Grassland Habitat Group

Alpine Tundra/Grasslands

1) Describe the habitat (Billings 1988, Braun 1980, Brown and Chambers 1990, Hann 1990, Ives and Barry 1974, Thilenius 1975, Zwinger 1972):

a) Historic conditions: Because many alpine ranges have been used for summer grazing continuously since the mid to late 1800s, it is often difficult to determine what their "natural" state was. However, except for some shifts in vegetation composition as a result of grazing, and other obvious but local impacts from recreation and mining, alpine tundra / grasslands probably existed historically in a similar state that they do today.

b) Present conditions: Impacts from human developments, pollution, and disturbance to natural processes have been relatively low in the alpine zones compared to other ecosystems. However, alpine tundra is sensitive to disturbance, and the consequences are often highly visible. Because of the lack of buffering ability in alpine ecosystems, the effects of human disturbances are more drastic and long-lasting than in other more productive ecosystems. Impacts from disturbances such as mining and recreation are usually obvious (e.g. rutting, erosion, and vegetation loss) but occur on a local scale. While grazing is much less intense than it was in the early 20th century, its impacts (e.g. changes in vegetation composition, erosion, and soil compaction) often occur on a landscape scale. Since alpine tundra / grasslands make up less than 1% of the land area in Wyoming [213,750 acres (86,500 ha)], this community is unique and has significant conservation value.

2) Identify the issues:

a) Use: Habitat for wildlife; grazing, especially by sheep; recreation (e.g. hiking, hunting, fishing, photography, rock climbing, camping, off-road vehicle travel, skiing, and horse-packing); and mining are the major uses. In addition, alpine areas are the primary watersheds for agricultural, industrial, and metropolitan development as snow accumulation and water storage in these areas provide the main sources of summer runoff for Wyoming's streams and rivers.

b) Access: Most alpine tundra / grasslands (98.5%) are in public ownership, but a large proportion of these ecosystems is protected as wilderness (72%), which prohibits mechanized equipment and limits the range of recreational activities. Remoteness, rough terrain, and seasonal use have also discouraged exploitation, but difficulty does not preclude use and is attractive to many. Improved equipment like snowmobiles, all-terrain vehicles, snowboards, and cross-country skis; and an increase in paved roads have allowed increased access, especially in areas that are not designated as wilderness.

c) Problems: Incompatible livestock grazing; high intensity recreation (e.g. summer use of ski lifts, high density hiking and camping, and packstock can cause soil compaction, erosion, and vegetation loss); off-road vehicle travel (including snowmobiles which impact snow quality and wildlife mobility and distribution); road construction; mining, which may cause pollution and landscape damage; nonnative species (including mountain goats); acid rain, which strongly affects alpine areas because they have little buffering ability; and global warming, which threatens to reduce the extent of alpine tundra through encroachment of forest. Short, cool growing seasons, strong winds, frequent frosts, and a limited pool of adapted plant species limit successful revegetation of disturbances.

d) What has been the cause of change to the habitat: Impacts from human developments, pollution, and disturbances have been relatively low in the alpine tundra/grassland compared to other ecosystems. However, these areas are sensitive to disturbance by humans, and the consequences are often highly visible, at least locally, and very slow to regenerate. Primary human disturbances that have affected the alpine ecosystems include recreation, domestic livestock grazing, mining, road construction, and air pollution and associated global climatic change.

The intensity of recreation in alpine habitats is increasing. As hikers and pack animals have increased in number, casual trails and campsites through alpine vegetation have proliferated into extensive networks. As trail systems grow, many alpine plant species decrease in abundance, while semi-weedy species from lower elevations increase in numbers. Late-summer stored carbohydrates in vegetation within 1.5 feet (0.5 m) of the trail decreases by 20 to 50%, as compared with the amounts stored by plants of the same species just beyond 7 feet (2 m) from the trail. Other impacts of high intensity recreation include soil compaction and erosion.

