

# Afield with Aquatic Birds



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## best management practices for aquatic areas to benefit birds in wyoming

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 travel 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.

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 Services Division.

Approximately 132 of Wyoming's avian species have been identified as using aquatic habitats. Some of these, such as the Common Loon, are among the imperiled bird 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 aquatic habitats that can be used to protect and enhance populations of both Neotropical migratory birds and resident birds that call Wyoming home year-round.

## aquatic ecology

A relatively small portion of the landscape of Wyoming consists of open, deep-water habitat in the form of lakes, ponds, and reservoirs. Reservoirs, stock ponds, and irrigation systems have dramatically increased the amount of aquatic habitat throughout the state, especially in the plains/basin regions. Fish stocking operations, which began in the early 20<sup>th</sup> century and continue today, have introduced fish into some lakes that did not naturally support them, and have introduced fish that are not native to Wyoming.

There are approximately 230,000 acres of deep water reservoir habitat in Wyoming, which provides important nesting, foraging, or staging habitat for many bird species. Large islands are often the most important feature of these reservoirs for some birds.

Few natural ponds exist in the plains/basin regions of Wyoming, but thousands of ponds have been dug in the area since the 1930s to provide water for livestock. Many constructed stock ponds in Wyoming are currently nonfunctional. For instance, in the Bighorn Basin, less than half of the 2,000 stock ponds constructed still contain water; the rest have breached or silted full. In some cases, old stock ponds are being replaced by stock tanks, which do not provide waterbird habitat. Nevertheless, many stock ponds do provide benefits to birds in otherwise arid areas.

Water is a critical and a limited resource in the

western U.S., and has always been a primary consideration in any human endeavor. In addition, actions on the land ultimately affect the condition of the waterways. For this reason and because of the importance of water to humans, the status of aquatic resources has been substantially influenced by settlement. The condition of the State's aquatic habitats and wildlife are in fact an indicator of the activities that take place in the surrounding watershed and airshed. In many cases, the status of aquatic life is the best measure of success in managing the landscape, air, and water quality.

There are many kinds of aquatic habitats showing a great variety of physical, chemical, and biological characteristics. Generally, the term "aquatic" may apply to any watery environment, including lakes, ponds, rivers, streams, estuaries, and marine habitats. However, because there are



PHOTO BY DONNA DEWBERRY, U.S. FISH AND WILDLIFE SERVICE

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no estuarine or marine habitats in Wyoming, and rivers and streams were covered in the Plains/Basin Riparian and Montane Riparian habitat sections, this section covers areas dominated by open, deep water, including lakes, ponds, and reservoirs.

Lakes, ponds, and reservoirs in Wyoming may range in size from less than an acre to thousands of acres. They may be nearly devoid of vegetation, or they may be densely vegetated. Aquatic vegetation may include algae, floating-leaved plants, submergent plants, and emergent plants. Areas dominated by emergent vegetation are usually considered wetlands, but many lakes and ponds with open, deep water are surrounded by a zone of emergent vegetation, and are often bordered by wetland areas.

A wide variety of birds use aquatic habitats for all or part of their life cycles. In fact, 50% of all the bird species in the U.S. that are listed either as federally threatened or endangered, or are on the U.S. Fish and Wildlife Service 2002 List of Birds of Conservation Concern, occupy wetland or aquatic habitats. Birds are attracted to the abundant fish and invertebrate resources and to the unique vegetation structure of aquatic habitats. The watery environment also provides nesting, resting, and feeding sites that are protected from many ground predators. Physical characteristics that influence how birds use aquatic habitats include lake or pond size; extent of open water; water depth; dominant vegetation type and structure; landscape setting and the surrounding upland habitat (e.g. grassland, shrubs, forest, etc.); annual water regimes (e.g. stable or unstable); and the presence of special features, such as islands, peninsulas, or mudflats. In general, aquatic habitats increase in value to birds if they have a stable water supply, are protected from human disturbance, and are free of contaminants.

## how to help

- Conserve unique representatives and/or large, ecologically functioning examples of aquatic habitat.
- Consider both long- and short-term impacts



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and/or benefits of any activities within or adjacent to aquatic areas. Manage aquatic habitats for sustainable use without abuse over the long term.

