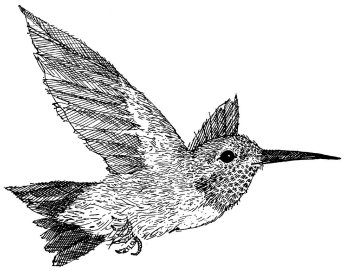
A Handbook of Riparian Restoration and Revegetation for the Conservation of Land Birds in Utah With Emphasis on Habitat Types in Middle and Lower Elevations



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INTRODUCTION

In the preface of his book *Where Have All the Birds Gone* Princeton ecologist and ornithologist, John Terborgh (1989) gives this warning:

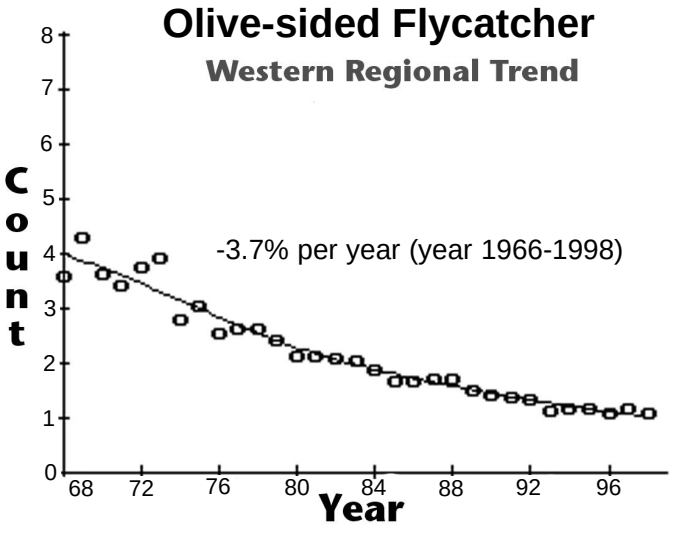
> *My principal message in this book is that if these excesses continue unchecked until they run their course, we shall wake up one day to a drastically altered spring–one lacking many familiar birds that we have heretofore taken for granted. If we are going to do some - thing to prevent this, we shall have to do it soon.*

The concern voiced by Dr. Terborgh arose in part from personal observations that are common to many who spend their time observing the courses of nature. The woods and fields where he wandered as a boy within sight of the Potomac and Georgetown University turned to malls, houses, and highways. Frogs, turtles,and snakes disappeared. Birds such as thrushes, cuckoos, and tanagers, that had been part of his youthful checklist, vanished as well.

However, casual observations and anecdotes hold little weight in science. But scientific work concerning the decline of avian populations near John Terborgh's childhood home were laying the foundation for more solid work as teenage wanderings transported him into a career as a professional ornithologist. These local, long-term studies initiated during the late 1940's in the Washington, D.C. area provided some of the best evidence for change taking place. Several sites were surveyed nearly every year. Species declined and in some cases disappeared entirely from the sites (Askins et al. 1990).

In 1965 another source of data,the Breeding Bird Survey (BBS), was established. That spring and each one since, at the height of the nesting season, an army of professionals and amateurs recorded all of the birds seen and heard along 24.5-mile survey routes across the United States and Canada. Robbins et al. (1989) analyzed these data.

They found that after a period of stability many populations of birds in the forests of eastern North America declined between 1978 and 1987. The pattern was distinct and paralleled that seen in analyses from other sites. Forest-interior birds that wintered in forests of Central and South America were declining.



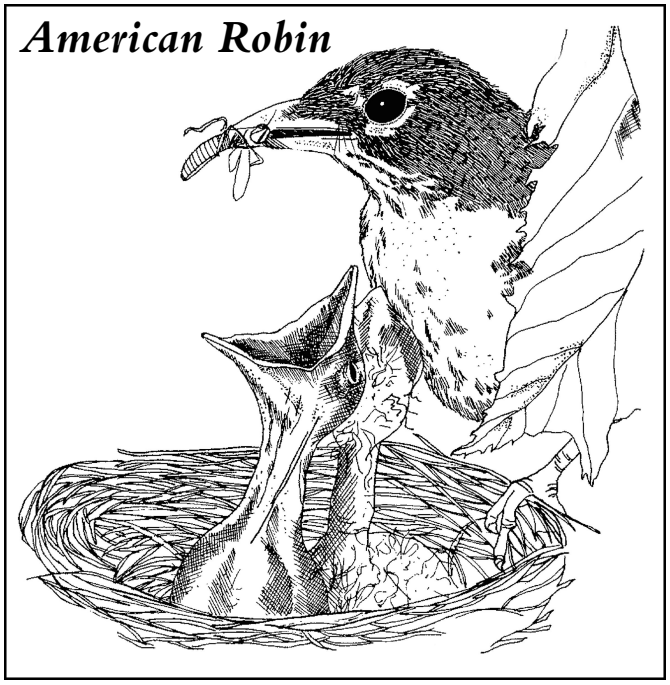
These findings spurred others into intense research dealing with these birds. Several reviews, collective works, and symposia produced excellent overviews of this effort (Ehrlich et al. 1992, Finch and Stangel 1993, Hagan and Johnston 1992, Martin and Finch 1995, Rappole 1995, Salathé 1991, Terborgh 1989). The concern grew so rapidly that 300 scientists converged on Woods Hole, Massachusetts in December of 1989 for a symposium. This was more than a seven-fold increase from the 40 that had gathered in Front Royal, Virginia in 1977 to discuss Neotropical migratory landbirds. Numbers, however, were not the only change in these meetings. In the 1970's research on these birds brewed with the excitement of exploration into the ecology of the nonbreeding season in the tropics. By the late 1980's the excitement had given way to concern over the decline. Many papers resulting from the Woods Hole symposium focused on conservation rather than purely academic questions. (Hagan and Johnston 1992, Terborgh 1992)

In addition to the research efforts, the realization of the declines also gave birth to an international team of governmental, non-governmental, academic, and private institutions from throughout the Americas. Named *Partners in Flight • Aves De Las Americas*, this organization has been working to further the research, define management practices, and educate professionals and the public.

The group of birds of concern, the Neotropical migrant birds (NTMB) were defined by *Partners in Flight's* Research Working Group as any Western Hemisphere species, all or part of whose populations breed north of the border between the United States and Mexico and winter south of that line. Based on this boundary, *Partners in Flight* established a working list of Neotropical migratory birds (Gauthreaux 1992). Although many species of waterfowl and shorebirds breed in the Nearctic and migrate to the Neotropics, most are not included in the work of *Partners in Flight*, nor are they dealt with in this handbook because there are separate conservation programs for these birds. The riparian habits of the Spotted Sandpiper (*Actitis macularia*) and Wood Duck (*Aix sponsa*) among others resulted in their inclusion in this handbook.

Utah's Neotropical migratory birds include passerines, diurnal raptors, owls, hummingbirds, swifts, and others (Howe 1996). They range from common, well known passerines such as the American Robin (*Turdus migratorius*) and Western Tanager (*Piranga ludoviciana*) to less renowned species such as the Swainson's Hawk (*Buteo swainsoni*) and the Northern Pygmy Owl (*Glaucidium gnoma*) to the rare and largely unknown Black Swift (*Cypseloides niger*). Some breed in North America and winter south of the United States. Other species breed and winter extensively in North America, but have some populations that winter south of the U.S.. Table 1 is a checklist of Utah's riparian birds and indi-

cates migratory classification of each. (Tables 2 and 3 provide information on the foraging guilds of Utah's riparian birds



and Tables 4 and 5 provide nesting information. Tables 6 and 7 provide information on plant species best suited for riparian restoration.)

The *Partner's in Flight* list for all of North America lists 107 species that have shown population declines. Of these, the U.S. Fish and Wildlife Service lists 28 as threatened, endangered, candidate or at risk species. At least 20 studies have shown populations of the other 79 species to be dwindling (DeGraaf and Rappole 1995). Some authors (e.g., Finch 1991) summarize the cause of decline into two key points. One of these appears to be the fragmentation of the forests of eastern North America leading to increased predation by such animals as jays and raccoons and parasitism by Brown-headed Cowbirds. The other seems to be a loss of habitat in the wintering grounds of Central and South America. DeGraaf and Rappole (1995) go beyond two factors. These authors give a lengthy list of factors likely involved in the apparent decline:

- Loss of breeding ground habitat
- Habitat fragmentation
  - Island biogeography effects
  - Area effect
  - Brood parasitism by cowbirds
  - Nest predation
  - Loss of critical microhabitats
  - Interspecific competition
- Successional changes to breeding-ground habitat
- Breeding habitat alteration by white-tailed deer
- Contaminant poisoning
- Normal population fluctuation
  - Variation in food resources on breeding sites
  - Climatic cycles on the breeding ground
- Procedural biases
  - Assumptions
  - Analytical errors
  - Sampling errors
- Stopover habitat alteration
- Winter habitat alteration

Oddly, amidst all the concern, effort, and apparent cause for declines in the East, little research focused on western species. Sparse human populations and vast landscapes resulted in few BBS routes, few researchers, and little information. L. Christine Paige (1990) analyzed what data there were. She found cause for concern in the West:

> *Although general declines are not evident for migrants as a group, we cannot become complacent about western birds. Fifty-one migrant and northern resident species displayed negative Western Region trends, and 18 of these species were significantly declining at $P<0.05$. This is indeed cause of concern.*

Concern was not limited to Paige. It was widespread enough to bring about the establishment of *Utah Partners in Flight* and other efforts to conserve landbirds in the West. This handbook is a part of those efforts. It is an attempt to do something here and now in Utah. It is meant to be a resource for land managers to turn to as they work within what may be the most drastically changed type of habitat in the arid West and the habitat type most important to western avifauna–riparian areas.

UTAH PARTNERS IN FLIGHT

The brief review above of the decline of bird populations and the following review of the ecology of riparian habitats give an overview of why this handbook was written. The heart of the publication, however, is the information on Utah's birds and management and restoration of riparian habitat. We hope land managers find this information of use.

PARTNERS IN FLIGHT · AVES DE LAS AMERICAS ·

ECOLOGY OF RIPARIAN SYSTEMS

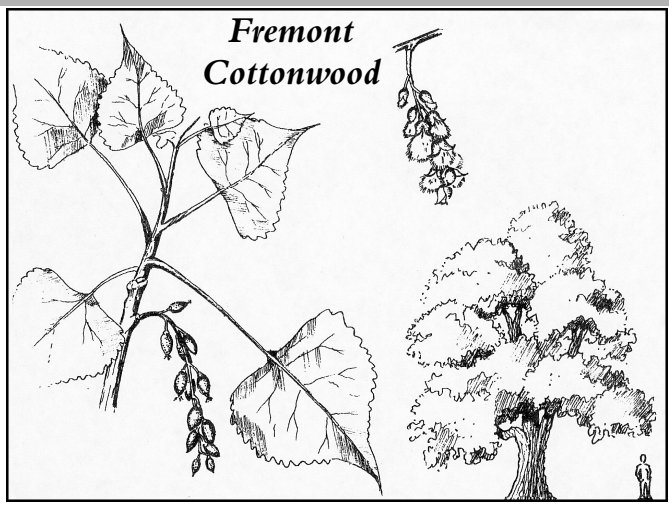
Introduction

In the arid West, riparian habitat covers less than 1% of the land, yet its role in the landscape is so significant that Wilson (1979:82 as quoted by Knopf et al. 1988.) referred to this habitat as the "aorta of an ecosystem." Ohmart and Anderson (1982) stated that riparian ecosystems " . . . are truly lifelines for many vertebrate species,including man." Consider these bits of information:

- Within the Great Basin,82% of the total species of birds are either totally or partially dependent on riparian habitats (Ohmart and Anderson 1982)
- Bird species diversity and abundance can be as great as in the deciduous forests of the East (Carothers et al. 1974).
- In the Southwest,51% of all the avian species are completely dependent upon riparian vegetation (Johnson et al. 1977 as quoted in Knopf et al. 1988).
- During spring migration, riparian systems may attract up to 10.6 times the number of migratory birds found in the surrounding uplands and 14 times the number of species recorded in the fall (Stevens et al. 1977 as quoted by Knopf et al. 1988).
- Its economic importance includes water for irrigation and culinary use, soil for crops,forage and cover for livestock and game species, timber, recreation, and pathways for roads.

The tremendous resources available in riparian habitat led to widespread use by European settlers and their descendants, usually to the detriment of the ecosystems involved (Elmore and Beschta 1987). In parts of the West this use began with the coming of the mountain men who trapped beavers from the streams.Beaver dams expanded the floodplain, dissipated the erosive power of floods, and acted as sites for the deposit of sediments and nutrient-rich organic matter energy. With these animals gone the energy from floods roared unabated through channels causing erosion and loss of nutrients. Following the mountain men, settlers brought cattle, sheep, goats and horses to graze the West. Livestock,like people, sought out the shade and cool climate of riparian habitat.They also sought the younger more lush growth to feed on.This preference and year-round grazing in many areas led to further degradation.

The need for farmland and fuel, as well as misconceived practices of phreatophyte control (removal of plants,such as willows, which draw water from the water table), introduction of exotic species such as salt cedar and Russian olive, damming, and channelization brought further destruction. More problems arose with the use of pesticides and fertilizers. Increases in human populations with more time and resources for recreation that often took place in riparian areas added to the problems.



Elna Bakker (1971 as quoted by Sands and Howe 1977) said that riparian habitat is the system most altered by man. The statistics seem to backup these statements. Overall estimates are that we have drained, cleared, trampled, and permanently flooded at least 70% of these ecosystems. In some areas the estimates are worse (Swift and Barclay 1980 as cited in Johnson and Carothers 1982).California was graced with approximately 775,000 acres of riparian woodland.By 1952, about 20,000 acres remained. By the late 1970's generous estimates gave the bear state 12,000 acres,less than 2% of the original (Smith 1977 as quoted by Johnson and Carothers 1982). The Arizona Riparian Coalition quotes estimated losses in that state at 90%.The loss and alteration of riparian areas in Utah is undocumented, but is likely as monumental as other areas in the West in which riparian habitat loss and alteration is estimated at greater than 95% (Krueper 1992). These tremendous losses led to what is now a widespread and energetic movement involving a multitude of individuals and organizations (see Tellman and Jemison 1995--the Riparian/Wetland Research Expertise Directory Web site at URL:http://www.ag.arizona.edu/AZWATER/swexpdir/riparian.html). Considerable effort now focuses on conserving the remaining acreage and restoring or revegetating riparian habitat wherever possible. Most Western states now have a riparian conservation and management organization. Some of these organizations are new. Some are old. Some are loose-knit and casual. Some are tightly structured and goal oriented. Most focus on education, but some are driving forces behind research and management practices.

The Utah Riparian Management Coalition, an alliance of state and federal governmental agencies, nongovernmental organizations,and academic institutions,is this state's version of such an organization. This is its mission statement:

> *It is the purpose of the Utah Riparian Management Coalition to provide a forum for discussion and consideration of the impacts of riparian zone management on all uses and to encourage the wise use and coordinated management of riparian areas in Utah.*

Whatever the workings of each organization, all must deal with the ecology of riparian habitat.A great deal is still unknown about these systems, but the basics are understood.

Definition

The most basic consideration is simply a definition of what riparian habitat is.The definition used by the U.S. Bureau of Land Management (1990) is "an area of land directly influenced by permanent water. It has visible vegetation or physical characteristics reflective of permanent water influence. Lakeshores and stream banks are typical riparian areas. Excluded are such sites as ephemeral streams or washes that do not exhibit the presence of vegetation dependent upon free water in the soil."

The Arizona Riparian Coalition (ARC)(Lofgren et al. 1990) uses a broader definition that includes intermittent and ephemeral streams and washes.The ARC's definition is "the aquatic or terrestrial ecosystems that are associated with bodies of water such as streams, lakes and wetlands, or are dependent on the existence of perennial or ephemeral surface or subsurface water drainage." The definition adopted by the Utah Riparian Management Coalition is a more restricted version of the BLM definition based on the presence of free or unbound water in the soil (Thomas E. Bingham, personal communication,Vice-President-Public Policy and Asst. Secretary Treasurer, Utah Riparian Management Coalition).

For the purposes of this handbook, riparian system refers to the broader definition (e.g.,ARC) which includes habitats associated with the floodplains, terraces, and channels of a stream,not the narrower hydrologic definition which is limited to the areas immediately adjacent to the stream channel. This broad definition is most appropriate when considering riparian zones as bird habitat.Whatever the definition, the ecology of these systems centers on water and the increase in the density and diversity of life that it brings to riparian areas.The ecology is also, of course, complex, as it is for any ecosystem.A few basics,however, explain the heart of workings of riparian habitat.

Basic Ecology

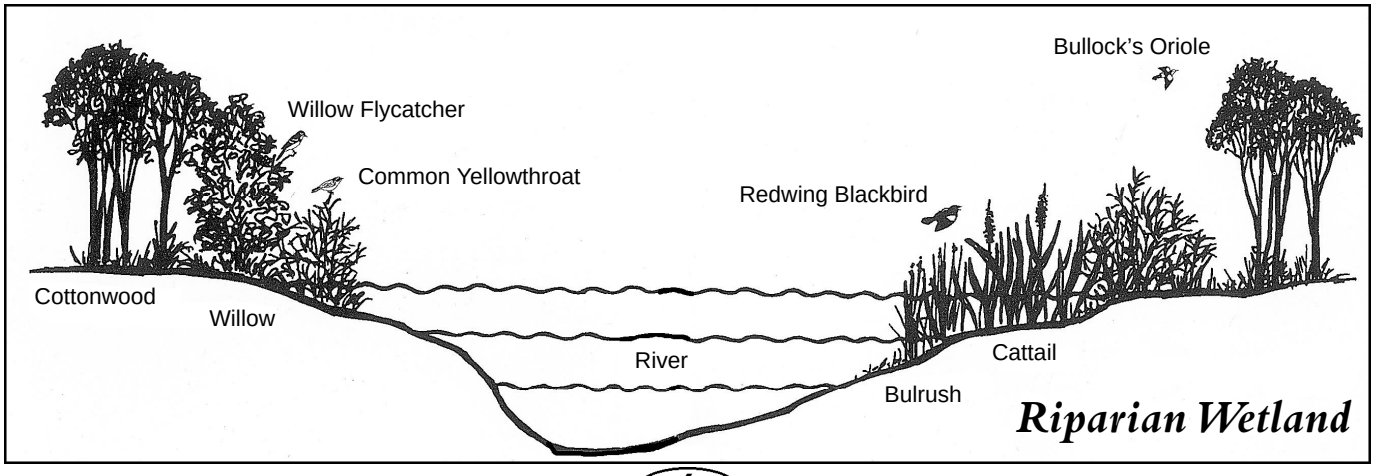
Running water in the stream may be perennial,intermittent, or ephemeral. Perennial streams flow continuously. Intermittent streams flow only at certain times of the year when they receive water from sources such as melting snow in the spring.Ephemeral streams flow only when precipitation falls within their watersheds (U.S. Bureau of Land Management 1993).

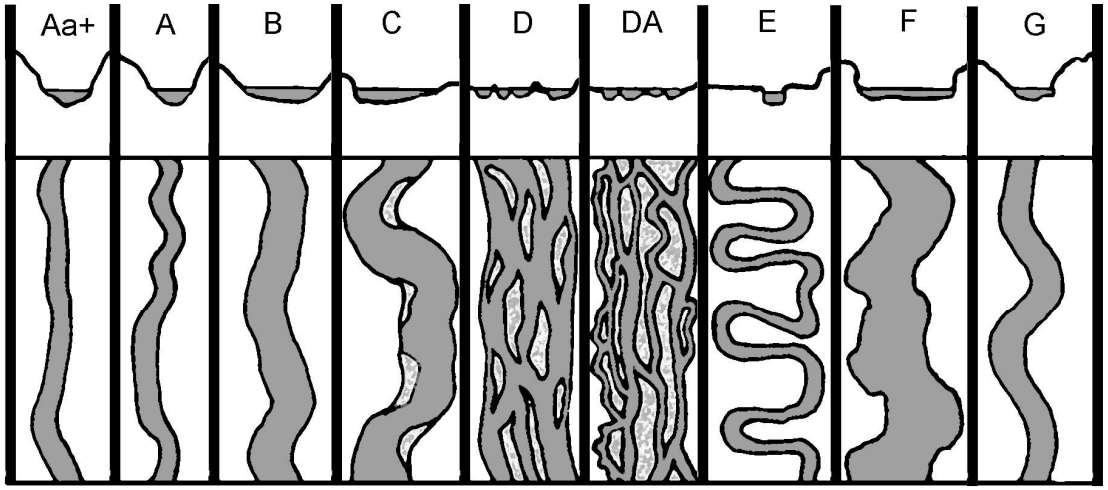
Whatever the flow, flooding and change are natural parts of riparian ecosystems.Flooding can scour all the vegetation from riparian zones and bury them in sediment.More commonly however, flooding carries sediment into the riparian zone. There, as riparian vegetation disperses the force of the flood, sediment settles onto the floodplain building it and adding organic matter and nutrients to the soil.

