive, or endangered species nest.



PHOTOS BY LARRY PRINER, WISCONSIN GAME AND FISH DEPARTMENT

Manage riparian areas for stable, non-eroding banks; good water quality; stable, year-round flows; and sustainable use without abuse over the long-term.

- Plant dense native vegetation, such as willows, to screen and reduce human use of fragile or vulnerable riparian areas.
- Avoid using foggers for mosquito control in riparian habitats, especially during the nesting season, so a food source remains available for birds.

beavers

Beavers alter the landscape. Although they cut down trees, they also create suitable sites for establishing new growth of trees and shrubs. Where beaver populations are stable, their activities help store water, buffer floods, raise water tables, and provide a diversity of habitats. Restoring or maintaining beaver popula-

tions can be an effective habitat management tool, depending on habitat goals.

- Establish desired beaver population levels on a drainage-by-drainage basis, and manage for that level. Address damage and loss of mature trees where they occur, and control beaver populations by relocation or harvest.
- Maintain beaver populations in locations where they currently occur. Encourage and promote reintroduction into areas that were historically occupied by beavers, and provide suitable habitat for reintroduced animals.
- Avoid removing beavers and destroying beaver dams where their activities do not affect irrigation, property developments, or habitat quality. Removing beavers and their dams can reduce water storage, lower water tables, reduce riparian vegetation, increase soil erosion, degrade aquatic habitat, and increase flood damage potential.
- Willow planting may create suitable beaver habitat where absent, and aspen regeneration may improve the suitability of habitat for beavers in some areas.
- Reintroduce beavers into drainages where gullying occurs and where willow re-establishment is a goal. Stream gradients should be less than 4%, and there should be an adequate supply of woody vegetation for food and dam-building materials (vegetation may have to be supplemented).

pesticides and herbicides

Pesticides and herbicides can harm bird populations if used incorrectly. Pesticides can negatively affect bird populations for the very reason they were created—to kill insects. Birds, even seed-eaters, depend on insects to feed their young.

Loss of insect prey during the nesting season can be devastating, and can turn a habitat that regularly produces birds into one that does not. Also, many migrants rely on insects in riparian areas to store up or replenish fat reserves for their journey. Improperly used pesticides can directly kill birds, or weaken them and make them more susceptible to disease or unable to produce young. Herbicides change the composition of the vegetation in the riparian area, which causes loss of nesting sites and declines in prey abundance. If pesticides or herbicides must be used, label directions should always be carefully followed.

- Strictly limit pesticide and herbicide application in riparian areas and adjacent sites to activities that improve or maintain the riparian vegetation and aquatic community (e.g. elimination of competitive noxious weeds). Where pesticides or herbicides are needed, use them as part of an Integrated Pest Management (IPM) program. IPM involves closely



PHOTOS BY LARRY PARKER, WYOMING GAME AND FISH DEPARTMENT

The American Dipper requires clear, rapidly flowing mountain streams. Its nesting and foraging is impacted by stream degradation due to sedimentation, channelization, logging, and incompatible livestock grazing.

monitoring pest populations of both plants and animals, and using chemicals only when and where pests are likely to cause economically or ecologically important damage. This reduces exposure of wildlife to harmful chemicals and reduces the destruction of non-target insects and plants.

- If available, use biological control for specific noxious species, rather than chemical control.
- When possible, apply pesticides and herbicides by hand to target weeds and other pests as specifically as possible.
- Carefully plan aerial application of herbicides to prevent drift of chemicals into riparian areas. Depending on the wind speed, provide a buffer zone of one to four miles downwind of the aircraft, and 250 feet to one mile upwind. Avoid spraying herbicides in winds exceeding 10 mph, or during calm weather when temperature inversions may prevent sprays from reaching the ground. Pellet herbicides are less prone to wind drift and are preferred when applying near riparian areas. Check with the Wyoming Department of Agriculture for more specific information.
- Work with state and federal agencies, such as APHIS, to coordinate the use of pesticides where necessary.



PHOTOS BY LUZBAI PARKER, WYOMING GAME AND FISH DEPARTMENT

To protect the stream channel and provide habitat for birds that depend on mature trees, retain a buffer zone in timber harvest and firewood cutting areas where no cutting is allowed.

rehabilitation

Riparian vegetation can be divided into two zones, each defined by its distance from the stream. The first zone and line of defense for the riparian area is the vegetation at the edge of the water. These plants, called the vegetative liner, keep moving water and debris away from the streambank. An effective vegetative liner should be at least 10 feet wide; the wider the vegetative liner, the more protection it provides during flooding. Ideal plants for the vegetative liner have pliable stems, establish quickly, tolerate water logging, regenerate after injury, and form a uniform stand. In many areas, native willows are excellent liner plants. Beyond the vegetative liner, as a second line of defense, is a combination of native trees and shrubs. This zone should be 30 to 150 feet wide from the high water mark (terrain, soil type and condition, and adjacent land uses and ownership will influence the appropriate width at each location). The vegetation in this second zone increases the filtering capability of the area, provides wildlife habitat, and helps shade the stream. Where rehabilitation of riparian zones is needed, use a combination of the suggested methods below.