- Maintain and enhance the habitat of aquatic areas. Identify and protect the ecological processes that support specific aquatic habitats and their associated bird communities. Avoid practices that degrade or destroy natural water flow or the vegetation in and around aquatic habitats.
- Where possible, restore or rehabilitate the hydrology, water quality, and native plant communities to degraded and disturbed lakes and ponds.
- Where natural nesting opportunities are limited, intensive management may involve the creation of nesting islands, earthen furrows, and perching or nesting platforms. Properly located artificial islands can be ideal nesting places for birds because they reduce predation. In some cases, nesting success on islands can be several times higher than on uplands or shorelines.
- Manage aquatic areas for good water quality. The reaction of the biological community to contaminants can be seen much more swiftly in an aquatic environment than in similar terrestrial situations. Reduce and control point and non-point sources of pollution to attain the



PHOTO BY JOHN FOSTER, U.S. FISH AND WILDLIFE SERVICE

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water quality condition necessary to support the living resources. It is particularly important to monitor the water supply because declining water quality may lead to insidious deterioration of the aquatic habitat.

- Reduce land use activities that increase soil erosion and sedimentation in aquatic habitats. Siltation is the primary pollution problem threatening U.S. waterways. While siltation is a natural physical process and a certain amount of sediment from natural erosion is normal, accelerated sediment runoff caused by human activities can cause severe negative impacts to aquatic life. Sediment input and runoff can carry with it contaminants from the surrounding watershed that can remain trapped in sediments indefinitely.

- Manage aquatic areas from a watershed perspective. Watershed conditions greatly influence water quality, water quantity, and timing of flows in aquatic habitats. Encourage the further development and implementation of conservation measures to improve the condition of riparian, wetland, and upland watershed components that affect water quality and aquatic habitats.
- Maintain a natural fire regime throughout the watershed. Periodic fires release nutrients that may be important as a nutrient subsidy to high elevation aquatic ecosystems. In areas where eutrophication (increase of nutrients) could be a problem, implement prescribed burns in the spring to limit the runoff of phosphorus into lakes.
- Restore and enhance natural aquatic habitats, and preserve natural processes as much as possible. Protect pristine lakes and ponds, and manage those that have been modified by human activities to enhance their functional value for wildlife. Assess the condition of the lake or pond, conduct reconnaissance of bird populations, and identify limiting factors before initiating management actions to avoid trying to fix something that isn't broken. While, in many cases, management is desirable, it is not always necessary. Protection itself is a form of management and, in some cases, may be the only management action necessary. Many montane lakes, particularly those in the upper montane and subalpine zones, have been insulated sufficiently from human activities so that no management actions are warranted. In these pristine habitats, actions are best directed toward habitat preservation rather than improvement. Conversely, aquatic areas that have been modified or impacted often must be actively managed to provide consistent resources to wildlife. A successfully managed lake or pond contains the type, quality, and distribution of food and cover that meet the goals for bird conservation.
- Minimize human disturbance at known nesting areas and colonies during the nesting season by creating refuge areas and limiting human use. Disturbance problems can be alleviated to some degree through public education, signing, or seasonal restrictions.
- Restrain household pets, at least during the nesting season peak, for better breeding success of birds that nest on or near the ground.
- Maintain optimum amounts of locally native

aquatic vegetation. A variety of plant species provides a diversity of vegetation structure and hosts a diversity of invertebrate populations, which are used by many bird and fish species. Aquatic vegetation can also subdue the erosive force of waves and protect the aquatic habitat from siltation and turbidity.

- Prevent the invasion of exotic plants (e.g. hydrilla, Eurasian water milfoil, and purple loosestrife). To reduce the likelihood of weed invasion in lakes and ponds that contain a community of native vegetation, maintain the vigor of native species, and clean watercraft and equipment when moving between bodies of water.
- Manage for a wide variety of bird and other wildlife species by maintaining habitat diversity. Within extensive areas of aquatic habitat, manage for a patchwork or mosaic of types and conditions across the landscape. A variety of pond characteristics are important to provide habitat components for a variety of birds. For example, shorebirds forage on mudflats, grebes prefer lakes bordered by emergent vegetation, and pelicans require islands with little or no vegetation. Ideally, a variety of sizes, depths, and shoreline conditions should be available.