In the arid West this soil building leads to vegetation that is more dense and diverse than that in the uplands.Increases in density and diversity of vegetation lead to further deposits of sediment and further increases in vegetation.This bank building leads to rises in the water table.The water table may eventually reach the root zone in the riparian zone. At this point,dramatic change can take place in the species composition and density.As water is the driving force, so vegetation is the key to improving stream flow. (Adams and Fitch 1995, Elmore and Beschta 1987).

It is stream flow, with periodic flooding,that makes riparian systems dynamic. Streams naturally erode sediments from some areas (e.g., outside bends) and deposit sediment in other areas (e.g., inside bends). Seasonal variations in stream flow can be dramatic in western riparian areas. However, over long periods and at large scales,streams naturally maintain a dynamic equilibrium.While the stream channel may move from year to year, streams tend to meander consistently within an identifiable floodplain. Both short-term dynamism and long-term stability of streams and rivers affect development and restoration of riparian plant communities.

Stream systems and their flows may take on many forms and stream morphology is dictated by the interaction of several geomorphic factors.In addition, these geomorphic factors may influence the riparian plant composition.While an in-depth treatment of these components is beyond the scope of this handbook, certain factors which might influence



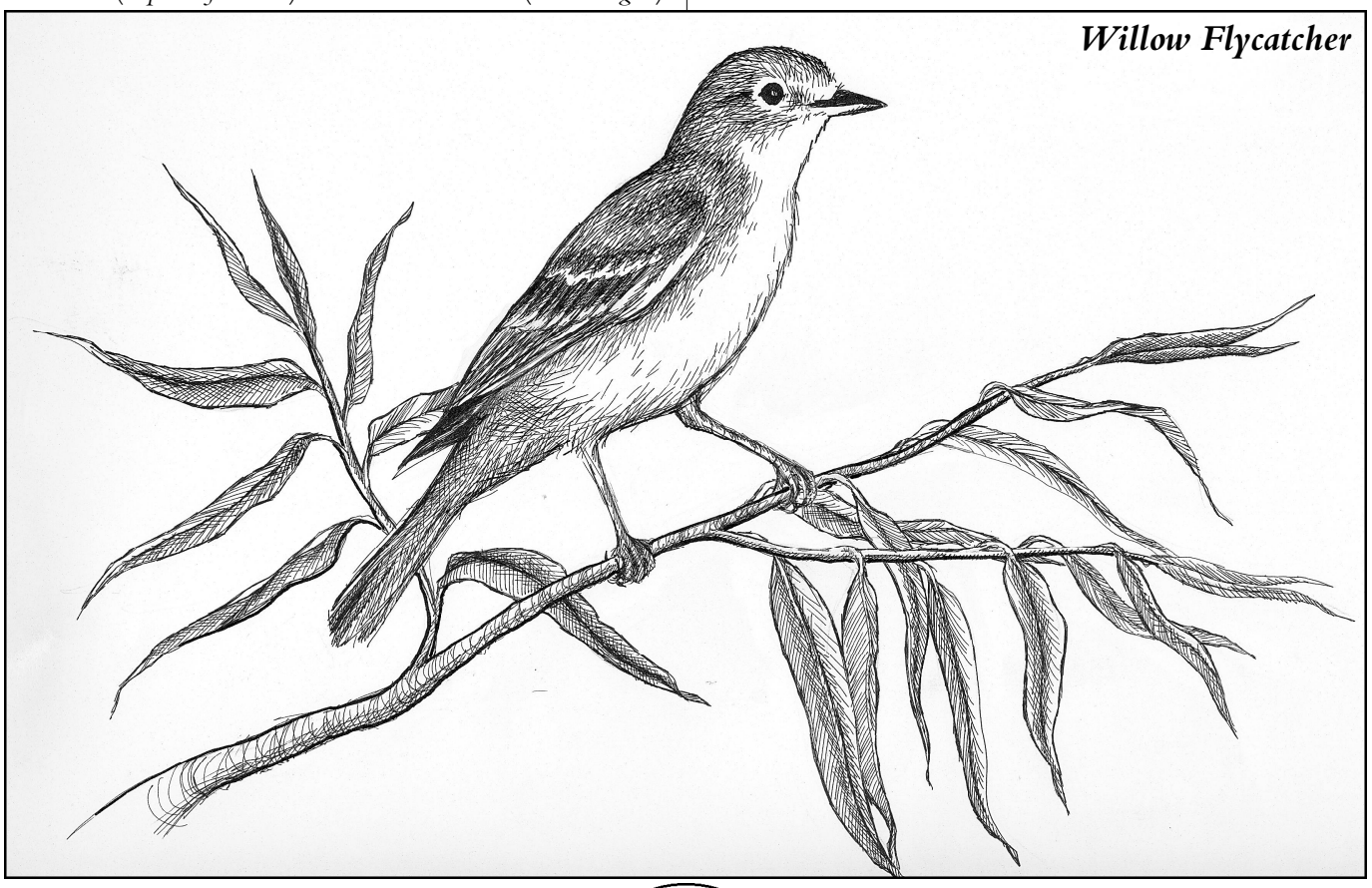


Stream Classifications *(Rosgen 1996)*

restoration efforts should be considered (e.g., soil type, soil depth, geology, gradient, flow regime). Many of these factors are considered in the evaluation of Properly Functioning Condition (Table 8) and others can be found in references such as Briggs (1996) and Rosgen (1996).

Three additional factors have a great influence on riparian plant composition. Perhaps most important is elevation which has an obvious influence on community composition. At higher elevations, aspen and spruce-fir may dominate the riparian zone, at middle elevations, narrowleaf cottonwood (*Populus angustifolia*) and water birch (*Betula occidentalis*) may dominate and at lower elevations, Fremont cottonwood (*Populus fremonti*) and sandbar willow (*Salix exigua*) are likely dominants. At a more local level, elevation above the stream channel (i.e., amount of bed degradation and depth of water table) may dictate plant composition and determine the survival potential of plantings. Soil salinity can also influence plant composition at the local level. Fortunately, many native riparian plants have developed some tolerance for saline soils; however, in some situations, soil salinity may need to be reduced in order to successfully reestablish suitable, diverse habitats.

In summary, riparian systems function to reduce flood peaks, recharge groundwater, transport and trap sediments and nutrients, control water temperatures, and stabilize surrounding ecosystems (Schmidt 1987). Healthy riparian zones provide favorable conditions for a wide variety of birds and other animals as well as plants, many of which are endemic to riparian systems.



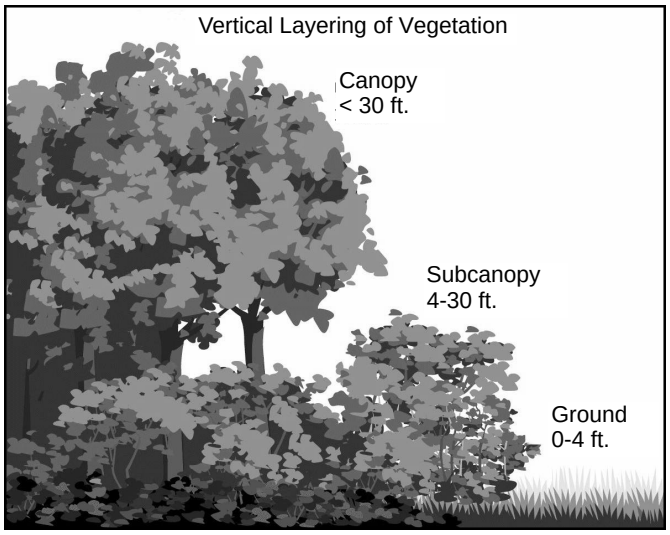
Willow Flycatcher

CONSERVATION OF BIRDS IN UTAH'S RIPARIAN HABITATS

Vegetation is a key to bird conservation. Foliage, branches, and cavities provide cover for birds to roost, nest, and evade predators. Birds feed on buds, berries, and seeds.They also feed on insects associated with plants. Free water in the aquatic zone associated with many riparian habitats provides birds with water and additional food items such as aquatic insects. Several important factors which affect riparian avifauna should be considered in the objectives of riparian restoration projects. Avian diversity and density increases as:

- vertical layers (ground, shrub, and canopy) of vegetation increase,
- the riparian vegetation increases in diversity
- the riparian zone increases in width
- patches of riparian habitat are connected to one another, and
- riparian habitats are connected to healthy upland habitats surrounding them

(Croonquist and Brooks 1993, Finch 1989, MacArthur and MacArthur 1961, Whitmore 1975).



Properly Functioning Condition

While plantings alone might provide habitat for birds, the long-term success of riparian restoration depends on the proper function of the riparian system. But what is a functioning riparian ecosystem? The alteration and destruction of riparian habitat have been so great that Elmore and Beschta (1987) have written, "Many people have never seen a 'healthy' rangeland riparian area, since degradation was widespread before many of us were born."

If Elmore and Beschta (1987) are correct, how do land managers who have never seen a healthy riparian zone even begin to assess the state of a riparian area and make management plans for it? One approach is the "Process for Assessing Proper Functioning Condition" (U.S. Bureau of Land Management 1993, 1994). This process classifies riparian areas within one of four categories:

- "Proper Functioning Condition,"
- "Functional - At Risk,"
- "Nonfunctional,"
- "Unknown."

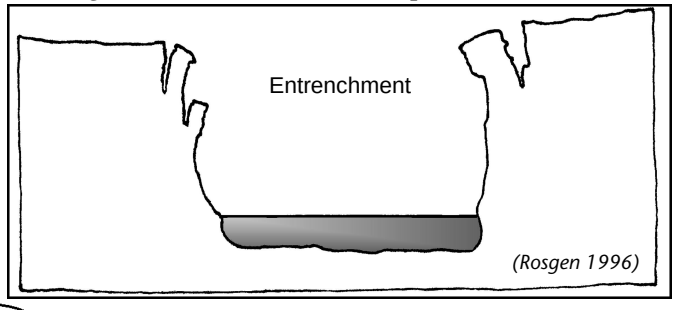
Riparian areas that are "Functional–At Risk" are further classified in their trend:

- Upward
- Downward
- Not apparent.

To determine the condition of a riparian zone, land managers using this assessment method consider three groups of factors working in a riparian zone: hydrologic, vegetative, and erosion deposition (Table 8). If a manager assessed a riparian area as nonfunctional or functional-at risk, a restoration program would likely be in order.

The process of assessing Proper Functioning Condition should assist managers in identifying factors which may affect restoration and help them determine the amount of effort required for successful restoration. However, further evaluation to identify the source(s) of the area's degradation may be required, since this is a key to successful restoration. Part of the assessment process will be to determine whether restoration can be successful. In some areas, damage may be so complete that the stream function cannot be restored without considerable cost and effort.In other areas, impacts may be minimal and successful restoration could be accomplished through natural revegetation with only moderate effort.

Managers will need to determine whether plantings alone will accomplish restoration objectives or whether additional methods, such as grazing management, streambank stabilization structures, and upland management, must be employed. In some cases, simply removing the source of degradation may allow natural revegetation to occur. Managers must also weigh ecological importance of a particular area, effort required, and probability of success then decide how to best distribute their limited resources.Assessing current site conditions, determining the level of site degradation, then evaluating and addressing the causes of riparian degradation may be the most critical steps in riparian restoration (Briggs 1996). The source of degradation may not originate on-site, so it is also important to assess condi-

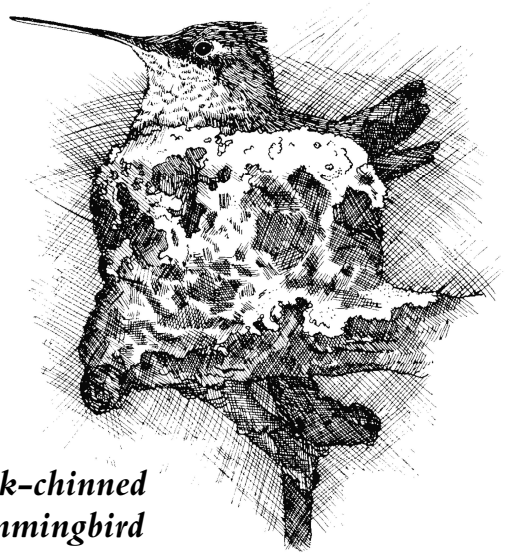


tions of the entire watershed (upstream and downstream reaches, tributaries, upland habitats). Success in long- term reestablishment of avian habitats in riparian systems depends on the condition of the site and the entire watershed.

Monitoring

Monitoring is an important part of judging the effectiveness of restoration efforts and guiding future management. Since the goal of management in this case is to increase habitat for birds,both vegetation and bird populations should be monitored. Once a site has been selected for restoration, the initial (baseline) monitoring should be conducted before the treatment (i.e., on-the-ground management). Monitoring should then be conducted in the first season following the treatment and continued periodically thereafter. Several methods of vegetation monitoring are available and managers should consult with the Great Basin Research Center or other appropriate experts in selecting an appropriate method.Vegetation monitoring should assess the effectiveness of plant restoration efforts (e.g.,survival of plantings) as well as benefits to habitat components important to birds (e.g., number of structural layers).

Avian monitoring should primarily assess changes in which species occur (community composition), the total number of species (species richness or diversity), and the number of birds (abundance or density). In cases where management objects are more specific, for example, improving habitat for Willow Flycatchers (*Empidonax trailii*),monitoring for presence/absence of specific species or guilds should be included. While several methods are available, a few have become well accepted and are used statewide. Avian monitoring techniques are relatively straight-forward, but require considerable expertise;observers need to be able to identify all birds (or at least target species) in an area by sight and sound. Managers should consult with the Utah Division of Wildlife Resources, Avian Program Coordinator or Utah Partners in Flight Coordinator when selecting an avian monitoring methodology and seeking training or assistance in conducting surveys.



Black-chinned Hummingbird

Impacts

The Western Division of the American Fisheries Society (1982) listed the following factors as the primary impacts on riparian resources:

- Livestock grazing
- Mining
- Water development and irrigation
- Road construction
- Agriculture and urbanization
- Timber harvest

At least two other impacts might be appropriate to add to this list (Aitchison 1977,Settergren 1977,Wyoming Partners in Flight 1996):

- Recreation
- Wildlife

Dealing with each of these sources of impact is beyond the scope of this publication.However, the first step in bringing about the restoration of a degraded riparian zone must involve dealing directly with the source of the impact to prevent any further degradation and insure success of restoration.

Management Considerations

Once the source of the impact is dealt with, restoration may be a passive or active approach.A passive approach allows the ecosystem to recover through its natural resilience. Often this is all that is necessary (Hoover and Wills 1984, Kaufmann et al.1995).Active restoration may be necessary when the following factors are involved (Kaufmann et al. 1995):

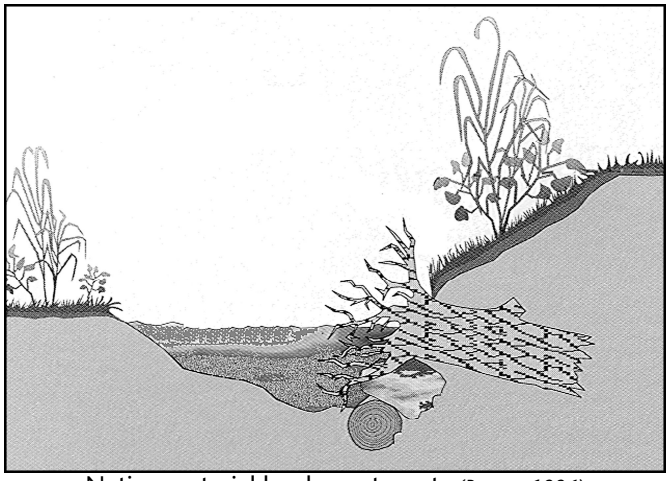
- Stream flow has been altered.
- The stream channel is degraded.
- There is little vegetation to naturally reseed the area.
- The soil seed bank is depleted.
- Exotics are present.
- There is a lack of structural components such as coarse woody debris.

A number of techniques are available for active restoration as well the halting of the sources of impact.These include, but are not limited to the following:

- Fencing
- Prescribed burns
- Forestry practices
- Vegetation plantings
- Opportunities from mineral activities
- Structures
- Beaver
- Bank stabilization
- Recreation planning
- Road construction and maintenance
- Grazing strategies
- Upland management

Obviously it is beyond the scope of this publication to deal with each of the potential impacts on riparian habitat or with each of the management techniques; however, several publications on stream channel restoration (e.g., Rosgen 1996), riparian ecosystem recovery (e.g., Briggs 1996), and

riparian grazing management (e.g., Payne 1992,Adams and Fitch 1995) are available.



Native material bank revetment. *(Rosgen 1996)*

Kaufmann et al. (1995) make an important note that must be considered.Active restoration often fails because the source of the impact has not been dealt with or the interactions between the riparian, aquatic, and upland ecosystems are not taken into account. Monsen and Stevens (in press) note this and several other important points:

1. Alteration of the riparian vegetation and soil may result from on site impacts, or as a result of poor management of other portions of the watershed. Proper management of the entire watershed is essential prior to initiation of rehabilitation measures in riparian communities. Restoration of riparian sites may be conducted simultaneously with treatment of other portions of the watershed.Unless adjoining areas are reasonably stable, repair of riparian disturbance will not be effective.
2. Riparian sites usually are extremely heterogeneous, containing different plant communities, topographic conditions, parent material, and soils within a short distance. Remedial treatments must be applicable to the different conditions encountered. For example, unstable, steep banks may occur immediately adjacent to wet and boggy meadows, requiring different site preparation practices, planting techniques, and plant materials.
3. Different treatments are often required to correct separate problems, such as controlling surface erosion, eliminating bank slumping, providing shade to the stream, controlling weeds, and providing concealment for wildlife.
4. Riparian sites are often narrow, irregularly shaped corridors that are not accessible to conventional planting equipment. Although only small areas may require treatment, extensive erosion, sedimentation, and plant community alteration may have occurred, thus requiring special equipment for rehabilitation.
5. The dense, and frequently storied assembly of plant species is required to maintain site stability. Grazing and other impacts have often reduced plant density or resulted in the removal of specific species.The loss of key species may seriously affect the persistence of other plants.To be successful, rehabilitation may require the reestablishment of a complex array of plants. Reestablishing woody plants is often essential.
6. Many sites are so seriously altered that extensive rehabilitation measures will be required to restrict further losses of soil and vegetation and reestablish a desirable plant cover.
7. Stabilization of the stream bank with vegetation is often the principal concern in rehabilitation. Vegetation is required to provide shade to the stream,forage for livestock,or improved wildlife habitat.
8. Some riparian sites have often been so seriously altered that the original vegetation can no longer survive. Thus, attempts to restore the original complement of plants may not be practical.However, unless a grouping of plants similar to the original community can be established, aquatic and terrestrial resources may not be significantly benefitted.
9. Noxious weeds and other less desirable species have often invaded riparian disturbances. Weeds often must be removed to improve the site and allow for planting.These plants do not always provide adequate soil protection or enhance aquatic habitat. Weeds may be spread by the stream to occupy downstream disturbances and interfere with the establishment of more desirable species.
10. Site preparation is usually required to accommodate planting. Some reduction of the existing plant cover may be necessary to eliminate competition to newly seeded or planted species. However, reduction of stream bank stability by plowing or similar methods of plant removal is hazardous. Thus, treatments normally include interseedings, selective, or delayed plantings. By such procedures, small areas can be treated in sequential intervals to retain existing plant cover and encourage natural recovery.
11. Seasonal runoff and flooding influence planting dates as well as establishment and survival of new seedlings or transplants. Sites may be covered with water in the spring for a few days or for weeks. Planting is frequently delayed by flooding until a time when air temperatures and precipitation may no longer be conducive to seedling survival. Disturbances may be seeded in the late summer or fall.However, fall germinated seedlings may not be able to survive spring runoff. Many riparian species survive or are propagated by flooding. However,

small seedlings usually are not as tenacious as larger plants. Seasonal runoff also disrupts and seriously damages prepared seedbeds. Transplanting large stock is often required to resist the effects of flooding and scouring.

12. Protection of young plants is essential for establishment and survival. Protection from grazing may be required for a number of years to allow plants to attain a reasonable size and furnish soil protection. Transplanting large stock may be necessary to overcome the influences of grazing and flooding.

It is also important to note that this publication is not meant to be a cookbook of solutions for the multitude of problems faced by those who manage riparian habitat and deal with the conservation of nongame birds. It is possible, however, to deal with active revegetation to some degree and consider its potential positive impact on birds.