- Always identify and address the causes of riparian degradation before starting rehabilitation. Many rehabilitation projects fail without a change in other management activities, such as grazing or intensive recreation.
- Tailor specific rehabilitation efforts to each riparian area. Physical factors such as stream type, geology, climate, and elevation will influence the project's success.
- Determine specific objectives for each riparian area, and develop a monitoring program to track whether the objectives are being met.
- To rehabilitate streambank damage, erosion, and adjacent over-utilized upland sites that all erode and add soil to streams, use willow plantings, dry root stock transplants, seeding, and/or livestock exclusion. Plant only native species to increase nesting cover and foraging opportunities for birds. Protect new plantings and seedlings from livestock and wildlife use.
- Cottonwood forest regeneration requires periodic flooding that scours out seedbeds for cottonwood seedlings. Where flood control and other water storage or diversions have removed this scouring action, consider sod removal, irrigation, or seeding to encourage cottonwood regeneration.
- Replenish cottonwood riparian forests to compensate for mortality of mature trees. Seed germination

requires spring flooding to prepare seedbeds and recharge underground water levels so seedlings have continuous moisture until their root systems develop. After the first two years, cottonwood saplings grow increasingly tolerant of flooding and drought stress as they develop larger root systems.

- Remove exotic plants, like Russian olive and tamarisk (salt cedar), that compete with native plant species and do not provide foraging or nesting opportunities for wildlife.
- Where streambank erosion is severe, banks may have to be reshaped to at least a 1:1 slope, and then stabilized with four to six inch diameter willow or cottonwood posts planted with a power auger or backhoe two feet below the low flow water surface. Streambank revegetation works best on slower moving streams [less than nine feet (3 m) per second] with relatively flat gradients. On faster streams, a combination of vegetation and structural measures, like riprap or jetties, may be needed to stabilize streambanks.
- Stabilize and protect eroding banks with professionally designed rock riprap, tree revetments, or gabions. Structural options include placing instream structures, such as low-head dikes, to improve riparian systems by slowing flow, increasing sediment deposition, and allowing re-establishment of riparian vegetation. These structures should not be used as substitutes for proper riparian management but as temporary solutions while addressing the causes of deterioration.
- Avoid channelizing streams, re-routing streams, straightening meanders, or diking banks. Where channelization has occurred in the past, restore meanders to raise water tables, narrow and deepen channels, stabilize banks, and allow re-growth of woody riparian vegetation.
- Reintroduce beavers into drainages where gullying occurs and where willow re-establishment is a goal. Stream gradients should be less than 4%, and there should be an adequate supply of woody vegetation for food and dam-building materials (these may have to be supplemented).
- Eliminate the invasion of non-native plants during the rehabilitation period. Fabric or plastic mats are



Photo by Rita Mukowski, Story, Wyoming

Found in northwestern Wyoming, the Harlequin Duck nests on the ground or in a tree cavity next to cold, shallow, rapid mountain streams. Its nesting success is impacted by stream sedimentation, channelization, logging and incompatible livestock grazing.



Photos by LARRY PARKER, WYOMING GAME AND FISH DEPARTMENT

Swainson's Hawk populations have declined due, in part, to the loss of native grasslands and nest trees and the conversion of suitable agricultural land to urbanization.

very useful in riparian areas to help tree seedlings stay ahead of grass competition.

- Landowners interested in improving riparian habitat on their lands can seek financial assistance and expert advice from the U.S. Fish and Wildlife Service's Partners for Wildlife Program (307-332-8719), the U.S. Natural Resources Conservation Service (307-261-6453), or the Wyoming Game and Fish Department (1-800-842-1934).

wildlife management

Wildlife, especially big game animals, can impact riparian areas. Managing for one species can sometimes have negative impacts on other species, such as birds. Wildlife management goals for each riparian area should be well planned, and should complement the overall goals of the riparian community.

- Consider riparian area conditions and big game impacts (e.g. on willows or aspen) when setting herd objective levels. Do not exceed the carrying capacity of riparian habitats.
- Cooperate with the Wyoming Game and Fish Department to identify and eliminate wild ungulate impacts to riparian areas. Locate ungulate feeding sites outside of riparian areas.
- Be aware of the impacts that cowbird nest parasitism and predators have on nesting birds. Increased nest parasitism results when forests are fragmented or livestock grazing occurs near woody habitats during the nesting season, and predators like raccoons, skunks, and crows often increase in number around human developments. Manage nest parasite and predator issues where negative impacts to birds occur.

residential and urban development

Urban and residential environments can be particularly hazardous for breeding birds. Nest predators such as crows, squirrels, raccoons, skunks, and domestic cats are common, as are nest parasites, Brown-headed Cowbirds. Human impacts on the environment and on birds can also be intense. Within riparian corridors, individual houses result in habitat fragmentation, human disturbance, and introduction of exotic plant species and predators like cats. The recommendations below will help reduce the impact of human developments on both birds and habitat.

- Retain and plant vegetation that is native to your area when landscaping, including a natural distribution of vegetation in the ground, shrub, and tree layers. This will result in a more natural-looking landscape, and will provide food, shelter, and nest sites for birds. Avoid planting exotic species, especially aggressive non-natives like Russian olive and tamarisk (salt cedar), because these have relatively little value to wildlife.
- Where possible, keep snags and dying trees in place. If safety is a concern, cut them to a height of about 10 feet, rather than removing them altogether.

- Clump housing into a small area and leave the rest of the riparian corridor as "open space" to reduce habitat fragmentation. Conservation easements can be used to protect the open space in perpetuity.
- Control Brown-headed Cowbirds in residential areas if nest parasitism becomes a problem.
- Keep domestic cats indoors or leashed when outside, and never feed feral cats. Keep pet food bowls indoors and tightly cover all outdoor garbage cans so predators like raccoons do not have an additional food source.
- For more information on landscaping for wildlife, contact the Wyoming Game and Fish Department (1-800-842-1934).

information and education

- Establish public education goals and implement programs to inform users of public lands and owners of private lands of the value, sensitivity, and importance of riparian areas to resident and Neotropical migratory birds and other species. This could range anywhere from interpretive signs on public lands, to distribution of Best Management Practices to landowners, to presentations at local grade schools, etc.

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