- Consider all the alternatives for vegetation management before taking action. A variety of management schemes can be used to alter the distribution, composition, or density of vegetation (e.g. trapping muskrats, water level manipulation, livestock grazing, disking, crushing, herbiciding, and maintaining or enhancing native crayfish populations). Biological methods are preferable when possible. Consider the use of herbicides extremely carefully, as treatment of submerged plants is an all or nothing proposition. While artificial techniques are often more expensive and less aesthetically pleasing than biological techniques, they may sometimes be necessary in highly modified or degraded habitats. In some situations, integration of mechanical, chemical, and biological control measures may offer the best solution. Whatever management scheme is selected should be scheduled and implemented to mimic natural processes as closely as possible.
- Maintain or restore a buffer strip of native vegetation surrounding the lake or pond to provide food and critical nesting, escape, and winter cover for birds and other wildlife. Buffer strips also improve water quality by trapping contaminants before they reach the water's edge, preventing soil erosion, and reducing sedimentation. Buffer strips should



PHOTO BY BUREAU OF LAND MANAGEMENT, [WWW.WY.BLM.GOV/BOTANUTICS](http://WWW.WY.BLM.GOV/BOTANUTICS)

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be 40 to 100 feet wide, and consist of tall herbaceous cover or other dense native vegetation.

- Protect those habitats used by colonial waterbirds for nesting sites. Colonial nesting birds are particularly sensitive to changes in habitat conditions after establishing a nesting site because factors that might lead to nesting failures affect entire colonies. Throughout the nesting season, maintain the isolation of colonies by restricting human access, sustaining water levels, and preventing access by grazing animals.
- Where appropriate, use water level control to enhance aquatic habitat. Manipulation of water depth to provide flooding and drying can have strong impacts on plant growth. Desirable plants may be seeded during drawdowns, and if unwanted vegetation is mowed or disked during drawdowns, the plants will decompose and produce abundant invertebrates when reflooded. Spring drawdowns will ensure that bird nests will not be flooded while high numbers of invertebrates will be available during nesting. Drawdowns in mid and late summer expose mudflats, which provide feeding sites for migrating shorebirds. If submerged vegetation has become a problem, a fall drawdown to dry unwanted plants will set back their growth the next year. If plant roots

freeze over winter, their regrowth will be further reduced. Before implementing a drawdown, be certain that adequate water levels will remain to avoid a fish kill.

- Provide stable water levels throughout the bird nesting season. Water level manipulation should be carefully conducted at the proper time of year to ensure maximum benefit to birds. Water fluctuations during the nesting season can flood nests, can leave nests dry and exposed to mammalian predators, and can cause some birds to abandon their nests.
- Ensure an adequate supply of water. Manage flows to maintain a minimum instream flow and a minimum pool size to maintain foraging areas for birds.
- During pond construction, keep in mind that the best ponds for birds are located in areas of rolling topography and constructed to provide a shoreline slope of less than 20%. Ponds should be greater than 1 acre, with adequate watershed area to maintain permanent water. Take fill for the dam from a rather small area to create a deep pool in front of the dam that will remain relatively free from emergent and aquatic vegetation for many years and hold water longer. The watershed should be well vegetated and maintained so runoff water is relatively free from sediment. Approximately



PHOTO BY U.S. FISH AND WILDLIFE SERVICE

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1/4 to 1/3 of the pond area should be at least 10 feet deep to ensure winter survival of fish. Since the presence and diversity of plants are related to water depth, it makes sense to vary water depth. Areas of deep water do not need to be located in the center of the pond; provide an island in the center for nesting sites.

- Regularly monitor birds to see how the management plan is working, and redirect efforts if necessary (with special emphasis for species that seem to be declining). Implement aquatic habitat monitoring programs to establish baseline data and identify changes in habitat quality (both positive and negative) through time. Use standardized methods to monitor the habitats and sensitive species in an area, before and at several-year intervals after treatments are applied, to aid in making proper land management decisions in the future.

## recreation

Unfortunately for birds, people also like to use lakes and ponds, and some recreational uses are not compatible with bird conservation goals. Recreational use can affect birds by creating disturbances and habitat degradation, especially during the breeding season. The recommendations below can help minimize negative effects associated with recreation. Recreation activities, such as camping, off-road travel, and boating, can degrade aquatic habitats. Humans may disrupt the breeding activities of birds, causing nest failures or decreased production of young.