Active Revegetation

Active revegetation should focus on restoring the targeted riparian habitat to a state as similar as possible to that which the landscape had produced before the impact (Kaufmann et al. 1995). The degree to which this may be accomplished will vary by site. In some areas,alteration of the habitat may be so severe that many native plants are no longer adapted to the changed environment (Platts et al. 1987). Conversely, simply establishing riparian vegetation on streambanks (Bentrup and Hoag 1998) in some areas can reduce or eliminate streambank erosion and provide an opportunity for additional riparian vegetation to become established (Briggs 1996). Whatever the degree, to meet the goal (improving avian habitat) and objectives (increasing structural layers of riparian vegetation, increasing diversity of riparian vegetation, etc.) reestablishment of native vegetation is required.

Three methods are available for planting new vegetation (Hoover and Wills 1984, Smith and Prichard 1992): using cuttings, transplanting bare root and container stock, and direct seeding.

Cuttings

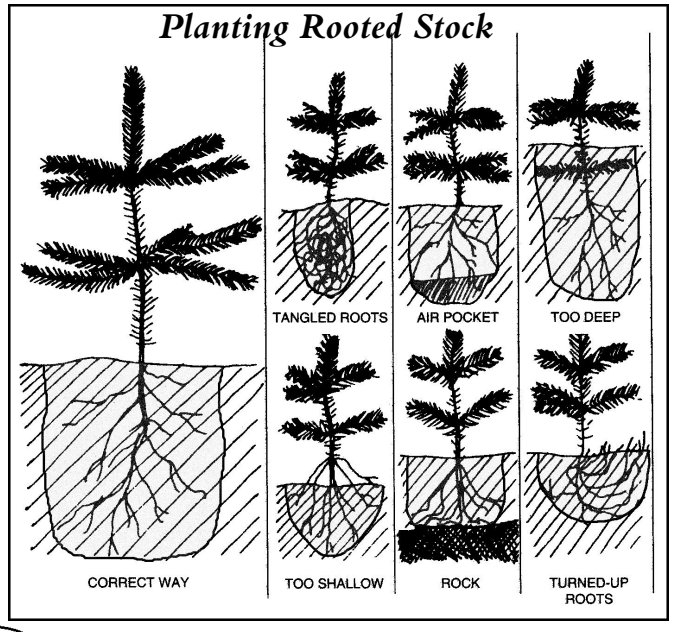
Cuttings are segments of live woody plants such as willow or cottonwood.When properly done, this technique tends to be low in cost and high in success for willows.Woody plants are often the most critical component that must be reestablished or rejuvenated in a riparian habitat (Platts et al.1987).

Good success has occurred where branches were cut at a 45° angle in the fall or spring when plants are dormant. Spring cuttings survive nearly four times better than fall cuttings.The growth from the last growing season will respond more vigorously than will older growth.The length of the cutting may be as short as 15 inches (eight inches are planted below the surface) for willows to be planted in areas where the water table is close to the surface. In areas where the water table is lower the cuttings should be long enough to reach the level of the water table and have eight to 15 inches above the ground. Relatively large cottonwoods may be established with cuttings four to six feet long. Applying a fungicide to the cut surfaces may increase survival. The application of a hormone to induce rooting may also increase survival, although most native riparian willow species will develop roots along the entire stem in the ground.

Cuttings may be planted immediately or stored in a cool moist place. They may also be stored with the cut end in water or moist sand for a few days or even long enough to root. Whatever the length of storage time, rooting stimulants may improve survival.The best time to plant cuttings is after snowmelt and peak runoff at higher elevations or before green- up at lower elevations.Cuttings can be planted using a spade or planting bar.This is accomplished by inserting the tool into the ground at 45-60° and lifting up to make an opening, then placing the cutting in the opening, with the cut end in the ground and the terminal end up, and stepping on the opening to close the soil around the cutting. For large cuttings a post hole digger or other appropriate tool may be needed. Cuttings are best placed at the high water level and above the upper edge of fast moving streams. Willow cuttings can also be planted three feet apart on badly eroding banks. Further from the streambed, the spacing may be six to nine feet.A random pattern on the outside of bends in the stream is the most attractive and natural looking arrangement and provides the most benefit for wildlife.

Transplanting Bare Root and Container Stock

To properly transplant bare root or container stock a hole deeper than the root mass needs to be dug.The root mass is placed in the hole and covered with soil; the soil should be well compacted around the roots. Roots have to be placed vertically. Placing roots in a "J-" or "S-shape" in the hole will result in poor success.Transplanting should not occur in dry soil. Water can be added when needed. Best results are generally obtained when transplanting is done just after spring



runoff. Transplanting can, however, be done at any time of the year, though spring runoff, summer heat,and lack of sufficient moisture will likely reduce survival rates.

Seeding

Seeds may be planted in the spring before green- up occurs, in the fall before the first snow, or in the winter on top of early snowfall. Fall seeding is, however, the most preferred. Broadcasting may be done with a hand spreader on small areas, with a drill on larger areas, or by aircraft over very large areas.Regardless of how the seed is dispersed, it must be covered.

What to plant?

In Tables 6 and 7, we provide lists of plant species that can be used for active riparian restoration.These tables also give the planting techniques, vegetative structure produced by the plant,characteristics of the seeds and fruit,and the plant community to which they are the most adapted.

Cover and Food

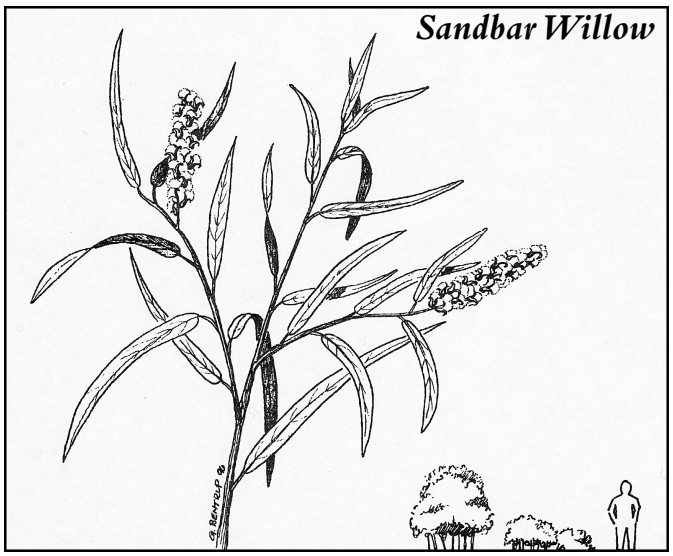
Choosing what species to plant is an important decision and will profoundly impact the avian community of the area. Unfortunately, there are no set guidelines for choosing what plant species to reestablish in a riparian area in order to benefit any one species of bird.However, plant species and combinations of species can be selected to increase overall avian diversity or to improve habitat for specific groups of birds (see Guilds section below and Tables 2-5 for bird groups).

The primary objective in most situations should be to provide birds with cover for nesting and foraging,since these are most often the limiting factors.Providing plants that produce food can also be an important objective in many situations.Several plant species may provide both good cover and food. And, combinations of plants can provide a variety of cover and food types.

Selecting plants that will provide a variety of vertical structure can enhance avian diversity. Canopy forming plants (e.g., cottonwood), should be combined with shrubs and small trees that form a subcanopy layer. A variety of shrubs should be used to provide cover, fruits, and flowers. Ground layer plants which provide a variety of seeds, fruits, and flowers will also enhance bird diversity.

The most emphasis should be placed on selecting the appropriate tree and shrub species, since the canopy and subcanopy layers are the most important to a wide variety of birds.Also, these are the layers which are most often absent in Utah riparian zones. In many situations, suitable ground layer plants will become established on their own. In situations where damage is extensive, the seed base is depauperate, or undesirable grasses and forbs dominate, more effort may need to be placed on reestablishing the ground layer.

Some introduced plant species such as tamarisk (*Tamarix chinensis*) and Russian olive (*Elaeagnus angustifolia*) should not be used. Some introduced species can be helpful in stabilizing and revegetating riparian systems as a stopgap measure. However, we recommend using native species whenever possible and only using introduced species that are not aggressive or persistent and will allow native species to reestablish.



Sandbar Willow

Cavity forming tree species are required by certain guilds. In situations where cavities are limiting and will not be restored for several years,nest boxes with various opening sizes may provide a provisional solution (Payne 1992).However, nest boxes should be checked and cleaned frequently to insure that introduced bird species such as European Starlings (*Sturnus vulgaris*) and House Sparrows (*Passer domesticus*) are not displacing native birds.

Guilds

Dealing with the avian community as a group of guilds may be helpful in guiding plant selection and assessing effectiveness of restoration efforts. Root (1967) defined guilds as "a

Belted Kingfisher

group of species that exploit the same class of environmental resources in a similar way." Since Root's definition there has been a broad discussion on the use of guilds in management (Croonquist and Brooks 1991, Jaksic 1981, Knopf et al. 1988, Landres 1983, Mannan et al. 1984, Paige 1990, Severinghaus 1981, Short and Burnham 1982, Verner 1984, Szaro 1986). Caution should certainly be used when working with guilds. We feel, however, that guilds can be useful in designing possible restoration plans and assessing their success. Efforts to restore riparian habitat may be excellent opportunities to investigate the impact of various plant species on avian communities.

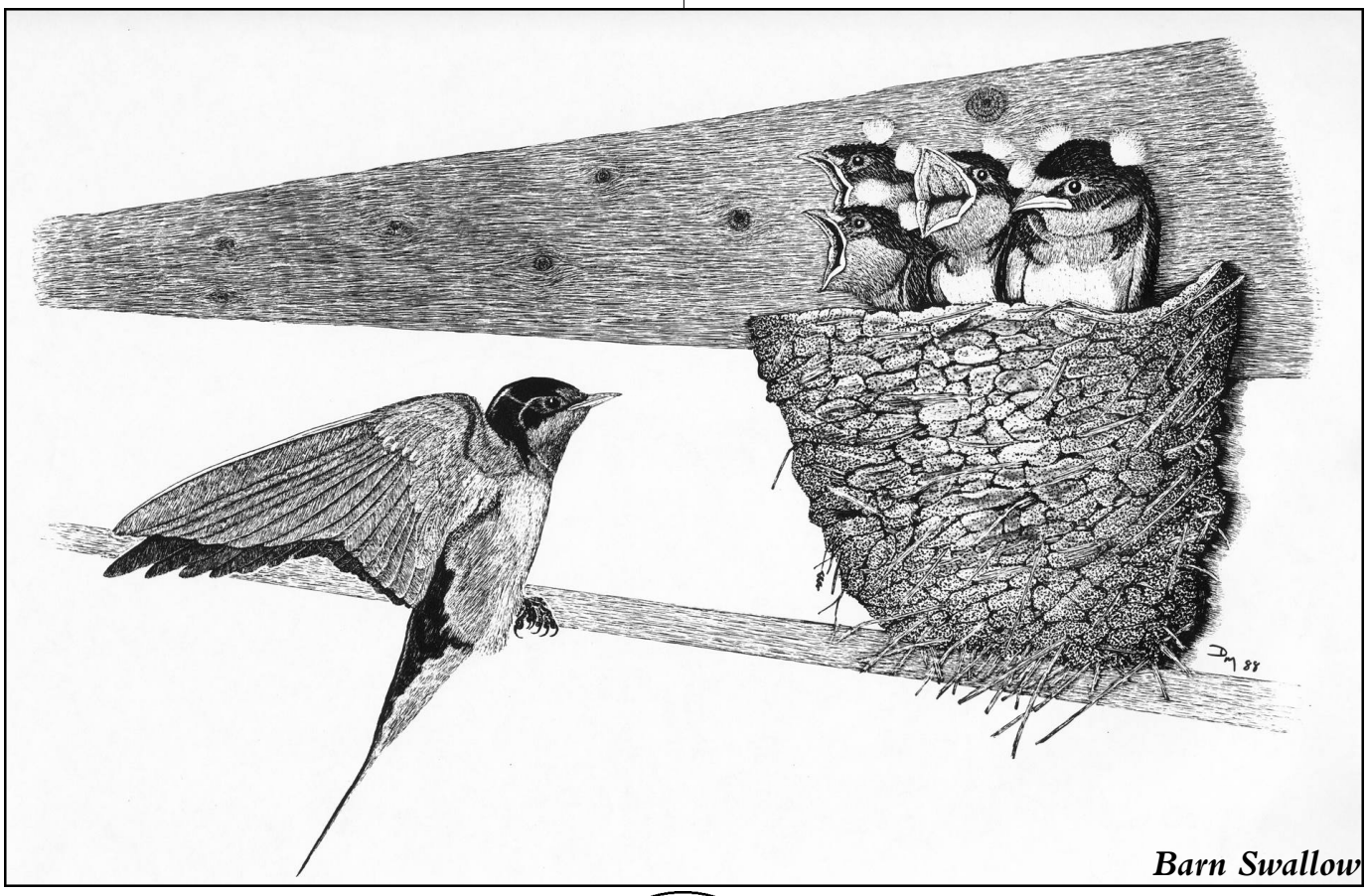
Song Sparrow

DeGraaf et al.(1985) proposed a foraging guild classification of North American birds. Their classification was based on major food type, substrate and foraging technique. Foraging guilds of Utah riparian birds are listed in Tables 2 and 3.

Nesting is another important factor in avian ecology. Martin (1993) has considered the availability of nest locations as limiting factors in bird populations. Nesting types, locations, and parasitism by cowbirds are factors managers should consider when dealing with bird populations. While we did not specifically define nesting guilds, we do provide groupings of birds that share similar nesting characteristics (e.g., canopy level cavity nesters) (Table 5) which can help with plant selection and project evaluation. Table 4 summarizes nest characteristics of Utah's riparian bird species in greater detail.

SUMMARY

The brief reviews on the decline of bird populations, the ecology of riparian habitats, and the restoration of riparian habitat are to act as only modest introductions to these subjects. The heart of this publication is the information in the following tables. It deals with Utah's birds, vegetation zones, and plant species available for management and restoration of riparian habitat. Additional sources of information and contacts can be found in the resources list in the Riparian Management Resources Appendix and Literature Cited section.



Barn Swallow

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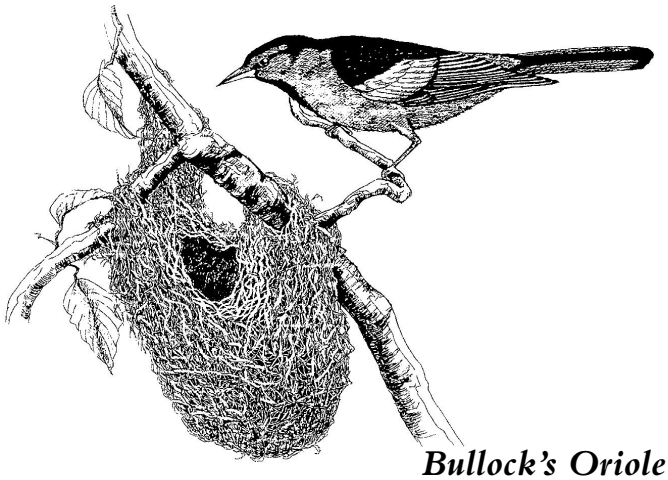


Bullock's Oriole

TABLE 1.

CHECKLIST OF UTAH RIPARIAN① BIRDS

Common name②	Scientific name	Abundance and Status③	Class④
Cormorants - Family Phalacrocoracidae			
Double-crested Cormorant	*Phalacrocorax auritus*	US,RW	m
Bitterns and Herons - Family Ardeidae			
Great Blue Heron	*Ardea herodias*	CP	p
Green Heron[R,C]	*Butorides virescens*	RS★	p
Black-crowned Night Heron	*Nycticorax nycticorax*	CS,UW	p
Swans, Geese, and Ducks - Family Anatidae			
Wood Duck	*Aix sponsa*	RP	m
Common Merganser[#]	*Mergus merganser*	RS,CT,UW	m
Osprey, Hawks, and Eagles - Family Accipitridae			
Osprey[#,SS]	*Pandion haliaetus*	RS	m
Bald Eagle[SS]	*Haliaeetus leucocephalus*	RS,CW	p
Sharp-shinned Hawk[#]	*Accipiter striatus*	CP	b
Cooper's Hawk	*Accipiter cooperi*	CP	b
Common Black-Hawk	*Buteogallus anthracinus*	RS	c
Swainson's Hawk[#,SS]	*Buteo swainsoni*	CS	a
Red-tailed Hawk	*Buteo jamaicensis*	CP	b
Falcons - Family Falconidae			
American Kestrel	*Falco sparverius*	CP	b
Peregrine Falcon[SS]	*Falco peregrinus*	RP	a
Pheasant, Grouse, and Turkey - Family Phasianidae			
Ruffed Grouse	*Bonasa umbellus*	UP	p
White-tailed Ptarmigan	*Lagopus leucurus*	RP	p
Blue Grouse[#]	*Dendragapus obscurus*	CP	p
Wild Turkey	*Meleagris gallopavo*	UP	p
Quail - Family Odontophoridae			
Gambel's Quail	*Callipepla gambelii*	CP★	p
Sandpipers, Phalaropes, and Allies - Family Scolopacidae			
Spotted Sandpiper	*Actitis macularia*	CS	m
Pigeons and Doves - Family Columbidae			
White-winged Dove	*Zenaida asiatica*	RS★	c
Mourning Dove	*Zenaida macroura*	CS,RW	b
Inca Dove	*Columbina inca*	RP★	p
Cuckoos and Roadrunners - Family Cuculidae			
Yellow-billed Cuckoo[SS]	*Coccyzus americanus*	RS	a
Typical Owls - Family Strigidae			
Western Screech Owl	*Otus kennicottii*	UP	p
Great Horned Owl	*Bubo virginianus*	CP	p
Northern Pygmy Owl	*Glaucidium gnoma*	UP	p
Spotted Owl[SS]	*Strix occidentalis*	RP	p
Long-eared Owl	*Asio otus*	UP	b
Northern Saw-whet Owl	*Aegolius acadicus*	UP	p
Nighthawks and Poorwills - Family Caprimulgidae			
Lesser Nighthawk	*Chordeiles acutipennis*	CS★	a
Common Nighthawk	*Chordeiles minor*	CS	a
Common Poorwill	*Phalaenoptilus nuttallii*	CS	b
Swifts - Family Apodidae			
Black Swift[SS]	*Cypseloides niger*	RS	a
White-throated Swift[#]	*Aeronautes saxatalis*	CS	a

Common name[2]	Scientific name	Abundance and Status[3]	Class[4]
Hummingbirds - Family Trochilidae			
Black-chinned Hummingbird[#]	*Archilochus alexandri*	CS	a
Costa's Hummingbird[#]	*Calypte costae*	US★	a
Calliope Hummingbird	*Stellula calliope*	US	a
Broad-tailed Hummingbird	*Selasphorus platycercus*	CS	a
Kingfishers - Family Alcedinidae			
Belted Kingfisher	*Ceryle alcyon*	UP	b
Woodpeckers - Family Picidae			
Lewis Woodpecker[SS]	*Melanerpes lewis*	UP	b
Red-naped Sapsucker[#,RC]	*Sphyrapicus nuchalis*	CS,RW	b
Ladder-backed Woodpecker	*Picoides scalaris*	CP★	p
Downy Woodpecker	*Picoides pubescens*	CP	p
Hairy Woodpecker	*Picoides villosus*	CP	p
Northern Flicker	*Colaptes auratus*	CP	b
Tyrant Flycatchers - Family Tyrannidae			
Olive-sided Flycatcher[#]	*Contopus borealis*	CS	a
Western Wood-pewee	*Contopus sordidulus*	CS	a
Willow Flycatcher[SS]	*Empidonax trailii*	CS	a
Least Flycatcher	*Empidonax minimus*	O	m
Dusky Flycatcher	*Empidonax oberholseri*	CS	a
Cordilleran Flycatcher[RC]	*Empidonax occidentalis*	CS	a
Black Phoebe	*Sayornis nigricans*	UP★	p
Vermilion Flycatcher	*Pyrocephalus rubinus*	RS★	a
Brown-crested Flycatcher	*Myiarchus tyrannulus*	RS★	c
Cassin's Kingbird	*Tyrannus vociferans*	US	a
Western Kingbird	*Tyrannus verticalis*	CS	a
Eastern Kingbird	*Tyrannus tyrannus*	RS	a
Vireos - Family Vireonidae			
Bell's Vireo[SS]	*Vireo bellii*	RS★	a
Plumbeous (Solitary) Vireo	*Vireo plumbeus*	CS	a
Warbling Vireo	*Vireo gilvus*	CS	a
Jays, Magpies, and Crows - Family Corvidae			
Black-billed Magpie	*Pica pica*	CP	p
American Crow	*Corvus brachyrhynchos*	RS,CW	p
Common Raven[#]	*Corvus corax*	CP	p
Swallows - Hirundinidae			
Purple Martin[#]	*Progne subis*	RS	a
Tree Swallow	*Tachycineta bicolor*	CS	b
Violet-green Swallow	*Tachycineta thalassina*	CS	a
N. Rough-winged Swallow	*Stelgidopteryx serripennis*	CS	a
Bank Swallow	*Riparia riparia*	CS	a
Cliff Swallow	*Petrochelidon pyrrhonota*	CS	a
Barn Swallow	*Hirundo rustica*	CS	a
Chickadees and Titmice - Family Paridae			
Black-capped Chickadee[#]	*Poecile atricapillus*	CP	p
Mountain Chickadee[#]	*Poecile gambeli*	CP	p
Verdin - Family Remizidae			
Verdin	*Auriparus flaviceps*	CP★	p
Bushtit - Family Aegithalidae			
Bushtit[#]	*Psaltriparus minimus*	CP	p
Nuthatches - Family Sittidae			
Red-breasted Nuthatch[#]	*Sitta canadensis*	CP	p
White-breasted Nuthatch[#]	*Sitta carolinensis*	UP	p
Creeper - Family Certhiidae			
Brown Creeper[#]	*Certhia americana*	UP	b