Alpine ranges have been used for grazing sheep since the mid to late 1800s. Early grazing operations herded sheep in tightly grouped bands, continuously bedded in the same location for several nights in a row, and drove sheep to and from water. These practices caused losses of forage through trampling and overgrazing, especially near water; and soil damage from excessive trailing and compaction. High intensity grazing caused changes in vegetation composition (e.g. the unpalatable alpine avens has probably increased because of grazing pressure on more choice species). Sheep numbers peaked in the western U.S. in about 1910, and have declined since. Alpine ranges are still grazed by sheep today, but the intensity is much lower. Wild ungulates also graze alpine habitats and overgrazing by elk, bighorn sheep, and mountain goats (a nonnative species) is not uncommon in localized areas.

Historically, mining operations were on a smaller scale, but were far more extensive than they are today. Because the alpine ecosystem recovers so slowly, many

mine sites are still evident even after more than a century (including old roads, deserted structures, and mine tailings). In localized communities that have had impacts from mining there has been a loss in plant species diversity and erosion along roads and trails. Nearly 12% of the alpine habitats in the western U.S. have been impacted by mining and need reclamation.

Road development in alpine habitats has brought more people, exotic plant species, and pollution into the ecosystem. Off-road vehicle travel, especially within reach of roads and towns, has caused significant damage to vegetation cover and soils. Even snowmobiles have impacts on snow quality and wildlife mobility and distribution.

Pollution is increasingly affecting the alpine tundra, primarily through acid rain, which strongly affects alpine areas because they have little buffering ability; and global warming, which threatens to reduce the extent of alpine tundra through encroachment of forest.

3) Priority bird species in Alpine Tundra/Grassland habitat in Wyoming:

Level III:
White-tailed Ptarmigan
Black Rosy-Finch
Brown-capped Rosy-Finch

Best Management Practices

Wyoming Partners In Flight Best Management Practices for Alpine Tundra/Grasslands to Benefit Birds in Wyoming.

Introduction

Land managers can take a variety of simple and inexpensive actions to improve alpine tundra / grasslands for birds and help them nest successfully. By maintaining and restoring habitat for birds in alpine habitat, many other wildlife species will also benefit. Some management activities may also improve watershed health by reducing soil erosion and increasing water retention.

As a land manager, the actions you take will depend on your goals, resources, and commitment, as well as the physical characteristics of the alpine tundra, such as soil type, topography, existing vegetation, and microclimates. The following Best Management Practices (BMPs) should provide some reasonable guidelines for managing alpine tundra / grassland habitats to benefit a wide variety of resident and Neotropical migratory birds in Wyoming.

Many of the Best Management Practices for alpine tundra / grasslands fall into major categories of land use such as Grazing, Recreation, etc. The recommended BMPs are broken out into categories for convenience, although some are general enough to cross into other categories.

Ecology of Alpine Tundra / Grassland Habitats

Alpine tundra / grasslands occupy high-mountain summits, slopes, and ridges above timberline. In Wyoming, subalpine forests and krummholz give way to the treeless alpine tundra at elevations ranging from about 11,480 feet (3,500 m) in the Medicine Bow Mountains to the south to about 9,840 feet (3,000 m) in the Beartooth Mountains to the north. Aspect plays a role as well—the treeline often occurs at higher elevations on warmer south slopes. Because the alpine zone is present only on mountains, much of the landscape is rugged and broken, with rocky, snowcapped peaks, spectacular cliffs, and talus slopes, but also contains areas of gently rolling to almost flat topography.

Typical high-elevation growing seasons range from 45 to 90 days, with average summer temperatures near 50° F (10° C). Growing season temperatures frequently fall below freezing, and frost occurs throughout the growing season in many areas. Precipitation occurs mainly as winter snow and may vary from 25 to over 47 inches (63 to over 120 cm) annually, but soil water availability is highly variable with season, location, and topography. For example, snowfields commonly accumulate on the lee sides of

ridges while ridgelines may remain nearly snow free due to redistribution by wind. Some alpine habitats may be up to 70% snow free in winter. High winds are common in alpine ecosystems, and can cause significant soil erosion and be physically and physiologically detrimental to plants. Also, wind coupled with high solar radiation can promote extremely high rates of evaporation and transpiration.