- Consider potential disturbances to birds and habitat (and other wildlife) when planning or locating camping sites, picnic areas, and other sites of human activity near aquatic habitats.
- Locate new recreation sites away from lakes and ponds whenever possible. If sites must be near aquatic zones, concentrate them in one area, rather than spreading them throughout the 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.
- 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.
- Promote "Tread Lightly" recreation ethics. Educate recreationists about problems humans can cause in aquatic habitat and how they can avoid damaging these areas.

- Reduce recreational disturbances, including bird watching, in aquatic areas during the bird nesting season, especially where rare, sensitive, or endangered species nest.
- Avoid using foggers for mosquito control near aquatic areas, especially during the nesting season, so a food source remains available for birds.
- Properly dispose of used fishing and hunting equipment (e.g. fishing line, lures, lead shot, and gill nets).
- Restrict the access of motorboats and personal watercraft to nesting areas. Establish no-wake zones and close off sensitive areas completely.
- Clean watercraft and other equipment when moving between bodies of water to prevent the introduction of exotic species (e.g. whirling disease and zebra mussels).
- Install booms to keep surface pollution within marina areas.
- Reduce human disturbance of nesting



PHOTO BY DONNA DEWURST, U.S. FISH AND WILDLIFE SERVICE

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PHOTO BY RYAN HIGERTY, U.S. FISH AND WILDLIFE SERVICE

*Include lake and pond management as an integral part of each grazing management plan.*

populations. Disturbance problems can be alleviated to some degree by providing refuge areas and by limiting human use during sensitive periods. In particular, restrict human use of islands.

- Establish noise free zones around nesting areas (e.g. islands). Limit horsepower and/or decibel levels.

## grazing

There are many possibilities for harmonizing grazing practices with habitat management for birds. Although improper grazing practices can cause degradation of aquatic habitat, proper stocking levels and grazing regimes can be effective habitat management tools and compatible with maintenance and improvement of lakes and ponds.

- 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 lake and pond management as an integral part of each grazing management plan. Determine site-specific habitat objectives and tailor the grazing management plan to help meet the objectives. Consider the site's specific factors of concern, such as loss of shoreline and aquatic vegetation; 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 aquatic area to check progress toward the objectives. Record how key aquatic plant species, the overall aquatic 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 aquatic ecosystems.

Incompatible grazing can have harmful long-term effects on survival and regeneration of plant seedlings; can negatively influence the species, structure, and health of vegetation; and can cause soil compaction, trampling of the shoreline, altered local hydrological conditions, 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 shorelines or water quality.

- Manage pastures with aquatic 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.
- Provide a mosaic of aquatic habitats that are suitable for different bird species. For example, use grazing to encourage mudflats on smaller ponds; and lush shorelines, emergents, and aquatic vegetation on larger (greater than 1 acre) ponds.
- Where feasible, fence livestock out of sensitive aquatic habitats to avoid destroying aquatic vegetation, increasing water turbidity, and polluting the system. Livestock can also destroy vegetation covering earthen retaining walls and dams, eventually leading to washout of these structures. Ideally, a 100-foot

perimeter fence should be constructed around the pond. If livestock is dependent on the pond as a water source, a pipeline may be constructed from the pond to a stock tank. If this option is not feasible, a "water gap" can be constructed. This involves constructing a fence into a small portion of the pond so livestock can use this restricted area for watering.

- Improve livestock distribution and forage use by using salt and mineral blocks, but avoid placing them immediately adjacent to lakes and ponds (keep them at least ½ mile from the aquatic area).
- Improve adjacent upland forage to lure livestock out of aquatic areas and to reduce erosion and runoff.
- Repair old stock ponds rather than replacing them with stock tanks.
- Develop conservation partnerships between



PHOTO BY DONNA DEWBERT, U.S. FISH AND WILDLIFE SERVICE

*Identify the habitat needs of the birds in the area and the economic needs of the landowner so a baseline need is established.*

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. Also, important habitat on private land can be protected with conservation easements. In some cases, landowners can derive income from hunters, trappers, tourism (e.g. bed-and-breakfasts with a view, wildlife watchers, and photographers), bait minnows, or aquatic plants for gardening.