Common name[2]	Scientific name	Abundance and Status[3]	Class[4]
Wrens - Family Troglodytidae			
Bewick's Wren	*Thryomanes bewickii*	CP	p
House Wren	*Troglodytes aedon*	CS	a
Dipper - Family Cinclidae			
American Dipper	*Cinclus mexicanus*	CP	p
Kinglets - Family Regulidae			
Ruby-crowned Kinglet#	*Regulus calendula*	CP	b
Gnatcatchers - Family Sylviidae			
Blue-gray Gnatcatcher	*Polioptila caerulea*	CS	a
Black-tailed Gnatcatcher	*Polioptila melanura*	RP★	p
Thrushes - Family Turdidae			
Mountain Bluebird	*Sialia currucoides*	CS,UW	b
Townsend's Solitaire	*Myadestes townsendi*	CP	b
Veery	*Catharus fuscescens*	RS	a
Swainson's Thrush	*Catharus ustulatus*	CS	a
Hermit Thrush	*Catharus guttatus*	CS,RW	b
American Robin	*Turdus migratorius*	CP	b
Mockingbirds and Thrashers - Family Mimidae			
Gray Catbird	*Dumetella carolinensis*	RS	a
Crissal Thrasher[SS]	*Toxostoma crissale*	UP★	p
Starling - Family Sturnidae			
European Starling	*Sturnus vulgaris*	CP	p
Waxwings - Family Bombycillidae			
Cedar Waxwing	*Bombycilla cedrorum*	RS,CW	b
Silky Flycatchers - Family Ptilogonatidae			
Phainopepla	*Phainopepla nitens*	UP★	a
Wood Warblers - Family Parulidae			
Orange-crowned Warbler	*Vermivora celata*	CS,RW	a
Virginia's Warbler#	*Vermivora virginiae*	CS	a
Lucy's Warbler	*Vermivora luciae*	CS★	c
Yellow Warbler	*Dendroica petechia*	CS	a
Yellow-rumped Warbler#	*Dendroica coronata*	CS,RW	b
Black-throated Gray Warbler	*Dendroica nigrescens*	CS	a
American Redstart	*Setophaga ruticilla*	RT	a
Northern Waterthrush#	*Seiurus noveboracensis*	RT	a
MacGillivray's Warbler	*Oporornis tolmiei*	CS	a
Common Yellowthroat[SS]	*Geothlypis trichas*	CS	a
Wilson's Warbler	*Wilsonia pusilla*	US,CT	a
Yellow-breasted Chat	*Icteria virens*	CS	a
Tanagers - Family Thraupidae			
Summer Tanager	*Piranga rubra*	US★	a
Western Tanager	*Piranga ludoviciana*	CS	a
Towhees, Sparrows, and Longspurs - Family Emberizidae			
Spotted Towhee[RC]	*Pipilo maculatus*	CP	b
Abert's Towhee	*Pipilo aberti*	UP★	p
American Tree Sparrow#,[RC]	*Spizella arborea*	UW	w
Chipping Sparrow	*Spizella passerina*	CS	a
Fox Sparrow	*Passerella iliaca*	US	b
Song Sparrow	*Melospiza melodia*	CP	b
Lincoln's Sparrow	*Melospiza lincolnii*	CS,RW	a
White-crowned Sparrow	*Zonotrichia leucophrys*	CP	b
Dark-eyed Junco#	*Junco hyemalis*	CP	b

Common name②	Scientific name	Abundance and Status③	Class④
Cardinals, Grosbeaks, and Buntings - Family Cardinalidae			
Black-headed Grosbeak	*Pheucticus melanocephalus*	CS	a
Blue GrosbeakSS	*Guiraca caerulea*	CS	a
Lazuli Bunting	*Passerina amoena*	CS	a
Indigo Bunting	*Passerina cyanea*	RS	a
Meadowlarks, Blackbirds, and Orioles - Family Icteridae			
Common Grackle	*Quiscalus quiscula*	RS	m
Great-tailed Grackle	*Quiscalus mexicanus*	RP	p
Brown-headed Cowbird#	*Molothrus ater*	CS,RW	b
Hooded Oriole	*Icterus cucullatus*	US★	a
Bullock's OrioleRC	*Icterus bullockii*	CS	a
Scott's Oriole#	*Icterus parisorum*	US	a
Finches - Family Fringillidae			
Cassin's Finch#	*Carpodacus cassinii*	CP	b
House Finch	*Carpodacus mexicanus*	CP	p
Pine Siskin#	*Carduelis pinus*	CP	b
Lesser Goldfinch	*Carduelis psaltria*	CS,UW	b
American Goldfinch	*Carduelis tristis*	CP	b
Evening Grosbeak#	*Coccothraustes vespertinus*	RS,IW	p
Weaver Finches - Family Passeridae			
House Sparrow	*Passer domesticus*	CP	p

① Unless noted,species listed are riparian-dependent, i.e., species whose primary and/or secondary breeding habitat is riparian; # = Species that use riparian habitat extensively as foraging,migrating,and/or wintering habitat but whose major breeding habitat is not riparian.

② RC = Recently changed species as published in the American Ornithologists' Union (1998) Checklist of North American Birds,7th edition. SS = Utah Sensitive Species (Utah Division of Wildlife Resources 1998).

③ Abundance (Utah Ornithological Society 1998):
- C = Common (Found consistently in fair numbers in appropriate habitat and season).
- U = Uncommon (Found occasionally in small numbers in appropriate habitat and season.)
- R = Rare (Found infrequently but regularly in very small numbers in proper habitat and season.)
- O = Occasional (Seldom found in the state and not reported annually.)
- I = Irregular (Abundance varies greatly from year to year - may be common one year and absent the next.)

Status (Utah Ornithological Society 1998)
- P = Permanent Resident (Found year round in state.)
- S = Summer Resident (Present in the state during the nesting season.)
- W = Winter Visitant (Present in the state during January and/or February.)
- T = Transient (Migrates through the state in spring and/or fall.)
- ★ Species that breed primarily in Washington County.

④ Class–Migratory Bird Classification (Howe 1996,Gauthreaux 1992.)
- m= Species that breed in Utah and migrate during the nonbreeding season but are not considered to be Neotropical Migratory Birds
- p= Species that are primarily permanent residents in Utah,a proportion of Utah population may migrate
- w= Species that winter in Utah but breed elsewhere

Neotropical Migratory Birds - proportion of Utah population that migrates varies with species and conditions
- a = Species that breed in North America and spend their nonbreeding period primarily south of the U.S.
- b = Species that breed and winter extensively in North America although some populations winter south of the U.S.
- c = Species whose breeding range is primarily south of the U.S./Mexican border, and enter the U.S. along the Rio Grande Valley and where the Mexican Highlands extend across the U.S. border.These populations vacate the United States during the winter months.

TABLE 2.

FORAGING GUILDS① OF UTAH RIPARIAN BIRDS: A TAXONOMIC LISTING

Common name②	Breeding period	Nonbreeding Period
Cormorants - Family Phalacrocoracidae		
Double-crested Cormorant	Piscivore: water diver	Piscivore: water diver
Bitterns and Herons - Family Ardeidae		
Great Blue Heron	Piscivore: water ambusher③	Piscivore: water ambusher③
Green Heron[RC]	Crustaceovore: water ambusher	Crustaceovore: water ambusher
	Piscivore: water ambusher	Piscivore: water ambusher
Black-crowned Night Heron	Piscivore: water ambusher	Piscivore: water ambusher
	Crustaceovore: water ambusher	Crustaceovore: water ambusher
Swans, Geese, and Ducks - Family Anatidae		
Wood Duck	Granivore: ground gleaner	Granivore: ground gleaner
	& freshwater surface gleaner	& freshwater surface gleaner
Common Merganser	Piscivore: freshwater diver	Piscivore: freshwater diver
Osprey, Hawks, and Eagles - Family Accipitridae		
Osprey	Piscivore: water foot-plunger	Piscivore: water foot-plunger
Bald Eagle	Piscivore: water foot-plunger	Piscivore: water foot-plunger
	Carnivore: ground scavenger	Carnivore: ground scavenger
Sharp-shinned Hawk[NT]	Carnivore: air hawker	Carnivore: air hawker
	& ground hawker	& ground hawker
Cooper's Hawk[NT]	Carnivore: air hawker	Carnivore: air hawker
	& ground hawker	& ground hawker
Common Black-Hawk[NT]	Carnivore: ground hawker	Carnivore: ground hawker
Swainson's Hawk[NT]	Carnivore: ground hawker	Carnivore: ground hawker
	Insectivore: air hawker	Insectivore: air hawker
Red-tailed Hawk[NT]	Carnivore: ground hawker	Carnivore: ground hawker
Falcons - Family Falconidae		
American Kestrel[NT]	Carnivore: ground hawker	Carnivore: ground hawker
	Insectivore: air hawker	
Peregrine Falcon[NT]	Carnivore: air hawker	Carnivore: air hawker
Pheasant, Grouse, and Turkey - Family Phasianidae		
Ruffed Grouse	Omnivore: ground forager	Herbivore: upper-canopy forager
White-tailed Ptarmigan	Omnivore: ground forager	Herbivore: ground forager
Blue Grouse	Omnivore: ground forager	Herbivore: upper-canopy forager
Wild Turkey	Omnivore: ground forager	Herbivore: ground forager
Quail - Family Odontophoridae		
Gambel's Quail	Herbivore: ground forager	Herbivore: ground forager
Sandpipers, Phalaropes, and Allies - Family Scolopacidae		
Spotted Sandpiper	Insectivore: shoreline gleaner	Insectivore: shoreline gleaner
Pigeons and Doves - Family Columbidae		
White-winged Dove[NT]	Granivore: ground gleaner	Granivore: ground gleaner
Mourning Dove[NT]	Granivore: ground gleaner	Granivore: ground gleaner
Inca Dove	Granivore: ground gleaner	Granivore: ground gleaner
Cuckoos and Roadrunners - Family Cuculidae		
Yellow-billed Cuckoo[NT]	Insectivore: lower-canopy gleaner	
Typical Owls - Family Strigidae		
Western Screech Owl	Carnivore: ground hawker	Carnivore: ground hawker
	Insectivore: ground hawker	
Great Horned Owl	Carnivore: ground hawker	Carnivore: ground hawker

Common name[2]	Breeding period	Nonbreeding Period
Northern Pygmy Owl	Carnivore: ground hawker Insectivore: ground hawker	Carnivore: ground hawker
Spotted Owl	Carnivore: ground hawker	Carnivore: ground hawker
Long-eared Owl[NT]	Carnivore: ground hawker	Carnivore: ground hawker
Northern Saw-whet Owl	Carnivore: ground hawker	Carnivore: ground hawker
Nighthawks and Poorwills - Family Caprimulgidae		
Lesser Nighthawk[NT]	Insectivore: air screener	
Common Nighthawk[NT]	Insectivore: air screener	
Common Poorwill[NT]	Insectivore: air screener	Insectivore: air screener
Swifts - Family Apodidae		
Black Swift[NT]	Insectivore: air screener	
White-throated Swift[NT]	Insectivore: air screener	Insectivore: air screener
Hummingbirds - Family Trochilidae[4]		
Black-chinned Hummingbird[NT]	Omnivore: floral hover-gleaner[5]	Omnivore: floral hover-gleaner[5]
Costa's Hummingbird[NT]	Omnivore: floral hover-gleaner	Omnivore: floral hover-gleaner
Calliope Hummingbird[NT]	Omnivore: floral hover-gleaner[6]	
Broad-tailed Hummingbird[NT]	Omnivore: floral hover-gleaner[7]	
Kingfishers - Family Alcedinidae		
Belted Kingfisher[NT]	Piscivore: water plunger	Piscivore: water plunger
Woodpeckers - Family Picidae		
Lewis Woodpecker[NT]	Insectivore: air sallier Granivore: upper-canopy gleaner	Insectivore: air sallier Granivore: upper-canopy gleaner
Red-naped Sapsucker[R,C,NT]	Insectivore: bark gleaner Omnivore:bark excavator	Insectivore: bark gleaner Omnivore:bark excavator
Ladder-backed Woodpecker	Insectivore: bark gleaner Frugivore:lower-canopy gleaner	Insectivore: bark gleaner Frugivore: lower-canopy gleaner[8]
Downy Woodpecker	Insectivore: bark gleaner Frugivore:lower-canopy gleaner	Insectivore: bark gleaner Frugivore:lower-canopy gleaner[9]
Hairy Woodpecker	Insectivore: bark gleaner Frugivore:lower-canopy gleaner	Insectivore: bark gleaner Frugivore: lower-canopy gleaner[10]
Northern Flicker[NT]	Insectivore: ground gleaner	Omnivore: ground forager & lower-canopy forager
Tyrant Flycatchers - Family Tyrannidae		
Olive-sided Flycatcher[NT]	Insectivore: air sallier	
Western Wood-pewee[NT]	Insectivore: air sallier	
Willow Flycatcher[NT]	Insectivore: air sallier	
Least Flycatcher[NT]	Insectivore: air sallier	
Dusky Flycatcher[NT]	Insectivore: air sallier	
Cordilleran Flycatcher[R,C, NT]	Insectivore: air sallier	
Black Phoebe	Insectivore: air sallier	Insectivore: air sallier Frugivore: lower-canopy gleaner
Vermilion Flycatcher[NT]	Insectivore: air sallier	Insectivore: air sallier
Brown-crested Flycatcher[NT]	Insectivore: air sallier	
Cassin's Kingbird[NT]	Insectivore: air sallier	Insectivore: air sallier Frugivore:lower-canopy gleaner
Western Kingbird[NT]	Insectivore: air sallier	Insectivore: air sallier
Eastern Kingbird[NT]	Insectivore: air sallier	
Vireos - Family Vireonidae		
Bell's Vireo[NT]	Insectivore: lower-canopy gleaner	
Plumbeous-(Solitary) Vireo[R,C, NT]	Insectivore: lower-canopy gleaner	Omnivore: lower-canopy forager
Warbling Vireo[NT]	Insectivore: upper-canopy gleaner	
Jays, Magpies, and Crows - Family Corvidae		
Black-billed Magpie	Insectivore: ground gleaner	Omnivore: ground forager[11]
American Crow	Omnivore: ground forager	Omnivore: ground forager[12]
Common Raven	Omnivore: ground scavenger	Omnivore: ground scavenger

Common name[2]	Breeding period	Nonbreeding Period
Swallows - Hirundinidae		
Purple Martin[NT]	Insectivore: air screener	
Tree Swallow[NT]	Insectivore: air screener	Insectivore: air screener Frugivore: lower-canopy gleaner[13]
Violet-green Swallow[NT]	Insectivore: air screener	Insectivore: air screener
N. Rough-winged Swallow[NT]	Insectivore: air screener	Insectivore: air screener
Bank Swallow[NT]	Insectivore: air screener	
Cliff Swallow[NT]	Insectivore: air screener	
Barn Swallow[NT]	Insectivore: air screener	
Chickadees and Titmice - Family Paridae		
Black-capped Chickadee	Insectivore: lower-canopy gleaner	Omnivore:lower-canopy forager
Mountain Chickadee	Insectivore: lower-canopy gleaner	Omnivore: lower-canopy forager
Verdin - Family Remizidae		
Verdin	Insectivore: lower-canopy gleaner	Omnivore:lower-canopy forager
Bushtit - Family Aegithalidae		
Bushtit	Insectivore: lower-canopy gleaner	Omnivore:lower-canopy forager
Nuthatches - Family Sittidae		
Red-breasted Nuthatch	Insectivore: bark gleaner	Insectivore: bark gleaner Granivore: upper-canopy gleaner
White-breasted Nuthatch	Insectivore: bark gleaner	Insectivore: bark gleaner Granivore: upper-canopy gleaner
Creeper - Family Certhiidae		
Brown Creeper[NT]	Insectivore: bark gleaner	Insectivore: bark gleaner
Wrens - Family Troglodytidae		
Bewick's Wren	Insectivore: ground gleaner[14]	Insectivore: ground gleaner[14]
House Wren[NT]	Insectivore: lower-canopy gleaner	Insectivore: lower-canopy gleaner
Dipper - Family Cinclidae		
American Dipper	Insectivore: riparian bottom gleaner	Insectivore: riparian bottom gleaner
Kinglets - Family Regulidae		
Ruby-crowned Kinglet[NT]	Insectivore: lower-canopy gleaner[15]	Insectivore: lower-canopy gleaner[15]
Gnatcatchers - Family Sylviidae		
Blue-gray Gnatcatcher[NT]	Insectivore: upper-canopy gleaner[16]	Insectivore: upper-canopy gleaner[16]
Black-tailed Gnatcatcher	Insectivore: lower-canopy gleaner	Insectivore: lower-canopy gleaner
Thrushes - Family Turdidae		
Mountain Bluebird[NT]	Insectivore: ground gleaner	Insectivore: ground gleaner Omnivore:lower-canopy forager
Townsend's Solitaire[NT]	Insectivore: air sallier Omnivore: ground forager	Insectivore: air sallier Omnivore: ground forager
Veery[NT]	Omnivore: ground forager & lower-canopy forager	
Swainson's Thrush[NT]	Omnivore: ground forager & lower-canopy forager	
Hermit Thrush[NT]	Insectivore: ground gleaner	Omnivore: ground forager & lower-canopy forager
American Robin[NT]	Omnivore:lower-canopy forager Vermivore: ground gleaner	Omnivore: lower-canopy forager Omnivore: ground forager
Mockingbirds and Thrashers - Family Mimidae		
Gray Catbird[NT]	Omnivore: ground forager & lower-canopy forager	Omnivore: ground forager & lower-canopy forager
Crissal's Thrasher	Omnivore: ground forager & lower-canopy forager	Omnivore: ground forager & lower-canopy forager
Starling - Family Sturnidae		
European Starling	Omnivore: ground forager	Omnivore: ground forager
Waxwings - Family Bombycillidae		
Cedar Waxwing[NT]	Insectivore: air sallier Frugivore: upper-canopy gleaner	Insectivore: air sallier Frugivore: upper-canopy gleaner

Common name②	Breeding period	Nonbreeding Period
Silky Flycatchers - Family Ptilogonatidae		
Phainopepla[NT]	Frugivore: lower-canopy gleaner	Frugivore:lower-canopy gleaner
Wood Warblers - Family Parulidae		
Orange-crowned Warbler[NT]	Insectivore: lower-canopy gleaner[17]	Omnivore: lower-canopy forager
Virginia's Warbler[NT]	Insectivore: lower-canopy gleaner	
Lucy's Warbler[NT]	Insectivore: lower-canopy gleaner	
Yellow Warbler[NT]	Insectivore: lower-canopy gleaner	
Yellow-rumped Warbler[NT]	Insectivore: lower-canopy gleaner[18]	Omnivore:lower-canopy forager
Black-throated Gray Warbler[NT]	Insectivore: lower-canopy gleaner	Insectivore: lower-canopy gleaner
American Redstart[NT]	Insectivore: lower-canopy gleaner & air sallier	
Northern Waterthrush[NT]	Insectivore: freshwater shoreline gleaner	Insectivore: freshwater shoreline gleaner
MacGillivray's Warbler[NT]	Insectivore: lower-canopy gleaner	
Common Yellowthroat[NT]	Insectivore: lower-canopy gleaner[19]	Insectivore: lower-canopy gleaner[19]
Wilson's Warbler[NT]	Insectivore: lower-canopy gleaner & air sallier	
Yellow-breasted Chat[NT]	Omnivore: lower-canopy forager	
Tanagers - Family Thraupidae		
Summer Tanager[NT]	Insectivore: upper-canopy gleaner	
Western Tanager[NT]	Omnivore:upper-canopy forager Insectivore: air sallier	
Towhees, Sparrows, and Longspurs - Family Emberizidae		
Spotted Towhee[R,C, NT]	Omnivore: ground forager	Omnivore: ground forager
Abert's Towhee	Omnivore: ground forager	Omnivore: ground forager
American Tree Sparrow[R,C]	Omnivore: ground forager[20]	Omnivore: ground forager[20]
Chipping Sparrow[NT]	Omnivore: ground forager	Granivore: ground gleaner
Fox Sparrow[NT]	Omnivore: ground forager	Granivore: ground gleaner
Song Sparrow[NT]	Omnivore:lower-canopy forager & ground forager	Granivore: ground gleaner
Lincoln's Sparrow[NT]	Omnivore: ground forager	Granivore: ground gleaner
White-crowned Sparrow[NT]	Omnivore: ground forager	Granivore: ground gleaner
Dark-eyed Junco[NT]	Omnivore: ground forager	Granivore: ground gleaner
Cardinals, Grosbeaks, and Buntings - Family Cardinalidae		
Black-headed Grosbeak[NT]	Omnivore:upper-canopy forager[21]	
Blue Grosbeak[NT]	Omnivore: ground forager[22]	
Lazuli Bunting[NT]	Omnivore:lower-canopy forager	Omnivore: lower-canopy forager
Indigo Bunting[NT]	Omnivore:lower-canopy forager	Omnivore: lower-canopy forager
Meadowlarks, Blackbirds, and Orioles - Family Icteridae		
Common Grackle	Omnivore: ground forager	Omnivore: ground forager
Great-tailed Grackle	Omnivore: ground forager	Omnivore: ground forager
Brown-headed Cowbird[NT]	Omnivore: ground forager	Granivore: ground gleaner
Hooded Oriole[NT]	Omnivore:lower-canopy forager	
Bullock's Oriole[R,C, NT]	Omivore:upper-canopy forager	
Scott's Oriole[NT]	Omnivore:lower-canopy forager	
Finches - Family Fringillidae		
Cassin's Finch[NT]	Omnivore: ground forager	Granivore: upper-canopy gleaner & ground gleaner
House Finch	Granivore: ground gleaner Frugivore: ground gleaner	Granivore: ground gleaner
Pine Siskin[NT]	Omnivore:upper-canopy forager & ground forager	Granivore: upper-canopy gleaner & ground gleaner
Lesser Goldfinch[NT]	Granivore: ground gleaner & lower-canopy gleaner	Granivore: ground gleaner & lower-canopy gleaner
American Goldfinch[NT]	Omnivore:lower-canopy forager & ground forager	Granivore: lower-canopy gleaner & ground gleaner
Evening Grosbeak	Omnivore: upper-canopy forager	Granivore: upper-canopy gleaner & ground gleaner

Common name②	Breeding period	Nonbreeding Period
Weaver Finches - Family Passeridae		
House Sparrow	Granivore: ground gleaner	Granivore: ground gleaner

① **Definitions of Foraging Guild Terms (DeGraaf et al.1985).**

Food types

For food types DeGraaf et al.(1985) "did not necessarily include all foods taken by each species– only the major food items (20% of diet during a given period).