In a world of intense radiation, wind, cold, snow, and ice, alpine vegetation is close to the ground and consists mainly of perennial grasses, sedges, forbs, and low-growing shrubs with prominent inclusions of lichens and mosses. Compared to ecosystems at lower elevations, the alpine tundra contains few plant species; usually there are no more than 200 to 300 species present in the alpine zone of a given mountain range. Perennial herbs (including grasses, sedges, and low woody or semi-woody shrubs) dominate the alpine landscape; they have much more root and rhizome biomass than that of shoots, leaves, and flowers. The roots and rhizomes not only function in water and nutrient absorption but also play a very important role in over-winter carbohydrate storage. Annual plants are rare in this ecosystem and usually are only a few inches tall, with weak root systems.

Alpine areas are unique because of the severity and complexity of their environmental conditions. Very small changes in topography [as small as 1 foot (0.3 m) or less] may mean the difference between a windswept area or an area of snow accumulation, changing the potential productivity and plant community drastically. Between these extremes of drought versus saturation, several intermediate environments may exist all within a few yards of each other, depending on topography, substrate, and climate. Alpine vegetation generally occurs in a mosaic of small patches with widely differing environmental conditions. Vegetation types vary from cushion and rosette plants on the ridges and in the rock crannies; to herbaceous and grassy vegetation along the slopes; dwarf shrubs with grasses and forbs below the melting snowdrifts; and sedges, grasses, low shrubs, and mosses in the bogs and along the brooks. The most prominent plant community types in Wyoming's alpine habitats, in order from most xeric (dry) to most mesic (moist) are: cushion plant, alpine avens turf, Idaho fescue / spike trisetum, tufted hairgrass meadow, and sedge bog. Much of the land area is exposed rock with little or no plant growth, such as on talus slopes, boulder fields, mountain peaks, and cliffs. Persistent snowbeds or glaciers cover other extensive areas.

Nowhere in Wyoming is the environment more rigorous, so, in one sense, the tundra is a highly stress-tolerant ecosystem. Yet ecosystem recovery after disturbances is slow, and the tundra is susceptible to changes in the vegetation and soils that will persist for many years. This situation of slow vegetation recovery is due to many things, the very short, cold growing season being one. Soil destruction—by compacting, by melting of the underlying permafrost, or by erosion—also makes vegetation reestablishment very difficult. Once the soil is gone in a cold climate, the unknown time required to replace it

certainly must be calculated in terms of thousands or tens of thousands of years. For these reasons, the tundra is considered fragile and requires careful management.

Because of the severe climate, few vertebrate species, including birds, are able to breed in this habitat. Although the avifauna of the alpine tundra is small compared to other habitats, these species are typically specialized and endemic, and are not found in other habitats during the breeding season.

General

1) Conserve unique representatives or core areas of alpine tundra / grasslands in Wyoming.

2) Identify and preserve local sites that are important for the conservation of priority species breeding in alpine tundra / grasslands.

3) Acquire a basic knowledge of the ecology of alpine habitats in order to properly allocate the various resources. Because of the steep, rugged topography, high erosion potential of the soils, and the short growing season, alpine ranges require careful management.

4) 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 alpine 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.

5) Consider both long- and short-term impacts and / or benefits of any activities within alpine areas. Limit activities that degrade or remove alpine habitats (e.g. heavy recreational use, overgrazing, and invasion by exotic plants). Manage alpine tundra / grasslands for sustainable use without abuse over the long-term.

6) In the use plans for alpine habitats, pay considerable attention to the kinds of vegetation and soils present and their susceptibility to change and destruction. Remember that most alpine vegetation returns very slowly after destruction.