## farming

These recommendations for farming practices will benefit birds and other wildlife, and also help to protect water quality and aquatic vegetation.

- Provide a buffer of uncultivated vegetation at least 40 to 100 feet wide around aquatic areas. Cultivating up to the edge of a lake or pond removes important vegetative filters, increases sedimentation, and accelerates siltation. Reestablish vegetation through plantings and, if necessary, fencing.
- Prevent chemical runoff into aquatic habitats. Agricultural chemicals can harm aquatic vegetation and wildlife.
- Prevent soil from eroding into lakes and ponds. Increased sedimentation reduces the quality of aquatic habitat. Use contouring and minimum tillage, and maintain winter cover and buffer strips to reduce siltation and erosion, and to extend the life of the aquatic habitat.
- While it is better for birds (and cats) if cats are kept indoors, have domestic "barn" cats spayed or neutered, keep pet food and food bowls indoors so predators like raccoons and feral cats do not have an additional food source, and 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.
- Use Integrated Pest Management (IPM) to control undesirable weeds and insects. IPM will reduce destruction of non-target insects that are food for many species of birds and

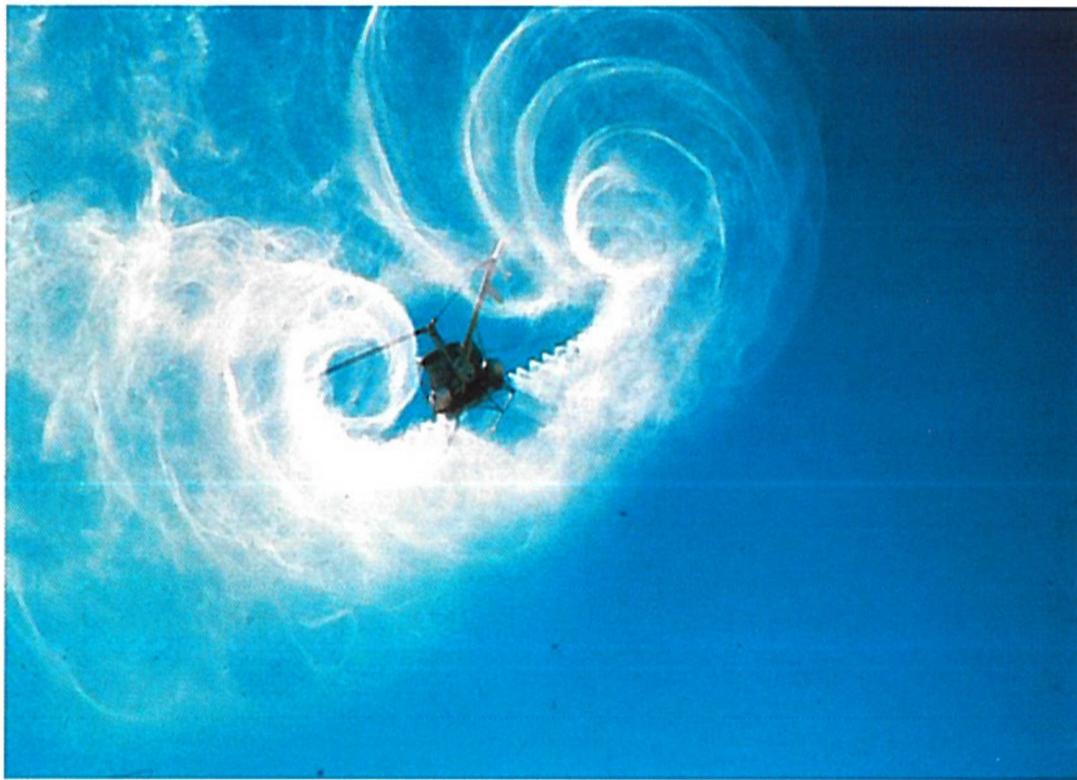


PHOTO BY BRAD E. JOHNS, U.S. FISH AND WILDLIFE SERVICE

*Carefully plan aerial application of herbicides to prevent drift of chemicals into aquatic areas and employ drift retardants.*

minimize exposure of birds to harmful chemicals. Most species of grasshoppers require bare ground to lay and hatch eggs; using minimum or no-till practices will reduce the need for insecticides.