- Carnivore: vertebrates
- Crustaceovore:crustaceans
- Frugivore:fruits
- Granivore: nuts
- Herbivore:plants (leaves, stems, roots)
- Insectivore: insects
- Molluscovore:mollusks
- Omnivore:a variety of foods including both animal and plant foods (the less common food group makes up 10% of diet)
- Piscivore: fish
- Vermivore:sandworms, earthworms, etc.

Substrates

Substrate refers to the place where the food item is found or taken. Note: some substrates are not found in Utah, but are included for reference.

- air: caught in the air
- bark: on, in, or under bark of trees
- coastal: waters along coast (can include brackish as well as salt water)
- coastal beach: beaches and/or tidal flats along coast
- coastal bottom: floor of continental shelf along coast
- coastal rock: rocks along the coast
- coastal surface: surface of coastal waters
- floral: on or in flowers
- fresh marsh: freshwater marshes (on mud, in shallow water, or on marsh plants).
- freshwater: freshwater habitats (ponds, lakes, rivers, streams)
- freshwater bottom: bottoms of freshwater ponds and lakes
- freshwater shoreline: shores of freshwater ponds.lakes, rivers, or streams
- freshwater surface: surface of freshwater habitats
- ground: on the ground or on very low, weedy vegetation
- lower canopy/shrub:on leaves, twigs, and branches of shrubs, saplings, and lower crowns of trees
- marsh: fresh, brackish, or saltwater marshes (on mud, in shallow water, or on marsh plants)
- mud: inland on mud flats (wet fields, meadows, tundra, or associated with freshwater habitats)
- pelagic: ocean water away from coastlines
- pelagic surface: surface of ocean waters
- riparian bottom: bottoms of rivers and streams
- salt marsh:brackish or salt marshes (on mud, in shallow water, or on marsh plants)
- shoreline: along shoreline of both freshwater and saltwater (coastal) habitats
- upper canopy: on leaves, twigs, and branches of trees in main canopy
- water: brackish, fresh- and saltwater habitats
- water bottom: on bottoms of fresh-, brackish, or saltwater habitats
- water surface: on surface of fresh-, brackish, or saltwater habitats

Technique

Techniques refers to the manner in which food is obtained. Note: some techniques are associated with particular food types and/or substrates; some techniques are not commonly used by Utah riparian birds but are included for reference

- ambusher: slowly stalks or waits for prey to come within reach
- chaser: pursues prey on ground
- dabbler: submerges head and neck or tips up (various water substrates)
- diver: dives from surface for underwater food
- excavator: locates food in bark by drilling holes
- food pirate: steals food from other species, usually other birds
- foot plunger: catches prey by plunging from air to water surface (or ground) and seizing prey in talons
- forager: takes almost any food items encountered upon the substrate (includes all herbivores and omnivores feeding on terrestrial habitats or vegetation, except grazers and grubbers)
- gleaner: selects particular food items from the substrate
- grazer: feeds on grasses, sedges, or grains in fields or meadows

- grubber: digs up roots and tubers of either terrestrial or aquatic plants
- hawker: flies after prey and captures it either in air or on ground
- hover-gleaner: hovers in air while selecting prey (from vegetation or ground)
- plunger: dives from air into water to capture prey in bill or gular pouch
- prober: inserts bill into substrate (beach, mud, ground) and locates prey by touch
- sallier: perches on exposed branch or twig, waits for insect to fly by, and then pursues and catches insect in air
- scaler: exposes prey under bark by scaling off loose bark
- scavenger: takes a variety of items, including refuse or carrion
- screener: flies with bill open and screens prey from air
- skimmer: flies low over water and skims food from water surface with lower mandible in water
- strainer: strains food items from water or mud through lamellae along edge of bill

② RC = Recently changed species as published in the American Ornithologists' Union (1998) Checklist of North American Birds, 7th edition or species which were omitted from foraging guilds listed by DeGraaf et al. (1985). Guilds for these species have been extrapolated from information on other species.
NT = Neotropical migratory bird

③ Authors' note: Great Blue Herons are also carnivores.

④ Authors' note: Ehrlich et al. 1988 list the Utah hummingbird species as hovers and gleaners feeding mainly on nectar and insects.

⑤ Authors' note: Ehrlich et al. 1988 note that Black-chinned Hummingbirds also hawk or in the terms of DeGraaf et al.1985 are air salliers.

⑥ Authors' note: Ehrlich et al. 1988 note that Calliope Hummingbirds also hawk or in the terms of DeGraaf et al. 1985 are air salliers.

⑦ Authors' note: Ehrlich et al. 1988 note that Broad-tailed Hummingbirds also hawk or in the terms of DeGraaf et al. 1985 are air salliers.

⑧ Authors' note: Ehrlich et al. 1988 note that the Ladder-backed Woodpecker is also a ground gleaner which feeds on insects and fruit, especially cactus fruit.

⑨ Authors' note: Ehrlich et al. 1988 note that although 75-85% of the Downy Woodpecker's diet is insects, it also feeds on fruit, seeds, and sap from sapsucker holes.

⑩ Authors' note: Ehrlich et al. 1988 note that although 75-95% of the Hairy Woodpecker's diet is insects it also feeds on sap from sapsucker holes and its winter diet may include nuts.

⑪ Authors' note: Some observers would classify the Black-billed Magpie as a year-round scavenger.

⑫ Authors' note: Some observers would classify the American Crow as a year-round scavenger.

⑬ Authors' note: Ehrlich et al.1988 note that berries are taken by this species when insects are not available.

⑭ Authors' note: Ehrlich et al 1988 classify Bewick's Wren as a ground gleaner but also note that it is a foliage gleaner and hawks.

⑮ Authors' note:The Ruby-crowned Kinglet could likely be classified as a lower- and upper-canopy gleaner.

⑯ Authors' note:The Blue-gray Gnatcatcher could likely be classified as a lower- and upper-canopy gleaner.

⑰ Authors' note: Some Utah observers would classify the Orange-crowned Warbler as an upper-canopy gleaner.

⑱ Authors' note: Some Utah observers would classify the Yellow-rumped Warbler as an upper-canopy gleaner.

⑲ Authors' note: Some Utah observers would classify the Common Yellowthroat as fresh marsh lower-canopy gleaner.

⑳ Authors' note: DeGraaf et al. 1985 omitted the American Tree Sparrow from their table. Ehrlich et al 1988 list it as a ground forager and foliage gleaner which feeds mainly on insects, seeds, and buds.

㉑ Authors' note: Some Utah observers would classify the Black-headed Grosbeak as an upper- and lower-canopy forager.

㉒ Authors' note: Ehrlich et al. 1988 classify the Blue Grosbeak as a ground gleaner, but also note that it is a foliage gleaner.

TABLE 3.

FORAGING GUILDS OF UTAH RIPARIAN BIRDS: LISTED BY GUILD[1] [2]

Foraging Guild	Breeding period	Nonbreeding period
Carnivore: air hawker		
	Sharp-shinned Hawk	Sharp-shinned Hawk
	Cooper's Hawk	Cooper's Hawk
	Peregrine Falcon	Peregrine Falcon
Carnivore: ground hawker		
	Sharp-shinned Hawk	Sharp-shinned Hawk
	Cooper's Hawk	Cooper's Hawk
	Common Black-Hawk	Common Black-Hawk
	Swainson's Hawk	Swainson's Hawk
	Red-tailed Hawk	Red-tailed Hawk
	American Kestrel	American Kestrel
	Western Screech Owl	Western Screech Owl
	Great Horned Owl	Great Horned Owl
	Northern Pygmy Owl	Northern Pygmy Owl
	Spotted Owl	Spotted Owl
	Long-eared Owl	Long-eared Owl
	Northern Saw-whet Owl	Northern Saw-whet Owl
Carnivore: ground scavenger		
	Bald Eagle	Bald Eagle
Crustaceovore: water ambusher		
	Green Heron*	Green Heron*
	Black-crowned Night Heron	Black-crowned Night Heron
Frugivore: ground gleaner		
	House Finch	
Frugivore: lower-canopy/shrub gleaner		
	Band-tailed Pigeon	Tree Swallow
	Ladder-backed Woodpecker	Black Phoebe
	Downy Woodpecker	Cassin's Kingbird
	Hairy Woodpecker	Ladder-backed Woodpecker
	Phainopepla	Downy Woodpecker
		Hairy Woodpecker
		Phainopepla
Frugivore: upper canopy gleaner		
	Cedar Waxwing	Band-tailed Pigeon
		Cedar Waxwing
Granivore: freshwater surface gleaner		
	Wood Duck	Wood Duck

Foraging Guild	Breeding period	Nonbreeding period
Granivore: ground gleaner		
	Wood Duck	Chipping Sparrow
	White-winged Dove	Fox Sparrow
	Mourning Dove	Song Sparrow
	Inca Dove	Lincoln's Sparrow
	House Finch	White-crowned Sparrow
	Lesser Goldfinch	Dark-eyed Junco
	House Sparrow	Brown-headed Cowbird
		Cassin's Finch
		Pine Siskin
		American Goldfinch
		Evening Grosbeak
		Wood Duck
		White-winged Dove
		Mourning Dove
		Inca Dove
		House Finch
		Lesser Goldfinch
		House Sparrow
Granivore: lower-canopy/shrub gleaner		
	Lesser Goldfinch	American Goldfinch
		Lesser Goldfinch
Granivore: upper-canopy gleaner		
	Red-breasted Nuthatch	Lewis' Woodpecker
	White-breasted Nuthatch	
	Cassin's Finch	
	Pine Siskin	
	Evening Grosbeak	
	Lewis' Woodpecker	
Herbivore: ground forager		
	Gambel's Quail	Gambel's Quail
		White-tailed Ptarmigan
		Wild Turkey
Herbivore: upper-canopy forager		
		Blue Grouse
		Ruffed Grouse
Insectivore: air hawker		
	American Kestrel	Swainson's Hawk
	Swainson's Hawk	
Insectivore: air sallier		
	Olive-sided Flycatcher	Lewis Woodpecker
	Western Wood-Pewee	Black Phoebe
	Willow Flycatcher	Vermilion Flycatcher
	Least Flycatcher	Cassin's Kingbird
	Dusky Flycatcher	Western Kingbird
	Cordilleran Flycatcher*	Townsend's Solitaire
	Brown-crested Flycatcher	Cedar Waxwing
	Eastern Kingbird	
	American Redstart	
	Wilson's Warbler	
	Western Tanager	
	Lewis Woodpecker	
	Black Phoebe	
	Vermilion Flycatcher	
	Cassin's Kingbird	
	Western Kingbird	
	Townsend's Solitaire	
	Cedar Waxwing	

Foraging Guild	Breeding period	Nonbreeding period
Insectivore: air screener		
	Lesser Nighthawk	Common Poorwill
	Common Nighthawk	White-throated Swift
	Black Swift	Tree Swallow
	Purple Martin	Violet-green Swallow
	Bank Swallow	N. Rough-winged Swallow
	Cliff Swallow	
	Barn Swallow	
	Common Poorwill	
	White-throated Swift	
	Tree Swallow	
	Violet-green Swallow	
	N. Rough-winged Swallow	
Insectivore: bark gleaner		
	Ladder-backed Woodpecker	Ladder-backed Woodpecker
	Downy Woodpecker	Downy Woodpecker
	Hairy Woodpecker	Hairy Woodpecker
	Red-breasted Nuthatch	Red-breasted Nuthatch
	White-breasted Nuthatch	White-breasted Nuthatch
	Brown Creeper	Brown Creeper
		Red-naped Sapsucker
Insectivore: freshwater shoreline gleaner		
	Northern Waterthrush	Northern Waterthrush
Insectivore: ground gleaner		
	Northern Flicker	Bewick's Wren
	Black-billed Magpie	Mountain Bluebird
	Hermit Thrush	
	Bewick's Wren	
	Mountain Bluebird	
Insectivore: ground hawker		
	Western Screech Owl	
	Northern Pygmy Owl	
Insectivore: lower-canopy/shrub gleaner		
	Yellow-billed Cuckoo	House Wren
	Bell's Vireo	Ruby-crowned Kinglet
	Plumbeous (Solitary) Vireo*	Black-tailed Gnatcatcher
	Black-capped Chickadee	Black-throated Gray Warbler
	Mountain Chickadee	Common Yellowthroat
	Verdin	
	Bushtit	
	Orange-crowned Warbler	
	Virginia's Warbler	
	Lucy's Warbler	
	Yellow Warbler	
	Yellow-rumped Warbler	
	American Redstart	
	MacGillivray's Warbler	
	Wilson's Warbler	
	House Wren	
	Ruby-crowned Kinglet	
	Black-tailed Gnatcatcher	
	Black-throated Gray Warbler	
	Common Yellowthroat	
Insectivore: riparian bottom gleaner		
	American Dipper	American Dipper
Insectivore: shoreline gleaner		
	Spotted Sandpiper	Spotted Sandpiper

Foraging Guild	Breeding period	Nonbreeding period
Insectivore: upper-canopy gleaner		
	Warbling Vireo	Blue-gray Gnatcatcher
	Summer Tanager	
	Blue-gray Gnatcatcher	
Omnivore: bark excavator		
	Red-naped Sapsucker★	Red-naped Sapsucker★
Omnivore: floral hover-gleaner		
	Calliope Hummingbird	Black-chinned Hummingbird
	Broad-tailed Hummingbird	Costa's Hummingbird
	Black-chinned Hummingbird	
	Costa's Hummingbird	
Omnivore: ground forager		
	Ruffed Grouse	Northern Flicker
	Blue Grouse	Black-billed Magpie
	White-tailed Ptarmigan	Hermit Thrush
	Wild Turkey	American Robin
	Veery	American Crow
	Swainson's Thrush	Townsend's Solitaire
	Blue Grosbeak	Gray Catbird
	Chipping Sparrow	Crissal Thrasher
	Fox Sparrow	European Starling
	Song Sparrow	Spotted Towhee★
	Lincoln's Sparrow	Abert's Towhee
	White-crowned Sparrow	American Tree Sparrow★
	Dark-eyed Junco	Common Grackle
	Brown-headed Cowbird	Great-tailed Grackle
	Cassin's Finch	
	Pine Siskin	
	American Goldfinch	
	American Crow	
	Townsend's Solitaire	
	Gray Catbird	
	Crissal Thrasher	
	European Starling	
	Spotted Towhee★	
	Abert's Towhee	
	American Tree Sparrow★	
	Common Grackle	
	Great-tailed Grackle	
Omnivore: ground scavenger		
	Common Raven	Common Raven
Omnivore: lower-canopy/shrub forager		
	Veery	Northern Flicker
	Swainson's Thrush	Plumbeous (Solitary) Vireo★
	Yellow-breasted Chat	Black-capped Chickadee
	Song Sparrow	Mountain Chickadee
	Hooded Oriole	Verdin
	Scott's Oriole	Bushtit
	American Goldfinch	Mountain Bluebird
	Crissal Thrasher	Hermit Thrush
	Lazuli's Bunting	Orange-crowned Warbler
	Indigo Bunting	Yellow-rumped Warbler
		American Robin
		Gray Catbird
		Crissal Thrasher
		Lazuli's Bunting
		Indigo Bunting

Foraging Guild	Breeding period	Nonbreeding period
Omnivore: upper-canopy forager		
	Western Tanager	
	Black-headed Grosbeak	
	Bullock's Oriole★	
	Pine Siskin	
	Evening Grosbeak	
Piscivore: freshwater diver		
	Common Merganser	Common Merganser
Piscivore: water ambusher		
	Great Blue Heron	Great Blue Heron
	Black-crowned Night Heron	Black-crowned Night Heron
Piscivore: water diver		
	Double-crested Cormorant	Double-crested Cormorant
Piscivore: water foot-plunger		
	Osprey	Osprey
	Bald Eagle	Bald Eagle
Piscivore: water plunger		
	Belted Kingfisher	Belted Kingfisher
Vermivore: ground gleaner		
	American Robin	

① Guilds are defined at the end of Table 2.

② ★ = Recently changed species as published in the American Ornithologists' Union (1998) Checklist of North American Birds, 7th edition or species which were omitted from foraging guilds listed by DeGraaf et al. (1985). Guilds for these species have been extrapolated from information on other species.

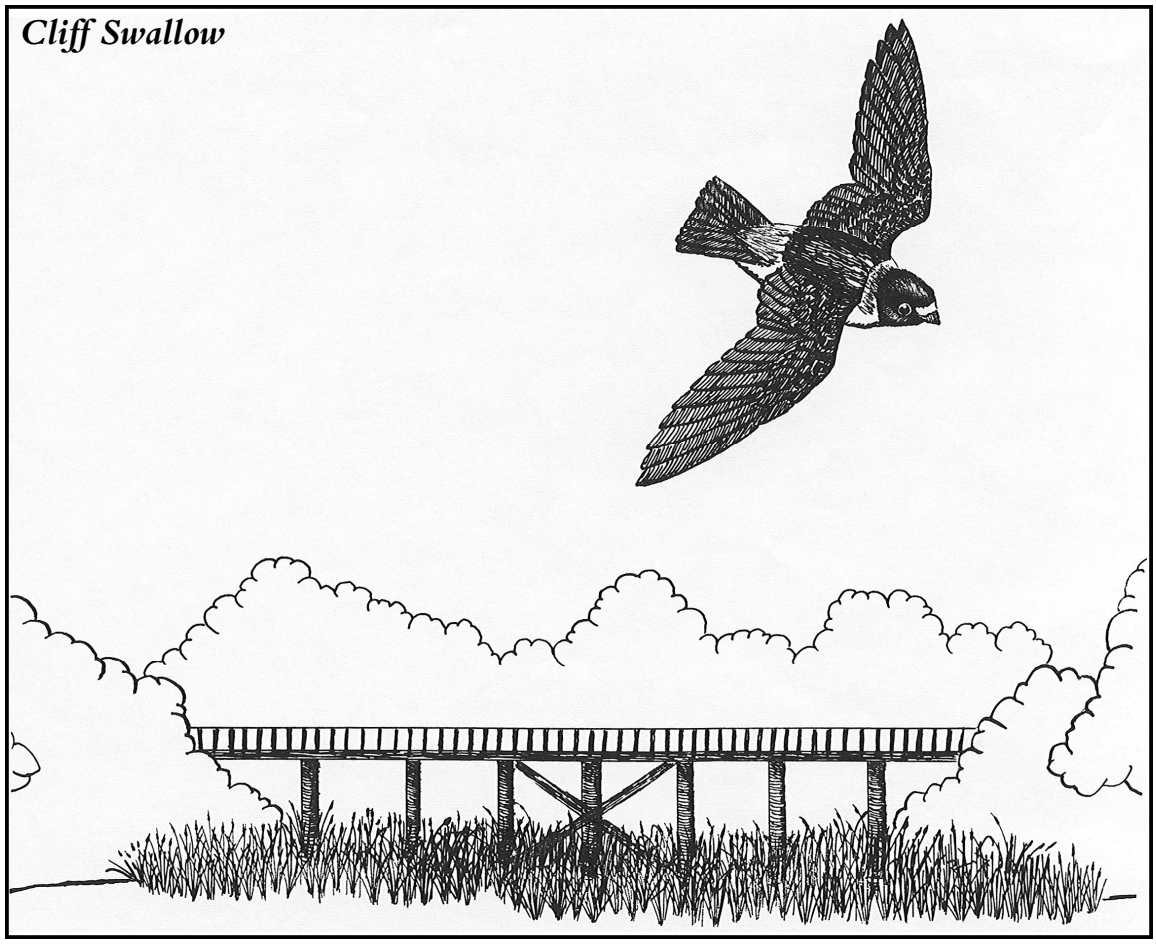


TABLE 4.