7) Manage for a variety of locally native plants. Different plant species host different insect populations, which provide food for a variety of bird species.

8) Use minimum impact fire suppression tactics (e.g. allow it to burn; and limit the use of retardants, fire lines, etc.). Fire, an important successional influence at lower elevations, is

not usually influential in the alpine zone. In general, alpine communities are usually too wet to burn, or the plants are too widely spaced to carry a fire. On the other hand, diligent fire suppression tactics may cause lasting damage to the local ecosystem.

Grazing

Although grazing in alpine tundra / grasslands is limited by the short snow-free season and low productivity, and ecosystem recovery after disturbances is slow, proper stocking levels and grazing regimes can be compatible with alpine tundra / grassland maintenance and improvement. However, improper grazing practices in alpine areas can eliminate vegetation, cause soil erosion and compaction, encourage invasion of noxious plants, and cause changes in vegetation composition. The degraded condition of some alpine areas in the West is from uncontrolled grazing, mainly by sheep, that occurred in the late 19th and early 20th centuries; today's successful manager can learn from past mistakes. The Best Management Practices for grazing focus on protecting alpine tundra / grasslands during crucial growing periods.

1) Because the ecology of the alpine zone is unique, carefully consider range management principles and practices developed in other ecosystems before extrapolating them into the alpine.

2) Grazing management plans for alpine tundra / grasslands 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. Determine site-specific alpine area objectives and tailor the grazing management plan to help meet the objectives. Consider the site's specific factors of concern; its 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 alpine area to check progress toward the objectives. Record how key alpine plant species and the overall alpine tundra / grassland ecosystem respond to grazing management (annual photographs taken from the same point are helpful).

3) Maintain proper stocking rates and livestock distribution to protect alpine ecosystems. Incompatible grazing can have harmful long-term effects on survival and regeneration of vegetation; can negatively influence the species, structure, and health of alpine vegetation; and can cause soil compaction and erosion. Manage grazing intensity at a level that will maintain the composition, density, and vigor of desired plants and will not damage alpine soils.

4) Limit the amount of time livestock spend in alpine tundra / grasslands. This can be a significant factor in the condition of the alpine area. Base the length of the grazing period within an alpine zone on the areas livestock are actually using, not the entire

allotment. If needed, add more rest to grazing cycles to increase plant vigor or encourage more desirable plant species composition.

5) Where feasible, use grazing systems like deferred-rotation, rest-rotation, high intensity-low frequency, and short duration to combine periods of use with nonuse. A year of rest for each alpine pasture every three to four years is beneficial for long-term alpine tundra / grassland maintenance.

6) Control the timing of grazing to keep livestock off alpine soils and vegetation when they are most vulnerable to damage (when the ground is saturated) and to coincide with the physiological needs of target plant species. Begin grazing in alpine areas in mid July or later to avoid grazing during the period of most active plant growth and to avoid the chance of trampling damage because of wet soils. Remove livestock from alpine areas by mid September to avoid trampling damage to soil that has been moistened by snow but it is not yet solidly frozen; to avoid damage to preformed flower buds, which could influence plant growth the following growing season; and to avoid livestock losses to early fall snowstorms.

7) Ensure adequate residual vegetation cover is left after grazing (70 to 80% of the herbage of the major species); this is essential for maintaining alpine ecosystem health. Instead of focusing on how much vegetation can be removed, focus on how much and what type of vegetation should be left.

8) 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.

9) Improve livestock distribution and forage use by using salt and mineral blocks, but avoid placing them within or immediately adjacent to riparian, wetland, or aquatic areas [at least ½ mile (0.8 km) away].

10) Consider temporarily removing livestock from an area that is damaged or otherwise needing protection. Livestock exclusion can be a short- or long-term option for locally or regionally rare vegetation types, sites undergoing restoration, wet sites (e.g. springs, seeps, wet meadows, streams, and near melting snow banks), very dry sites (because of their low herbage production and the high erosion potential), steep slopes (greater than 40°), and other areas that are easily degraded.