- 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. Also, important habitat on private land can be protected with conservation easements. In some cases, landowners can derive income from hunters, trappers, tourism (e.g. bed-and-breakfasts with a view, wildlife watchers and photographers), bait minnows, or aquatic plants for gardening.

## pesticides

Pesticides can harm bird populations if used incorrectly. Insecticides can negatively affect bird populations for the very reason they were created—to kill insects. Birds, even seedeaters, 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 aquatic 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 a lake or pond, which causes declines in prey abundance. If

pesticides must be used, carefully follow the label directions.

- Strictly limit pesticide application in aquatic areas and adjacent sites to activities that improve or maintain aquatic vegetation (e.g. elimination of competitive noxious weeds). Where pesticides are needed, use them as part of an Integrated Pest Management (IPM) program. IPM involves closely monitoring pest populations of both plants and animals, and using chemicals only when and where pests are likely to cause economically or



PHOTO BY U.S. FISH AND WILDLIFE SERVICE

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ecologically important damage. This reduces exposure of wildlife to harmful chemicals and reduces the destruction of non-target insects and plants. Include birds in IPM plans for insect control, along with natural pathogens, suitable crop and grazing practices, pest-resistant crop strains, minimal use of pesticides, and using less toxic or persistent forms of pesticides.

- Use only those pesticides that are approved by the U.S. Environmental Protection Agency specifically for use in and adjacent to aquatic areas.
- 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 aquatic areas and employ drift retardants. Depending on the wind speed, provide a buffer zone of 1 to 4 miles downwind of the aircraft, and 250 feet to 1 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 aquatic areas. Check with the Wyoming Department of Agriculture for more specific information.

- Do not apply pesticides when there is a high probability of rain.
- Limit pesticide use to periods in the life cycle of the pest when the chemical is likely to be most effective and least toxic to non-target species.
- Consider other alternatives, besides herbicides, for vegetation management. These include regulation of muskrat populations, water level manipulation, livestock grazing, prescribed burning, mowing, disking, crushing, and excavating. Whatever management scheme is selected should mimic natural processes as closely as possible.

## forestry

Timber harvesting, including firewood cutting, can negatively affect aquatic habitats by removing nesting trees and foraging sites from the aquatic area. 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 aquatic habitats.

- To protect the aquatic habitat from erosion and sedimentation and to 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 should be modified to protect natural resources.
- Avoid locating landings, log decks, or skid trails immediately adjacent to lakes and ponds.
- Avoid operating heavy equipment immediately adjacent to aquatic areas. If equipment operation is necessary, use tracked equipment rather than wheeled vehicles, and only during winter when the ground is frozen and less



PHOTO BY TIM BORMAN, U.S. FISH AND WILDLIFE SERVICE

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PHOTO BY JOHN AND KAREN HULLINGSWORTH, U.S. FISH AND WILDLIFE SERVICE

*Maintain buffer zones between aquatic areas and mining, oil, gas, sand/gravel, and geothermal activities, including structures, roads, and support facilities.*

vulnerable to damage.

- During fire activities, locate incident bases, camps, helibases, staging areas, helispots, and other centers for incident activities away from aquatic habitats. Design fuel treatment and fire suppression strategies, practices, and actions to reduce disturbance of aquatic vegetation. Keep chemical retardant, foam, or additives out of surface waters.
- Reseed and stabilize the surrounding uplands where necessary to promote the timely regrowth of vegetation.

## engineering

Well-planned roads and other engineering projects can help reduce disturbance to aquatic areas. Use the recommendations below to minimize impacts of engineering projects.

- Avoid building roads adjacent to aquatic habitats to minimize impacts on aquatic vegetation and water quality.
- Restore disturbed areas with native vegetation, prevent grazing by livestock while plants recover, and eliminate the invasion of nonnative plants during the reclamation period.
- Maintain buffer zones between aquatic areas

and mining, oil, gas, sand/gravel, and geothermal activities, including structures, roads, and support facilities. Establish buffer strips of land bordering lakes and ponds that are wide, vegetated, and otherwise roughened enough to trap sediment that might otherwise enter the aquatic area.