NESTING INFORMATION① FOR UTAH RIPARIAN BIRDS

Common Name②	Nest Location③	Nest Height (ft)④	Nest Type⑤	Cowbird Host⑥
Cormorants - Family Phalacrocoracidae				
Double-crested Cormorant	Ground, tree	6-150 (0-150)	Platform	No
Bitterns and Herons - Family Ardeidae				
Great Blue Heron	Decid. tree	30-70 (10-130)	Platform	No
Green Heron★	Decid. tree, shrub	10-20 (0-30)	Platform	No
Black-crowned Night Heron	Decid. tree, shrub	15 - 30 (0-60)	Platform	No
Swans, Geese, and Ducks - Family Anatidae				
Wood Duck	Snag, nestbox	>30 (2-65)	Cavity	No
Common Merganser	Decid. tree, ground	15-50 (0-50)	Cavity, crevice	No
Osprey, Hawks, and Eagles - Family Accipitridae				
Osprey	Decid. tree, cliff	10-60 (0-200)	Platform	No
Bald Eagle	Conifer, cliff	30-60 (10-180)	Platform	No
Sharp-shinned Hawk	Conifer, decid. tree	10-60 (10-90)	Platform	No
Cooper's Hawk	Decid. tree, conifer	35-45 (10-60)	Platform	No
Common Black-Hawk	Decid. tree	20-30 (15-100)	Platform	No
Swainson's Hawk	Decid. tree, cliff	20-30 (6-70)	Platform	No
Red-tailed Hawk	Decid. tree, cliff	15-70 (0-120)	Platform	No
Falcons - Family Falconidae				
American Kestrel	Snag, cliff	12-80	Cavity	No
Peregrine Falcon	Cliff, tree	50-200+	Scrape	No
Pheasant, Grouse, and Turkey - Family Phasianidae				
Ruffed Grouse	Ground	0	Scrape	No
White-tailed Ptarmigan	Ground	0	Scrape	No
Blue Grouse	Ground	0	Scrape	No
Wild Turkey	Ground	0	Scrape	No
Quail - Family Odontophoridae				
Gambel's Quail	Ground	0	Scrape	No
Sandpipers, Phalaropes, and Allies - Family Scolopacidae				
Spotted Sandpiper	Ground	0	Scrape	No
Pigeons and Doves - Family Columbidae				
White-winged Dove	Decid. tree	4-25	Saucer	No
Mourning Dove	Decid. tree, conifer, ground	0-40	Saucer	Rare
Inca Dove	Shrub	10-12 (4-25)	Saucer	No
Cuckoos and Roadrunners - Family Cuculidae				
Yellow-billed Cuckoo	Decid. tree, shrub	4-8 (3-20)	Platform	No
Typical Owls - Family Strigidae				
Western Screech Owl	Snag, cactus	5-30	Cavity	No
Great Horned Owl	Decid. tree, cliff	30-50 (15-70)	Abandoned nest	No
Northern Pygmy Owl	Snag	8-20	Cavity	No
Spotted Owl	Cliff, conifer. tree,	80 (30-160)	Cavity, scrape	No
Long-eared Owl	Decid. tree, ground	25-35 (0-40)	Abandoned nest	No
Northern Saw-whet Owl	Snag	14-60	Cavity	No
Nighthawks and Poorwills - Family Caprimulgidae				
Lesser Nighthawk	Ground	0	No nest	No
Common Nighthawk	Ground	0	No nest	No
Common Poorwill	Ground	0	No nest, scrape	No
Swifts - Family Apodidae				
Black Swift	Cliff		Saucer	No
White-throated Swift	Cliff		Crevice	No

Common Name[2]	Nest Location[3]	Nest Height (ft)[4]	Nest Type[5]	Cowbird Host[6]
Hummingbirds - Family Trochilidae				
Black-chinned Hummingbird	Decid. tree	4-8 (To 30)	Cup	No
Costa's Hummingbird	Shrub, decid. tree	3-5 (1-30)	Cup	No
Calliope Hummingbird	Conifer, decid. tree, shrub	1.8-70	Cup	No
Broad-tailed Hummingbird	Decid. tree, conifer	3-15 (To 30)	Cup	No
Kingfishers - Family Alcedinidae				
Belted Kingfisher	Bank, snag		Burrow, cavity	No
Woodpeckers - Family Picidae				
Lewis Woodpecker	Decid. tree, snag	5-100 (To 170)	Cavity	No
Red-naped Sapsucker★	Decid. tree	10-20 (3-35)	Cavity	No
Ladder-backed Woodpecker	Decid. tree, agave	6-14 (3-30)	Cavity	No
Downy Woodpecker	Snag	3-50	Cavity	No
Hairy Woodpecker	Decid. tree, snag	4-60	Cavity	No
Northern Flicker	Snag	6-15 (To 100)	Cavity	No
Tyrant Flycatchers - Family Tyrannidae				
Olive-sided Flycatcher	Conifer	5-75	Cup	Rare
Western Wood-pewee	Conifer	15-35 (2-75)	Cup	Rare
Willow Flycatcher	Decid. tree, shrub	10-40 (2-60)	Cup	Uncommon
Least Flycatcher	Shrub, decid. tree	2-10 (1-18)	Cup	Common
Dusky Flycatcher	Shrub, tree	3-7 (2-15)	Cup	Rare
Cordilleran Flycatcher★	Decid. tree, cliff, ground	0-30	Cavity	Rare
Black Phoebe	Cliff, wall		Cup	Rare
Vermilion Flycatcher	Decid. tree	8-20 (4-60)	Cup	Rare
Brown-crested Flycatcher	Decid. tree, cactus	5-30	Cavity	No
Cassin's Kingbird	Decid. tree	20-55 (8-55)	Cup	No
Western Kingbird	Decid. tree, shrub	15-30 (5-40)	Cup	Rare
Eastern Kingbird	Decid. tree, shrub	8-25 (2-60)	Cup	Common
Vireos - Family Vireonidae				
Bell's Vireo	Shrub	1-5 (To 25)	Cup	Common
Plumbeous (Solitary) Vireo	Conifer, decid. tree	4-30	Cup	Common
Warbling Vireo	Decid. tree, shrub	30-90 (4-90)	Cup	Common
Jays, Magpies, and Crows - Family Corvidae				
Black-billed Magpie	Decid. tree, shrub	20-30 (5-50)	Spherical	No
American Crow	Decid. tree, shrub	0-70	Cup	Rare
Common Raven	Cliff, conifer		Cup	No
Swallows - Hirundinidae				
Purple Martin	Snag	5+	Cavity	No
Tree Swallow	Snag	5+	Cavity	Rare
Violet-green Swallow	Snag	5+	Cavity	No
N. Rough-winged Swallow	Bank, cliff, culvert	4+	Burrow, crevice	No
Bank Swallow	Bank	4+	Burrow	Rare
Cliff Swallow	Bridge, cliff, building	3+	Mud gourd	Rare
Barn Swallow	Building	6-40	Cup	Rare
Chickadees and Titmice - Family Paridae				
Black-capped Chickadee	Decid. tree, snag	4-8 (To 40)	Cavity	Rare
Mountain Chickadee	Conifer, snag	4-8 (0.5-80)	Cavity	No
Verdin - Family Remizidae				
Verdin	Shrub, cactus	2-20	Spherical	No
Bushtit - Family Aegithalidae				
Bushtit	Decid. tree, shrub	4-25 (To 50)	Pendant	Rare
Nuthatches - Family Sittidae				
Red-breasted Nuthatch	Conifer	5-40 (To 120)	Cavity	No
White-breasted Nuthatch	Decid. tree	10-60 (3-60)	Cavity	Rare
Creeper - Family Certhiidae				
Brown Creeper	Conifer, decid. tree	3-50	Under bark	Rare

Common Name[2]	Nest Location[3]	Nest Height (ft)[4]	Nest Type[5]	Cowbird Host[6]
Wrens - Family Troglodytidae				
Bewick's Wren	Decid. tree, snag	0-20+?	Cavity	Uncommon
House Wren	Decid. tree, snag	0-20	Cavity	Rare
Dipper - Family Cinclidae				
American Dipper	Cliff, bridge	0+	Oven	No
Kinglets - Family Regulidae				
Ruby-crowned Kinglet	Conifer	15-30 (2-100)	Pendant	Rare
Gnatcatchers - Family Sylviidae				
Blue-gray Gnatcatcher	Decid. tree	2-25 (To 80)	Cup	Common
Black-tailed Gnatcatcher	Shrub	1-4	Cup	Uncommon
Thrushes - Family Turdidae				
Mountain Bluebird	Snag	2-50	Cavity	Rare
Townsend's Solitaire	Ground, snag	0-10	Cup, cavity	No
Veery	Ground, shrub	0-6 (To 25)	Cup	Common
Swainson's Thrush	Shrub, conifer	4-20 (0-40)	Cup	Rare
Hermit Thrush	Ground, tree	0-8	Cup	Rare
American Robin	Decid. tree, conifer	10-20 (0-75)	Cup	Rare
Mockingbirds and Thrashers - Family Mimidae				
Gray Catbird	Shrub	2-10 (1-50)	Cup	Uncommon
Crissal Thrasher	Shrub	3-8	Cup	Rejects eggs
Starling - Family Sturnidae				
European Starling	Decid. tree, building	10-25 (2-60)	Cavity	No
Waxwings - Family Bombycillidae				
Cedar Waxwing	Decid. tree, conifer	6-50	Cup	Uncommon
Silky Flycatchers - Family Ptilogonatidae				
Phainopepla	Decid. tree, shrub	4-50	Cup	Rare
Wood Warblers - Family Parulidae				
Orange-crowned Warbler	Ground, shrub	0-3	Cup	Rare
Virginia's Warbler	Ground	0	Cup	Rare
Lucy's Warbler	Snag	3-11 (0-11)	Cavity	Occasional
Yellow Warbler	Shrub, tree	1-14 (To 60)	Cup	Frequent
Yellow-rumped Warbler	Conifer	4-50	Cup	Rare
Black-throated Gray Warbler	Conifer, decid. tree	5-50 (1-50)	Cup	Rare
American Redstart	Decid. tree, shrub	10-20 (4-70)	Cup	Frequent
Northern Waterthrush	Ground, bank	0-2	Cup	Common
MacGillivray's Warbler	Shrub, ground	2-3 (1-5)	Cup	Uncommon
Common Yellowthroat	Shrub	0-3	Cup	Frequent
Wilson's Warbler	Ground, vine tangle	0-3	Cup	Uncommon
Yellow-breasted Chat	Shrub	1-5 (To 8)	Cup	Frequent
Tanagers - Family Thraupidae				
Summer Tanager	Decid. tree, conifer	10-35	Cup	Uncommon
Western Tanager	Conifer	6-65	Cup	Rare
Towhees, Sparrows, and Longspurs - Family Emberizidae				
Spotted Towhee★	Ground, shrub	0-5 (To 18)	Cup	Frequent
Abert's Towhee	Shrub, tree	(To 30)	Cup	Common
American Tree Sparrow★	Ground, shrub	0-5	Cup	No
Chipping Sparrow	Conifer, decid. tree	0-11 (To 60)	Cup	Frequent
Fox Sparrow	Ground, shrub	0-3 (To 20)	Cup	Uncommon
Song Sparrow	Ground, shrub	0-3 (To 12)	Cup	Frequent
Lincoln's Sparrow	Ground	0-5	Cup	Rare
White-crowned Sparrow	Shrub, ground	1-5 (0-35)	Cup	Uncommon
Dark-eyed Junco	Ground, bank	(To 20)	Cup, cavity	Uncommon

Common Name②	Nest Location③	Nest Height (ft)④	Nest Type⑤	Cowbird Host⑥
Cardinals, Grosbeaks, and Buntings - Family Cardinalidae				
Black-headed Grosbeak	Decid. tree, shrub	4-12	Cup	Uncommon
Blue Grosbeak	Shrub, tree	3-12 (0.5-15)	Cup	Frequent
Lazuli Bunting	Shrub, vine tangle	1.5-4 (To 10)	Cup	Uncommon
Indigo Bunting	Shrub, tree, vine tangle	1-15	Cup	Frequent
Meadowlarks, Blackbirds, and Orioles - Family Icteridae				
Common Grackle	Decid. tree, conifer	2-12 (To 100)	Cup	Rare
Great-tailed Grackle	Decid. tree, shrub, reeds	2-30	Cup	Rejects eggs^{B}
Brown-headed Cowbird	Tree, shrub, ground		Parasite	No
Hooded Oriole	Decid. tree, yucca	12-45	Pendant	Frequent^{B}
Bullock's Oriole★	Decid. tree	15-30 (6-60)	Pendant	Uncommon
Scott's Oriole	Decid. tree, yucca	4-18	Pendant	Rare^{B}
Finches - Family Fringillidae				
Cassin's Finch	Conifer	10-80	Cup	No
House Finch	Decid. tree, shrub, building	5-35	Cup, cavity	Uncommon
Pine Siskin	Conifer, decid. tree	8-50 (3-50)	Saucer	Uncommon
Lesser Goldfinch	Decid. tree, shrub, forb	2-30	Cup	Rare
American Goldfinch	Shrub, tree	1-30 (To 60)	Cup	Common
Evening Grosbeak	Conifer, decid. tree	20-100	Cup	Rare
Weaver Finches - Family Passeridae				
House Sparrow	Building, tree	To 40	Cavity, spherical	No

① Nesting information in this table was extracted from Ehrlich et al.1988.Baicich and Harrison (1997), Harrison (1979) are also good sources of information on nesting. Species in this table are limited to summer residences of Utah.

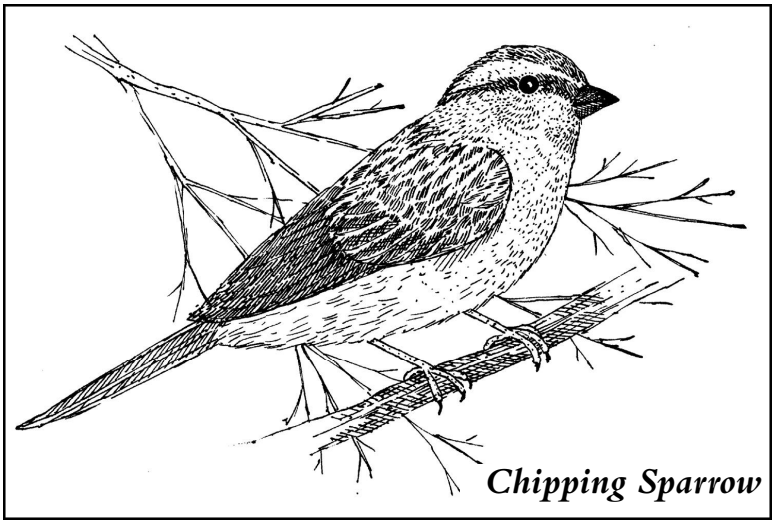
② ★ = Recently changed species as published in the American Ornithologists' Union (1998) Checklist of North American Birds, 7th edition.

③ Nest locations: agave, bank, bridge, building, cactus, cave, cliff, conifer, culvert, deciduous tree, floating, ground, reeds, shrub, snag, tree, vine tangle. Each of these is from Ehrlich et al. (1988) and is self-explanatory.

④ Nest height is given in feet. Numbers outside of parentheses are usual heights. Numbers in parentheses are ranges.

⑤ Nest types: burrow, cavity, crevice, cup, no nest, pendant, platform, saucer, scrape, sphere. Each of these is from Ehrlich et al. (1988) and is self-explanatory.

⑥ Cowbird host categories: no, rare, occassional, uncommon, common, frequent.The Brown-headed Cowbird is the most common species found in Utah. Bronzed Cowbirds occur only occasionally in the state. Host species for Bronzed Cowbirds are marked with "B" as a superscript.



Chipping Sparrow

TABLE 5.

NESTING GROUPS① OF UTAH RIPARIAN BIRDS

Canopy Level② - Tree/Snag - Open Nest③

Double-crested Cormorant	**Olive-sided Flycatcher**	Gray Catbird
Great Blue Heron	Western Wood-pewee	**Cedar Waxwing**
Green Heron	Willow Flycatcher	**Phainopepla**
Black-crowned Night Heron	Vermilion Flycatcher	Yellow Warbler
Osprey	**Cassin's Kingbird**	**Yellow-rumped Warbler**
Bald Eagle	Western Kingbird	**Black-throated Gray Warbler**
Sharp-shinned Hawk	Eastern Kingbird	American Redstart
Cooper's Hawk	**Warbling Vireo**	**Western Tanager**
Common Black-Hawk	Black-billed Magpie[S]	Chipping Sparrow
Swainson's Hawk	**American Crow**	Common Grackle
Red-tailed Hawk	Common Raven	Brown-headed Cowbird⑧
Mourning Dove	Barn Swallow	**Hooded Oriole**[P]
Great Horned Owl	Bushtit[P]	Bullock's Oriole[P]
Spotted Owl	Ruby-crowned Kinglet[P]	**Cassin's Finch**
Long-eared Owl	Blue-gray Gnatcatcher	**Pine Siskin**
Calliope Hummingbird	Swainson's Thrush	American Goldfinch
Belted Kingfisher	American Robin	**Evening Grosbeak**

Canopy Level - Tree/Snag - Cavity Nest④

Wood Duck	**Hairy Woodpecker**	**Red-breasted Nuthatch**
Common Merganser	Northern Flicker	**White-breasted Nuthatch**
American Kestrel	**Purple Martin**	**Brown Creeper**[b]
Peregrine Falcon	**Tree Swallow**	**Mountain Bluebird**
Northern Saw-whet Owl	**Violet-green Swallow**	European Starling
Lewis Woodpecker	Black-capped Chickadee	**House Sparrow**[S]
Downy Woodpecker	Mountain Chickadee	

Subcanopy Level - Tree/Snag/Shrub - Cavity④

Wood Duck	**Northern Flicker**	**Bewick's Wren**
Common Merganser	**Cordilleran Flycatcher**	**House Wren**
American Kestrel	**Brown-crested Flycatcher**	**Mountain Bluebird**
Western Screech Owl	**Purple Martin**	Townsend's Solitaire
Northern Pygmy Owl	**Tree Swallow**	**European Starling**
Northern Saw-whet Owl	**Violet-green Swallow**	**Lucy's Warbler**
Lewis Woodpecker	**Black-capped Chickadee**	Dark-eyed Junco
Red-naped Sapsucker	**Mountain Chickadee**	**House Finch**
Ladder-backed Woodpecker	**Red-breasted Nuthatch**	**House Sparrow**[S]
Downy Woodpecker	**White-breasted Nuthatch**	
Hairy Woodpecker	**Brown Creeper**[b]	

Subcanopy Level[5] - Tree/Snag/Shrub - Open Nest[3]