11) Distribute sheep in loosely bunched bands and move them slowly, but steadily, in one direction while grazing (progressive herding). Herd bands of sheep by guiding the movement of the lead animals rather than herding from the rear. Plan herding so the

band reaches water only once a day; graze the band quietly to water, rather than driving it. Graze a given area only one time during the grazing season, and do not allow the sheep to remain in the area long enough to cause excessive forage utilization. Bed the band down on a well-drained site near where they finish grazing, at a different location each night. Provide salt in movable containers on the bedding ground.

12) Avoid the repeated use of sheep driveways.

Wildlife Management

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

1) Consider alpine tundra / grassland conditions and big game impacts when setting herd objective levels. Do not exceed the carrying capacity of alpine habitats.

2) Use whatever management techniques are available to reduce the mountain goat herd in Wyoming and avoid establishing them further in the state. The original distribution of mountain goats was limited to northwestern North America and did not include Wyoming. While goats are not yet a major element of the fauna of northwestern Wyoming, they have been released in and are colonizing the Greater Yellowstone Ecosystem. The species is capable of doubling in numbers about every nine years, so there is cause for concern over their imminent increase. Grazing and wallowing by goats alters plant species composition, increases amounts of bare ground (in wallows), and reduces the standing crop of native plants. Exotic mountain goats in Olympic National Park have seriously degraded rare, endemic alpine plants found nowhere else on the continent, and have eliminated mosses and lichens, which are crucial to the stabilization of alpine soils, in many areas.

Recreation

Unfortunately for birds, people also like to use alpine areas and some recreational uses are not compatible with bird conservation goals. Recreational activities, such as camping, hiking, biking, horse-packing, and off-road travel, can degrade alpine tundra / grasslands. Recreationists may trample plants, compact the soil, increase soil erosion, and increase the incidence of weed invasion. Recreational use can affect birds by creating disturbance and habitat degradation, especially during the breeding season.

1) Consider potential disturbances to birds and habitat (and other wildlife) when planning or locating trails, camping sites, picnic areas, and other sites of human activity within alpine areas.

2) Locate new recreation sites outside of alpine areas wherever possible. If sites must be within alpine zones, concentrate them in one area, rather than spreading them throughout the alpine area, to limit negative impacts on breeding birds and habitat.

3) Keep pets under control in recreation areas. Free-roaming dogs can be devastating to birds that nest on or just above the ground.

4) Promote "Tread Lightly" recreation ethics. Educate outdoor enthusiasts about the unique and fragile nature of alpine habitats, the problems humans can cause and how they can avoid damaging these areas.

5) Manage or restrict off-road vehicles, bicycles, and horses in alpine tundra / grasslands because soil compaction and ruts caused by these uses can lead to erosion and long-term loss of soil and vegetation. Driving vehicles off-road across alpine habitats destroys vegetation and contributes to soil erosion and compaction. Keep all vehicles on established roads and trails or confined within areas established specifically for off-road recreation.

6) Reduce impacts to alpine areas by keeping hikers on established trails. In sensitive areas, hikers can damage vegetation and contribute to soil erosion.

7) Reduce recreational disturbances, including bird watching, in alpine areas during the bird nesting season, especially where rare, sensitive, or endangered species nest.

8) Limit scenic pullouts along highways in alpine habitat. Scenic pullouts bring people to a stop and encourage them to explore on foot, endangering the soils and vegetation in the area. Post interpretive signs at existing pullouts to educate the public about the unique and fragile nature of alpine habitat.

9) Some of the heavily used alpine slopes have been webbed with paths. In spite of established trails, hikers in non-forested areas often take the shortest distance between two points, or simply strike off on their own. Reestablish vegetation by reseeding and replanting, blocking paths off, and covering them with mesh and burlap to prevent erosion. It is necessary to restore their original aspect since any trace of a path is an invitation to use it again. Post interpretive signs at trailheads to educate the public about the unique and fragile nature of alpine habitat.