- Install temporary fencing (e.g. silt fences) around sensitive areas during construction.
- Control erosion and runoff from construction sites.

Construction activities in and around aquatic areas can result in significant erosion and sedimentation. To minimize erosion, plan access on shallow grades, even though this may not be the most direct access.

- Locate facilities; projects (e.g. maintenance areas, storage, and composts); and cleared, paved, and compacted surfaces away from aquatic areas. Developed facilities with hardened surfaces such as roads, trails, and parking lots may deliver runoff, sediments, and toxins to adjacent lakes and ponds.
- Do not dump materials into lakes or ponds. During construction and maintenance, establish routine carryout procedures to minimize pollution risks.
- Minimize collisions between birds and power lines by avoiding constructing power lines in areas where birds concentrate during migration, breeding, or winter. However, if problems exist after construction, reduce the potential for collisions by using natural vegetation or human-made structures to shield power lines, modifying habitat near power lines to change its attractiveness to birds, and/or modifying land use to reduce disturbance (i.e. flushing birds near power lines). Some of the possibilities for line modification include enhancing the visibility of lines (e.g. flags or marker balls), burying the line, removing overhead groundwires,

and removing small lightning shield wires in sensitive areas. Other possible mitigations include constructing lines parallel to the prevailing wind, constructing lines lower than flight corridors, and placing lines across aquatic areas at oblique rather than right angles. To minimize avian mortality, power lines should be constructed to the most current standards using publications such as those from the Avian Power Line Interaction Committee (APLIC) (1994). For details on power line mitigation to benefit birds, please refer to these publications.

- Minimize the electrocution of raptors on power lines by constructing and retrofitting power lines to the most current standards. Raptor electrocution can be addressed by a variety of mitigation measures, through design and retrofitting existing lines. Possible mitigation includes using insulating materials; gapping groundwires; adding pole-top extensions; lowering crossarms; and adding elevated perches, depending on the nature of the pole and the problem. Also, nest platforms may be installed on power line structures to enhance populations of raptors while minimizing the risk of electrocution and the risk to service. Nest platforms may be provided on the poles themselves or on "dummy" poles placed near those poles where nests have been built. To

minimize avian mortality, power lines should be constructed and retrofitted to the most current standards using publications such as those from the Avian Power Line Interaction Committee (APLIC) (2006). For details on power line mitigation to benefit birds, please refer to these publications.

- To minimize the effects of continuous noise on bird populations, reduce noise levels to 49 dBA or less, particularly during the bird nesting season. Constant noise generators should be located far enough away from sensitive habitats such as grouse leks and raptor nests that the noise that reaches those habitats is less than 49 dBA. For example, the noise impact from drill rigs is greater than 49 dBA when the rig is closer than about 800 feet to a receptor; impact from a 26,000 horsepower compressor station is greater than 49 dBA when located closer than about 2,500 feet to a receptor. Near roads with 10,000 cars per day the population density of birds may be reduced up to 1 mile from the road, while near very busy roads (up to 60,000 cars per day) the effect may be felt up to 2 miles away. Avoid placing well pads, roads, and any other facilities requiring human presence within 1/2 mile of raptor nests (and 1 mile of Ferruginous Hawk nests) to prevent flushing adults from the nest. This buffer zone should be expanded in areas where prey are scarce, as

raptors must spend more time searching for prey and may be less tolerant of disturbances. If necessary, implement mitigation measures to decrease continuous noise levels. For example, enclose compressor engines with buildings and install additional suppression around muffler exhausts. Noise barriers can be constructed at drilling and testing operations, and noise dampening around engines should be considered (including foam insulation around drilling rigs).

- Where possible, avoid construction activities and other temporary disturbances during the breeding season in areas where priority bird species occur. Avoid noisy disturbances within a 1/2 to 1



PHOTO BY U.S. FISH AND WILDLIFE SERVICE

*Do not dump materials into lakes or ponds. Locate facilities; projects (e.g. maintenance areas, storage, and composts); and cleared, paved, and compacted surfaces away from aquatic areas.*

mile of active or occupied raptor nests, depending on the species, during the period from February 1 through July 31 to prevent nest abandonment.

## 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 aquatic 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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