Double-crested Cormorant	**Western Kingbird**	**Summer Tanager**
Great Blue Heron	**Eastern Kingbird**	**Western Tanager**
Green Heron	Bell's Vireo	**Spotted Towhee**
Black-crowned Night Heron	**Plumbeous (Solitary) Vireo**	**Abert's Towhee**
Osprey	Warbling Vireo	**American Tree Sparrow**
Sharp-shinned Hawk	**Black-billed Magpie**[S]	**Chipping Sparrow**
Cooper's Hawk	**American Crow**	Fox Sparrow
Common Black-Hawk	**Barn Swallow**	Song Sparrow
Swainson's Hawk	**Verdin**[S]	**Lincoln's Sparrow**
Red-tailed Hawk	**Bushtit**[P]	**White-crowned Sparrow**
White-winged Dove	**Ruby-crowned Kinglet**[P]	Dark-eyed Junco
Mourning Dove	**Blue-gray Gnatcatcher**	**Black-headed Grosbeak**
Inca Dove	Black-tailed Gnatcatcher	**Blue Grosbeak**
Yellow-billed Cuckoo	**Townsend's Solitaire**	Lazuli Bunting
Great Horned Owl	**Veery**	**Indigo Bunting**
Long-eared Owl	**Swainson's Thrush**	**Common Grackle**
Black-chinned Hummingbird	**Hermit Thrush**	**Great-tailed Grackle**
Costa's Hummingbird	**American Robin**	Brown-headed Cowbird[8]
Calliope Hummingbird	**Gray Catbird**	**Hooded Oriole**[P]
Broad-tailed Hummingbird	**Crissal Thrasher**	**Bullock's Oriole**[P]
Belted Kingfisher	**Cedar Waxwing**	**Scott's Oriole**[P]
Olive-sided Flycatcher	**Phainopepla**	**Cassin's Finch**
Western Wood-pewee	**Yellow Warbler**	**House Finch**
Willow Flycatcher	**Yellow-rumped Warbler**	**Pine Siskin**
Least Flycatcher	**Black-throated Gray Warbler**	**Lesser Goldfinch**
Dusky Flycatcher	**American Redstart**	**American Goldfinch**
Vermilion Flycatcher	MacGillivray's Warbler	**Evening Grosbeak**
Cassin's Kingbird	Yellow-breasted Chat	

Ground Level[6]

Double-crested Cormorant	Dusky Flycatcher	**Northern Waterthrush**
Great Blue Heron	**Cordilleran Flycatcher**	**MacGillivray's Warbler**
Green Heron	Eastern Kingbird	**Wilson's Warbler**
Black-crowned Night Heron	**Bell's Vireo**	**Yellow-breasted Chat**
Common Merganser	**American Crow**	**Spotted Towhee**
Red-tailed Hawk	Verdin[S]	**Abert's Towhee**
Blue Grouse	**Bewick's Wren**	**American Tree Sparrow**
Ruffed Grouse	**House Wren**	**Chipping Sparrow**
White-tailed Ptarmigan	Blue-gray Gnatcatcher	**Fox Sparrow**
Wild Turkey	**Black-tailed Gnatcatcher**	**Song Sparrow**
Gambel's Quail	Mountain Bluebird	**Lincoln's Sparrow**
Spotted Sandpiper	**Townsend's Solitaire**	**White-crowned Sparrow**
Mourning Dove	**Veery**	**Dark-eyed Junco**
Long-eared Owl	Swainson's Thrush	Blue Grosbeak
Lesser Nighthawk	**Hermit Thrush**	**Lazuli Bunting**
Common Nighthawk	American Robin	**Indigo Bunting**
Common Poorwill	**Gray Catbird**	**Common Grackle**
Costa's Hummingbird	European Starling	**Great-tailed Grackle**
Calliope Hummingbird	**Orange-crowned Warbler**	Brown-headed Cowbird[8]
Broad-tailed Hummingbird	**Virginia's Warbler**	Lesser Goldfinch
Western Wood-pewee	**Lucy's Warbler**	**American Goldfinch**
Willow Flycatcher	**Yellow Warbler**	House Sparrow[S]
Least Flycatcher	Black-throated Gray Warbler	

Cliff/Bank⑦		
Osprey	**Spotted Owl**	**N. Rough-winged Swallow**
Bald Eagle	**Black Swift**	**Bank Swallow**
Swainson's Hawk	**White-throated Swift**	**Cliff Swallow**
Red-tailed Hawk	**Belted Kingfisher**	Mountain Chickadee
American Kestrel	**Black Phoebe**	**American Dipper**
Peregrine Falcon	**Common Raven**	

① Species names are bolded in the nesting group(s) where those species usually occur in Utah; unbolded names indicate that the species occurs in the nesting group(s) but not commonly; groupings and nest type definitions follow Erhlich et al. 1988.

② Canopy level may vary by site but is defined for this table as >30 feet.

③ Open nest includes platform, saucer, and cup unless otherwise indicated; ^{p} = pedant, ^{s} = spherical

④ Cavity nest includes nests in tree cavities, burrows, and caves unless otherwise indicated; ^{b} = under bark

⑤ Subcanopy level may vary by site but is defined for this table as > 3 and < 30 feet.

⑥ Ground level is 0-3 feet; species in this group include those that nest directly on the ground and those that nest low in trees, shrubs, etc..

⑦ Cliff/Bank nests may be at any height; see Table 4 for species-specific nest types

⑧ Brown-headed Cowbirds are nest parasites.

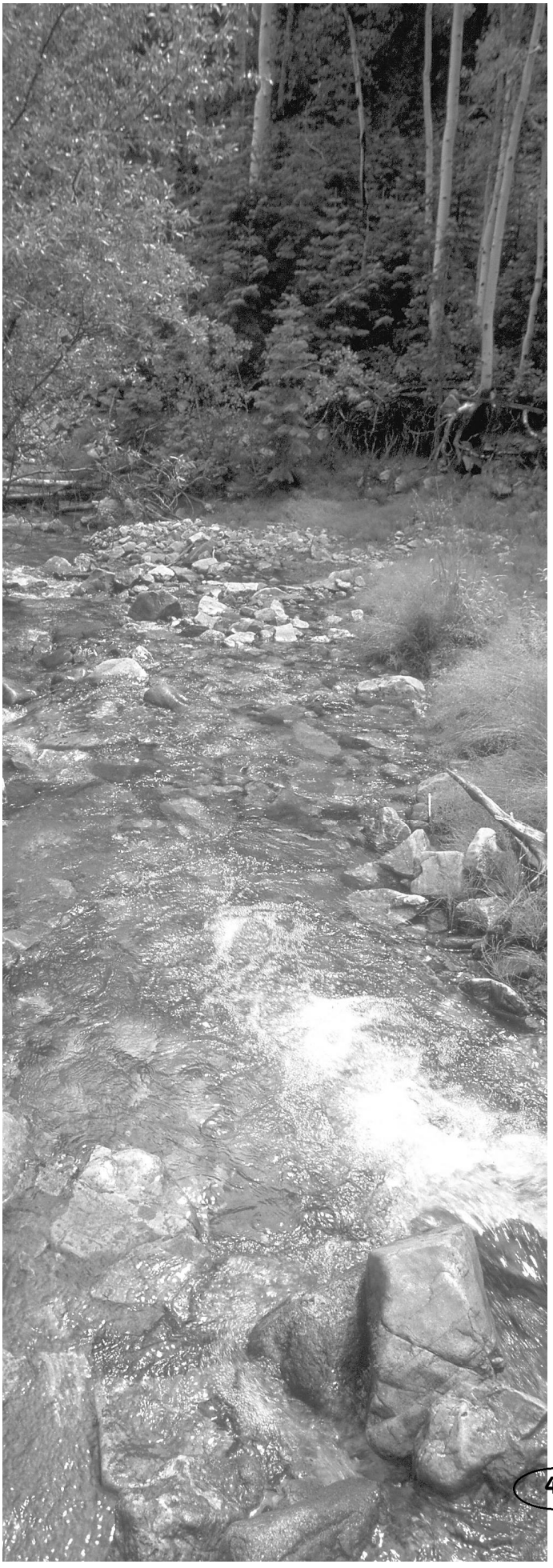
Table 6.

Plant Species, Planting Zones, and Techniques for Revegetation and Restoration of Utah Riparian Habitat

Scientific name	Common name[1]	Planting zone[2]	Vegetation Types[3] and Planting Techniques[4]							
			MBS	WBS	BBS	BS	SS	MBPP	PJ	BK
Acer glabram	Rocky Mountain maple	Green zone	T					T		
Acer grandidentatum	Big tooth maple	Green zone	T					T		
Agropyron elongatum	Tall wheatgrass[I]	Green zone		S	S	S	S		S	
Agropyron intermedium	Intermediate wheatgrass[I]	Green zone	S	S	S	S	S	S	S	S
Agropyron smithii	Western wheatgrass	Green zone		S	S	S	S		S	S
Agrostis stolonifera	Redtop[I]	Both		S	S	S	S		S	S
Alopecurus arundinaceus	Creeping meadow foxtail[I]	Both	T-S					T-S		
Amelanchier alnifolia	Saskatoon serviceberry	Green zone	T-S					T-S	T-S	
Amorpha canescens	Leadplant amorpha[I]	Green zone		T	T	T			T	
Arrhenatherum elatius	Tall oatgrass[I]	Green zone	S					S		
Artemisia abrotanum	Oldman wormwood[I]	Green zone		C	C				C	
Artemisia cana	Silver sagebrush	Green zone		T-S						
Artemisia filifolia	Sand sagebrush	Green zone							T-S	
Artemisia tridentata tridentata	Basin big sagebrush	Green zone		T-S	T-S				T-S	
Artemisia tridentata vaseyana	Mountain big sagebrush	Green zone	T-S					T-S		
Artemisia tridentata wyomingensis	Wyoming big sagebrush	Green zone		T-S					T-S	
Atriplex canescena	Fourwing saltbrush	Green zone			T-S	T-S			T-S	
Atriplex lentiformis	Big saltbrush	Green zone								T-S
Baccharis emoryi	Emory baccharis	Both	T-S-P	T-S-P	T-S-P	T-S-P	T-S-P	T-S-P	T-S-P	
Betula occidentalis	Water birch	Both	T					T		
Caragana arborescens	Siberian peashrub[I]	Green zone		T-S	T-S				T-S	
Caragana pygmaea	Pygmy peashrub[I]	Green zone		T-S	T-S				T-S	
Carex	Carex (use local species)	Both	P-S	P-S	P-S	P-S	P-S	P-S	P-S	P-S
Celtis occidentalis	Hackberry	Both	T					T		
Chilopsis lenearis	Desert willow	Both								T
Chrysothamnus nauseosus	Rubber rabbitbrush	Green zone		T-S	T-S	T-S	T-S		T-S	T-S
Clematis ligusticifolia	Western virgin bower	Green zone	T-S	T-S	T-S			T-S	T-S	
Colutea	Bladdersenna[I]	Green zone		T-S	T-S	T-S	T-S		T-S	
Cornus stolonifera	Dogwood	Both	T					T		
Cotoneaster acutifolia	Peking catoneaster[I]	Green zone	T					T	T	
Crataegus douglasii	Douglas hawthorn	Both	T					T	T	

Crataegus rivularis	River hawthorn	Both	T					T	T	
Elaeagnus umbellatum	Autumn eleagus[I]	Streambank		T	T	T	T		T	
Eleocharis	Spikerush (use local species)	Streambank		P-S	P-S	P-S	P-S	P-S	P-S	P-S
Elymus cinereus	Great Basin wildrye	Green zone	S	S	S	S		S	S	
Elymus giganteus	Mammoth wildrye[I]	Green zone	S	S	S	S		S	S	
Juncus	Rush (use local species)	Streambank	P-S	P-S	P-S	P-S	P-S	P-S	P-S	P-S
Lonicera tatarica	Tetarian honeysuckle[I]	Green zone	T					T	T	
Lonicera utahensis	Utah honeysuckle	Green zone						T		
Malus hopa	Hopa crabapple[I]	Green zone	T					T	T	
Morus alba	Russian mulberry[I]	Streambank		T	T				T	
Phalaris arundinacea	Reed canary grass[I]	Streambank	S	S	S	S	S	S	S	S
Poa pratensis	Kentucky bluegrass[I]	Green zone	S	S	S	S	S	S	S	
Poa secunda	Sandburg bluegrass	Green zone	S					S	S	
Populus angustifolia	Narrowleaf cottonwood	Streambank	T-C					T-C		
Populus canadensis	Carolina poplar[I]	Streambank	T-C	T-C	T-C	T-C	T-C		T-C	
Populus fremonti	Fremont cottonwood	Streambank	T-C	T-C	T-C	T-C	T-C		T-C	T-C
Potentilla fruiticosa	Bush cinquefoil	Both	T					T		
Prunus americana	American plum	Green zone	T		T			T	T	
Prunus andersonii	Anderson peachbush	Green zone		T-S	T-S	T-S	T-S			T-S
Prunus besseyi	Bessy cherry[I]	Green zone	T	T	T				T	
Prunus fasciculata	Desert peachbush	Green zone		T-S	T-S	T-S	T-S			T-S
Prunus virginiana	Chokecherry	Both	T					T		
Quercus gambelii	Gamble oak	Green zone	T					T		
Quercus turbruella	Shrub live oak	Green zone								T
Rhus glabra	Rocky Mountain sumac	Green zone		T-S	T-S				T-S	
Rhus trilobata	Skunk bush sumac	Green zone						T-S	T-S	
Riber aureum	Golden currant	Green zone	T	T	T			T	T	
Robinia neomexicana	New Mexico locust	Green zone								T
Rosa woodsii	Woods rose	Green zone	T	T	T				T	
Salix	Willow (use local species)	Both	T-C	T-C	T-C	T-C	T-C	T-C	T-C	T-C
Sambucus cerulea	Blueberry elder	Green zone	T					T	T	
Sarcobatus vermiculatus	Greasewood	Green zone					T-S			
Scirpus	Bulrush (use local species)	Streambank		P-S	P-S	P-S	P-S	P-S	P-S	P-S
Secale montanum	Mountain rye[I]	Green zone	S	S	S	S	S	S	S	
Shepherdia argentea	Silver buffaloberry	Both		T	T				T	
Sorbus scopulina	Mountain ash	Green zone	T					T		
Sporobolus airoides	Alkali sacaton	Green zone		S	S	S	S	S	S	S
Symphoricarpus longiflorus	Longflower snowberry	Green zone		T	T	T			T	T
Symphoricarpus occidentalis	Western snowberry	Green zone	T	T	T			T	T	
Symphoricarpus oreophilus	Mountain snowberry	Green zone	T	T	T			T	T	
Syringa vulgaris	Lilac[I]	Green zone	T		T				T	
Vitis arizonica	Canyon grape	Both								T-S

Table 6 continues on next page



① I = **Introduced species** - we recommend using native species whenever possible and only using introduced species that are not aggressive or persistent and will allow native species to reestablish

② **Streambank** - That portion of the riparian zone made up of the segment of the stream channel that controls the lateral flow of water (Hansen et al. 1995). This area may or may not be covered with vegetation.

Green zone - That portion of the riparian zone made up of the alluvial plain caused by the overbank deposition of alluvial material (Hansen et al. 1995, Adams and Fitch 1995). This area contains free water in the rooting zone frequently enough to result in vegetation that differs from that of the surrounding uplands. Typically this vegetative cover contains perennial elements.

③ **Vegetation Types** (see below for detailed descriptions of vegetation types): MBS = Mountain big sage; WBS = Wyoming big sage; BBS = Basin big sage; BS = Black sagebrush; SS = Shadscale-saltbrush; MBPP = Mountain Brush and Ponderosa Pine; PJ = Pinyon-Juniper; BK = Blackbrush.

In selecting plant species for revegetation and restoration three points made by Platts et al.(1987) are important to consider. First stabilizing the streambank is often the principal concern. Second, plants used should be similar to the original community. Third, woody plants are often the most critical in the revegetation process.

④ Planting Techniques: T = Transplanting; S = Seeding; C = Cuttings; P = Plugs

Detailed Descriptions of Vegetation Types

These descriptions are based on Monsen and Stevens (in press) descriptions of vegetation types associated with riparian habitats on Utah Division of Wildlife Resources' lands; types should be similar on other public lands at middle and lower elevations in Utah.

Mountain Big Sagebrush (MBS)

Throughout the Intermountain West, mountain big sagebrush (*Artemisia tridentata vaseyana*) generally occurs from 3,500 to 9,800 feet (1060 m to 3000 m) from foothills up to timber line. A large number of grass, forbs, and other shrubs grow in association with this sagebrush type and, consequently, a large amount of forage is usually produced. Annual precipitation can range from 12 to 30 inches (30 to 76 cm). Soils in which mountain big sagebrush is found range from slightly acid to slightly alkaline, and are generally well drained, but soil moisture hardly ever falls below wilting point during the growing season. This big sagebrush subspecies is the most palatable of all the big sagebrush to livestock and big game. Sagegrouse prefer this subspecies.

Wyoming Big Sagebrush (WBS)

Wyoming big sagebrush (*Artemisia tridentata wyomingensis*) can be found throughout the Intermountain West on xeric sites, foothills, dry valleys, and mesas between 2,500 to 7,000 feet (760 and 2100 m) elevation.Annual precipitation varies from 7 to 15 inches (18 to 28 cm).Soils in which Wyoming big sagebrush occurs are usually well drained,gravelly to stony, with low water-holding capacity. Soils are generally shallow, being less than about 18 inches (46 cm) deep. Few herbaceous species are associated with Wyoming big sagebrush resulting in low herbage production from associated species and a considerable amount of bare ground between plants. This sagebrush is used extensively throughout the year by livestock, big game, and upland game birds.

Basin Big Sagebrush (BBS)

Basin big sagebrush (*Artemisia tridentata tridentata*) was one of the most abundant shrubs in western North America.The plant occurs on plains, valleys, canyon bottoms, and foothill ranges. It is most prevalent on deep, well drained, fertile soils with a pH ranging from slightly acidic to highly alkaline. Within the Intermountain West, basin big sagebrush can be found from 3,000 to 7,000 (914 and 2140 meters) elevation,with annual precipitation ranging from 9 to 16 inches (23 and 41 cm).

A majority of the irrigated farmlands, dry farms, and dryland pastures within the Intermountain West were once inhabited by basin big sagebrush.A large number of native and introduced grasses and forbs do well on lands that have sustained basin big sagebrush. The productive potential of the basin big sagebrush type is reported to be higher than that of the Wyoming big sagebrush type but less than mountain big sagebrush.

Basin big sagebrush is not readily eaten by livestock or big game when it occurs with other, more preferred species.However, it does contain high levels of protein.The herbage is digestible, and plants withstand considerable use. It is browsed heavily by deer and sheep when more desirable plants are absent, unavailable, or already eaten.Sage grouse use this subspecies year round.

Black Sagebrush (BS)

Black sagebrush (*Artemisia nova*) is highly palatable to livestock,big game, and sage grouse.The species generally occurs between 4,900 and 8,000 feet (1500 to 2400 m).A majority of the black sagebrush communities occur on calcareous soils derived from limestone.There are, however, extensive areas where black sagebrush occurs on volcanic soils.Annual precipitation ranges from 7 to 18 inches (18 to 46 cm). Because of the low moisture-holding capacity of the soil,only a small portion of the annual precipitation is available. Black sagebrush generally occupies warmer, more xeric sites than does Wyoming big sagebrush.

On sites that are too xeric or saline for black sagebrush, salt desert shrub species occur.

Shadscale-saltbrush (SS)

The shadscale-saltbush type (*Atriplex confertifolia*) occurs on over 50,000 square miles (129,000 square km) ranging from Canada to Mexico at elevations from 1,500 to 7,000 feet (450 to 2100 m). The type occurs abundantly on broad valley bottoms, but exists on foothill rangelands where it joins the juniper-pinyon type (*Juniperus spp. and Pinus spp.*). Pure and mixed stands of shadscale or mixed saltbush species occur in the Colorado River drainage, in western Utah, and throughout Nevada. Isolated islands extend into eastern Oregon, southern Idaho, and southwestern Wyoming. Community composition may be predominantly shadscale or other saltbush. Normally, areas with Gardner saltbush (*Atriplex gardneri*) or mat-saltbush (*Atriplex corrugata*) species are too dry or saline for successful seeding. However, in shadscale or mixed shrub communities which include fourwing saltbush (*Atriplex canescens*), winterfat (*Ceratoides lanata*), black greasewood (*Sarcobatus vermiculatus*), blackbrush (*Coleogyne ramosissima*), basin big sagebrush, hopsage (*Grayia spinosa*), horsebrush (*Tetradymia spp.*), and juniper, treatment may be seeded successfully. In areas of common occurrence, bud sagebrush (*Artemisia spinescens*) is a frequent codominant or subdominant. On disturbed or abused shadscale areas, Russian thistle (*Salsola pestifer*), cheatgrass brome (*Bromus tectorum*), and halogeton (*Halogeton glomeratus*) are common. Where disturbances occur, there exists a need to revegetate areas to reduce erosion, increase forage, and control or hold in check undesirable annuals and poisonous plants or noxious weeds.

Shadscale generally occurs on heavy soils with soluble salts ranging from 160 to 3,000 ppm and pH from 7.4 to 10.3. On highly alkaline soils, shadscale occurs in nearly pure stands. Annual precipitation in this type is generally less than 10 inches (25 cm) with many areas ranging between 3 and 8 inches (8 to 20 cm).