<u>Engineering</u>

1) Design roads with adequate structures to prevent vehicles from leaving the roads and traveling off-road in alpine tundra / grasslands.

2) Maintain buffer zones between alpine tundra/grasslands and mining and other industrial activities, including structures, roads, and support facilities.

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

4) Reclaim areas as soon as possible after activities, such as mining and road building, are completed. This reduces the amount of habitat converted at any one time and speeds up the recovery of the alpine habitat.

5) Emphasize proper environmental engineering of mine sites and careful evaluation of proposed development of additional roads, water storage structures, ski facilities, electronic relay stations, and cabin sites.

Rehabilitation

1) Where possible, restore or rehabilitate degraded and disturbed sites to native plant communities. The impacts of disturbance on high-elevation lands threaten their important watershed, wildlife habitat, grazing, and recreational values. Revegetation of these disturbances is essential to minimize the consequences of erosion and loss of water quality, and to reestablish stable native ecosystems.

2) Always identify and address the causes of alpine degradation before starting rehabilitation. Many rehabilitation projects fail without a change in other management activities, such as grazing or intensive recreation.

3) Tailor specific rehabilitation efforts to each alpine area. Physical factors such as geology, microclimate, and elevation will influence the project's success. Conventional techniques of revegetation developed for habitats at lower elevations are often unsuccessful in disturbed alpine ecosystems. The rigorous climate at high elevations, coupled with the impacts of disturbance, dictate the use of techniques that have been designed for the unique conditions in high-elevation areas. Short, cool growing seasons, strong winds, frequent frosts, and a limited pool of adapted plant species can complicate revegetation efforts.

4) Determine specific objectives for each alpine area, and develop a monitoring program to track whether the objectives are being met.

5) Remove exotic plants that compete with native plant species and do not provide foraging or nesting opportunities for wildlife.

6) Some of the heavily used alpine slopes have been webbed with paths. In spite of established trails, hikers in non-forested areas often take the shortest distance between two points, or simply strike off on their own. Reestablish vegetation by reseeding and replanting, blocking paths off, and covering them with mesh and burlap to prevent erosion. It is necessary to restore their original aspect since any trace of a path is an invitation to use it again.

7) Carefully plan for a complex of vegetation that reflects the diversity of plant species and habitats in the surrounding area. Choose mixtures of plant species that represent different life histories and physiological traits. Typically, grasses are the most widely used group of plants in revegetation, but heavily fertilized swards of high-nutrient adapted grasses often tend to form closed stands that exclude or inhibit the invasion of other species. Include different lifeforms in seeding and planting mixtures to increase species and structural diversity of revegetation communities and enhance rates of successional development. In addition, use seed mixtures consisting of species with many different physiological and ecological characteristics to improve the chances of stand survival in the event of catastrophic events such as insect infestations, disease, or drought.

8) Reseed with local genetic seed stock, if available, and avoid using nonnative plant species that compete with native species.

9) Provide topography similar to the surrounding area to provide microsites that promote a mosaic pattern.

10) Revegetate alpine disturbances in the fall. Timing of revegetation can be extremely important to successful plant establishment. Transplant stock should be hardened to low fall temperatures and should be in a dormant condition during planting. Seeds, transplants, and soil amendments should be applied as late in the growing season as possible so that cold temperatures prevent germination and growth. Severe frost damage to young seedlings and transplanted stock may result if planting is too early. Fall revegetation ensures that seeds and amendments will be in place when conditions are ideal for germination the following spring as snowmelt occurs. Fall seeding and planting can usually be accomplished when conditions are relatively dry and when the soil can be worked most easily.

11) Avoid revegetating alpine disturbances in the spring or summer. Most high-elevation areas remain inaccessible in the spring until large snowdrifts melt. By the time access and site conditions are suitable, the optimum conditions for seed germination and seedling development may be past.

Information and Education

1) 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 alpine tundra / grasslands 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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