Mountain Brush and Ponderosa Pine (MBPP)

In the Intermountain West, the mountain brush type occupies considerable acreage. The chief components are Gambel oak (*Quercus gambelii*), bigtooth maple (*Acer grandidentatum*), Rocky Mountain maple (*Acer glabrum*), mountain big sagebrush, Saskatoon serviceberry (*Amelanchier alnifolia*), and Utah serviceberry (*Amelanchier utahensis*). Associated with the above species, in various geographic areas, are chokecherry (*Prunus virginiana*), bitter cherry (*Prunus emarginata*), skunkbush sumac (*Rhus aromatica*), antelope bitterbrush (*Purshia tridentata*), true mountain mahogany (*Cercocarpus montanus*), and curlleaf mountain mahogany (*Cercocarpus ledifolius*). The type is rich in diversity of forbs and associated grasses. Gambel oak dominates from north-central Utah to northern Arizona, and on scattered mountain ranges in Nevada. Big tooth maple is dominant in northern Utah, northern Nevada, and southern Idaho. Scattered stands of serviceberry occur over the full range of the mountain brush type. The oakbrush, serviceberry, and maple communities normally occur above the pinyon-juniper, and below the aspen-fir zone. The oakbrush type can integrate to some extent into the ponderosa pine (*Pinus ponderosa*) and lodgepole pine (*Pinus contorta*) forests. The ponderosa pine type is a counterpart with regard to elevation and total precipitation to the mountain brush type, except it occurs on lighter textured, more well drained soils and in areas that receive summer storms.

Extensive stands of curlleaf mountain mahogany occur intermixed throughout the region occupied by other mountain brush woody species. Curlleaf mountain mahogany normally grows on shallow, more rocky soils than other associated shrubs. Mature stands often support less diversity of understory herbs than other mountain brush shrub associations. This plant association provides important habitat to big game animals, and stands have frequently been heavily grazed by game and livestock. Mature and taller plants often grow out of the reach of grazing animals, yet smaller or younger plants are hedged and maintained in a stunted form. Seedling recruitment is seriously impacted by grazing, limiting natural regeneration. Extensive areas now exist where reproduction is prevented by continued grazing and invasion of annual weeds.

Mountain brush occurs between 5,000 feet (1524 m) and 9,000 feet (2743 m). Annual precipitation varies from a low of 15 inches (38 cm) to 26 inches (66 cm). A linear increase in precipitation of 4.94 inches (12.6 cm) per 1,000 feet (350 m) rise in elevation has been demonstrated for this type. Seasonal moisture distribution in the mountain brush shows a crest from February to April and a low from July to September. Ponderosa pine moisture distribution shows two crests–February through April, and July through August.

The mountain brush and ponderosa pine communities were recognized early as important, highly productive spring-summer-fall ranges for cattle and sheep. Deer, elk, bear, grouse, and wild turkeys also make considerable use of the type.

Gambel oak grows in clumps that vary in height and density. Much of the Gambel oak is tall and the foliage is out of reach of grazing animals. Some stands are thick and impenetrable to livestock and wildlife. Density of Gambel oak clumps has increased in many areas due to grazing and fire control measures. Understory forage production

generally decreased due to livestock grazing and competition from the oak. Loss of the understory is more evident on the hotter and drier south-facing slopes.

Serviceberry and maple-dominated communities are generally in quite open stands.Serviceberry and mountain big sagebrush often occur intermixed, with a number of grasses and forbs filling the large interspaces. Tall, robust plants of serviceberry and maple also become unavailable to livestock and game animals as the plants mature. The desirable understory species that occupy the interspaces are often subjected to misuse by improper grazing. The primary objective in treating most mountain brush communities is to reestablish the understory herbs.

Pinyon-Juniper (PJ)

Pinyon-juniper occupies substantial portions of the Intermountain region and approximately 15.5 million acres (6.2 million ha) in Utah. In the Great Basin, data grids analysis from Landsat-1 satellite photography indicates there are about 17.6 million acres (7.1 million ha).

Singleleaf pinyon (*Pinus monophylla*) occurs throughout Nevada to central Utah where pinyon pine (*Pinus edulis*) takes over and extends into Colorado. Utah juniper (*Juniperus osteosperma*) is found in association with both singleleaf pinyon and pinyon pine. On the drier sites where conditions are too arid for pinyons, Utah juniper occurs in pure stands covering vast areas. Rocky Mountain juniper (*Juniperus scopulorum*) occurs at the upper edge of the singleleaf pinyon and pinyon types, occupying small scattered areas. Western juniper (*Juniperus occidentalis*) dominates the low foothills in eastern Oregon and Washington, existing on sites similar to those occupied by Utah juniper in the Intermountain region.

The pinyon-juniper type ranges from 10,000 feet (3,280 M) in elevation on the crest of the Sierras to a low of 3,200 feet (1,050 M) along the Utah-Arizona border. Pinyon tends to favor higher elevations with Utah juniper becoming more dominant at lower elevations.Annual precipitation in the pinyon-juniper type ranges from 3 to 22 inches (20-56 cm), with the best stand development occurring between 12 and 17 inches (30 and 43 cm).

Blackbrush (BK)

Blackbrush (*Coleogyne ramosissima*) grows on fairly large tracts in the Southwest, often with few other associated species. In some areas, spreading creosotebush (*Larrea tridentata*), desert peachbrush (*Prunus fasciculata*), basin big sagebrush, Wyoming big sagebrush, and various cacti, yuccas, and Utah junipers grow in association with blackbrush. Annual precipitation ranges between 6 and 16 inches (15 and 40 cm). Usually, seedlings are not successful where annual precipitation averages less than 9 inches (22 cm). Blackbrush sites should not be disrupted or attempts made to convert to another vegetative type without careful evaluation of the project.

Cheatgrass and red brome (*Bromus rubens*) do establish under the crowns of blackbrush plants. In wet years, these annuals may be so abundant that when they dry, occasional accidental fires burn across large acreages. Since blackbrush is not fire tolerant, these burned areas automatically become annual cheatgrass and red brome ranges,and therefore, special problem areas. Unless disturbances are seeded, the annual grasses may persist for many years.

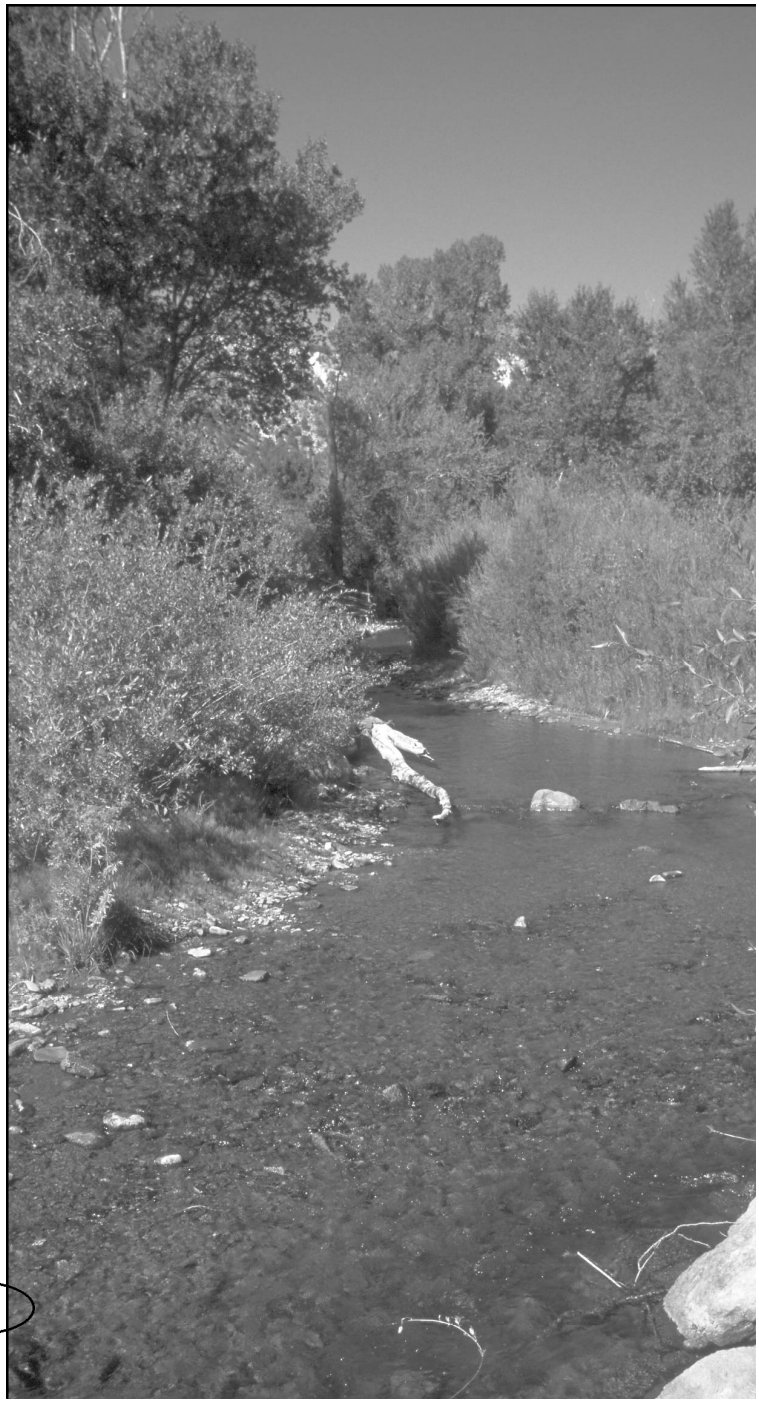


Table 7.

Characteristics of Species for Revegetation and Restoration of Utah Riparian Habitat

Scientific name	Common name	Origin[1]	Height	Ground[2] cover	Canopy[3] cover	Fruit type	Fruit[4] retention	Winter buds
Acer glabram	Rocky Mountain maple	N	>10 ft.	Thicket	Intermediate	Samara	B	Yes
Acer grandidentatum	Big tooth maple	N	>10 ft.	Open	Intermediate	Samara	B	Yes
Agropyron elongatum	Tall wheatgrass	I	3-5 ft.	Thicket	Closed	Caryopis	A	No
Agropyron interndium	Intermediate wheatgrass	I	1-3 ft.	Thicket	Intermediate	Caryopis	A	No
Agropyron smithii	Western wheatgrass	N	<1 ft.	Thicket	Intermediate	Caryopis	A	No
Agrostis stolonifera	Redtop	I	5-10 ft.	Thicket	Intermediate	Caryopis	B	No
Alopecurus arundinaceus	Creeping meadow foxtail	I	1-3 ft.	Thicket	Closed	Caryopis	A	No
Amelanchier alnifolia	Saskatoon serviceberry	N	>10 ft.	Open	Intermediate	Berry	A	Yes
Amorpha canescens	Leadplant amorpha	N	3-5 ft.	Closed	Closed	Legume	B	Yes
Arrhenatherum elatius	Tall oatgrass	I	3-5 ft.	Thicket	Intermediate	Caryopis	A	No
Artemisia abrotanum	Oldman wormwood	I	3-5 ft.	Thicket	Closed	Achene	A	Yes
Artemisia cana	Silver sagebrush	N	1-3 ft.	Closed	Closed	Achene	A	Yes
Artemisia filifolia	Sand sagebrush	N	3-5 ft.	Closed	Intermediate	Achene	A	Yes
Artemisia tridentata tridentata	Basin big sagebrush	N	3-5 ft.	Closed	Closed	Achene	A	Yes
Artemisia tridentata vaseyana	Mountain big sagebrush	N	1-3 ft.	Closed	Closed	Achene	A	Yes
Artemisia tridentata wyomingensis	Wyoming big sagebrush	N	1-3 ft.	Closed	Closed	Achene	A	Yes
Atriplex canescena	Fourwing saltbrush	N	3-5 ft.	Closed	Intermediate	Utricle	C	Yes
Atriplex lentiformis	Big saltbrush	N	5-10 ft.	Thicket	Closed	Utricle	B	Yes
Atriplex polycarpa	Cattle saltbrush	N	1-3 ft.	Closed	Closed	Utricle	B	Yes
Atriplex torreyi	Torrey saltbrush	N	3-5 ft.	Closed	Closed	Utricle	B	Yes
Baccharis emoryi	Emory baccharis	N	5-10 ft.	Thicket	Open	Achene	A	?
Betula occidentalis	Water birch	N	>10 ft.	Open	Open	Winged nut	B	Yes
Caragana arborescens	Siberian peashrub	I	5-10 ft.	Open	Intermediate	Legume	A	Yes
Caragana pygmaea	Pygmy peashrub	I	1-3 ft.	Closed	Closed	Legume	A	Yes
Carex	Carex (use local species)	N	<1 ft.	Thicket	Intermediate	Achene	A	Yes
Celtis occidentalis	Hackberry	N	>10 ft.	Open	Intermediate	Drupe	C	Yes
Chilopsis lenearis	Desert willow	N	5-10 ft.	Thicket	Intermediate	Capsule	A	Yes
Chrysothamnus nauseosus	Rubber rabbitbrush	N	3-5 ft.	Closed	Intermediate	Achene	A	Yes
Clematis ligusticifolia	Western virgin bower	N	1-3 ft.	Thicket	Closed	Achene	B	Yes
Colutea	Bladdersenna	I	5-10 ft.	Open	Intermediate	Legume	C	Yes
Cornus stolonifera	Dogwood	N	3-5 ft.	Open	Open	Drupe	A	Yes
Cotoneaster acutifolia	Peking catoneaster	I	3-5 ft.	Closed	Closed	Pome	C	Yes
Crataegus douglasii	Douglas hawthorn	N	3-5 ft.	Open	Open	Pome	C	Yes

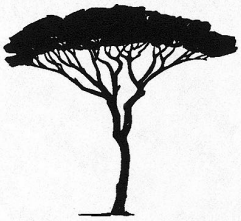
Crataegus rivularis	River hawthorn	N	3-5 ft.	Open	Open	Pome	C	Yes
Elaeagnus umbellatum	Autum eleagus	I	3-5 ft.	Thicket	Intermediate	Achene	B	Yes
Eleocharis	Spikerush (use local species)	N	3-5 ft.	Thicket	Closed	Achene	A	No
Elymus cinereus	Great Basin wildrye	N	5-10 ft.	Thicket	Closed	Caryopis	A	No
Elymus giganteus	Mammoth wildrye	I	5-10 ft.	Thicket	Closed	Caryopis	A	No
Juncus	Rush (use local species)	N	<1 ft.	Thicket	Intermediate	Achene	A	Yes
Lonicera tatarica	Tetarian honeysuckle	I	1-3 ft.	Open	Open	Berry	C	Yes
Lonicera utahensis	Utah honeysuckle	N	?	?	?	Berry	B	Yes
Malus hopa	Hopa crabapple	I	5-10 ft.	Open	Open	Pome	A	Yes
Morus alba	Russian mulberry	I	>10 ft.	Open	Open	Drupe	B	No
Phalaris arundinacea	Reed canary grass	I	3-5 ft.	Thicket	Closed	Caryopis	A	No
Poa pratensis	Kentucky bluegrass	I	<1 ft.	Thicket	Closed	Caryopis	A	No
Poa secunda	Sandberg bluegrass	N	<1 ft.	Thicket	Closed	Caryopis	A	No
Populus angustifolia	Narrowleaf cottonwood	N	>10 ft.	Open	Open	Capsule	A	Yes
Populus canadensis	Carolina poplar	I	>10 ft.	Open	Open	Capsule	A	Yes
Populus fremonti	Fremont cottonwood	N	>10 ft.	Open	Open	Capsule	A	Yes
Potentilla fruiticosa	Bush cinquefoil	N	1-3 ft.	Closed	Intermediate	Achene	A	?
Prunus americana	American plum	N	?	?	Intermediate	Drupe	B	Yes
Prunus andersonii	Anderson peachbush	N	1-3 ft.	Closed	Intermediate	Drupe	B	?
Prunus besseyi	Bessy cherry	I	1-3 ft.	Thicket	Closed	Drupe	A	Yes
Prunus fasciculata	Desert peachbush	N	3-5 ft.	Closed	Closed	Drupe	B	?
Prunus virginiana	Chokecherry	N	>10 ft.	Thicket	Closed	Drupe	B	Yes
Quercus gambelii	Gamble oak	N	>10 ft.	Thicket	Open	Acorn	A	?
Quercus turbruella	Shrub live oak	N	5-10 ft.	Thicket	Open	Acorn	A	?
Rhus glabra	Rocky Mountain sumac	N	3-5 ft.	Open	Open	Drupe	C	?
Rhus trilobata	Skunk bush sumac	N	5-10 ft.	Closed	Closed	Drupe	B	?
Riber aureum	Golden currant	N	5-10 ft.	Thicket	Closed	Berry	A	Yes
Robinia neomexicana	New Mexico locust	N	>10 ft.	Thicket	Open	Legume	A	?
Rosa woodsii	Woods rose	N	5-10 ft.	Thicket	Closed	Hip	C	Yes
Salix	Willow (use local species)	N	5-10 ft.	Thicket	Closed	Capsule	A	Yes
Sambucus cerulea	Blueberry elder	N	5-10 ft.	Thicket	Intermediate	Drupe	A	Yes
Sarcobatus vermiculatus	Greasewood	N	5-10 ft.	Open	Intermediate	Utricle	C	No
Scirpus	Bulrush (use local species)	N	3-5 ft.	Thicket	Closed	Achene	A	No
Secale montanum	Mountain rye	I	1-3 ft.	Thicket	Intermediate	Caryopis	A	Yes
Shepherdia argentea	Silver buffaloberry	N	3-5 ft.	Closed	Open	Achene	B	?
Sorbus scopulina	Mountain ash	N	5-10 ft.	Open	Intermediate	Pome	B	Yes
Sporobolus airoides	Alkali sacaton	N	1-3 ft.	Thicket	Intermediate	Caryopis	A	No
Symphoricarpus longiflorus	Longflower snowberry	N	1-3 ft.	Closed	Closed	Drupe	B	Yes
Symphoricarpus occidentalis	Western snowberry	N	1-3 ft.	Closed	Closed	Drupe	B	Yes
Symphoricarpus oreophilus	Mountain snowberry	N	3-5 ft.	Closed	Closed	Drupe	B	Yes
Syringa vulgaris	Lilac	I	5-10 ft.	Closed	Intermediate	Capsule	?	Yes
Vitis arizonica	Canyon grape	N	Vine	Closed	Intermediate	Berry	B	?

Table 7 continues on next page.

① Origin: I = Introduced N = Native

② Ground Cover:

Closed



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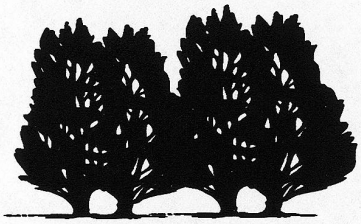
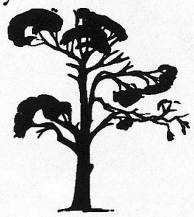


Thicket

③ Canopy Cover:



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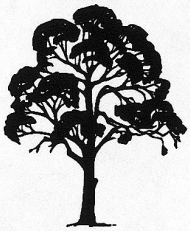

Intermediate

Closed

④ Fruit retention: A = fruit falls readily; B = Some fruits retained for up to 4 months; C = Fruit retained through winter

Western Tanager

Table 8.

Criteria for the Assessment of Riparian Areas①

Yes	No	N/A	Hydrologic
			Floodplain inundated in "relatively frequent" events (1-3 yrs.)
			Active/stable beaver dams
			Sinuosity, width/depth ratio, and gradient are in balance with the landscape setting (i.e., landform, geology, and bioclimatic region
			Riparian zone widening
			Upland watershed not contributing to riparian degradation
Yes	**No**	**N/A**	**Vegetative**
			Diverse age structure of vegetation
			Species present indicate maintenance of riparian soil moisture characteristics
			Streambank vegetation is comprised of those plants or plant communities that have root masses capable of withstanding high streamflow events
			Riparian plants exhibit high vigor
			Adequate vegetative cover present to protect banks and dissipate energy during high flows
			Plant communities in the riparian area are an adequate source of coarse and/or large woody debris
Yes	**No**	**N/A**	**Erosion Deposition**
			Floodplain and channel characteristics (i.e., rocks, coarse and/or large woody debris) adequate to dissipate energy
			Point bars are revegetating
			Lateral stream movement is associated with natural sinuosity
			System is vertically stable
			Stream is in balance with the water and sediment being supplied by the watershed (i.e., no excessive erosion or deposition

① From U.S. Bureau of Land Management (1993).

Appendix.

Riparian Management Resources

Bureau of Land Management

Access to Bureau of Land Management (BLM) Information

http://www-a.blm.gov/nhp/BLMinfo/ReadingRoom/

Bureau of Reclamation

Ecological Research and Investigations:
Riparian and Wetland Studies
http://www.usbr.gov/ecology/eri3low.html

Lone Peak Conservation Nursery

Utah Division of Sovereign Lands and Forestry
271 West Bitterbrush Lane
Draper, UT 84020-9599
(801) 571-0900

National Resource Conservation Service

http://etcs.ext.missouri.edu:70/1/agebb/usda/nrcs

Aberdeen Plant Materials Center

Box AA
Aberdeen, ID 83210

National Riparian Service Team

Wayne Elmore, Team Leader
Bureau of Land Management
U.S. Department of the Interior
Prineville District Office
P.O. Box 550-3050 3rd St.
Prineville, OR 97754
Phone:(541) 416-6700
E-mail: welmore@sc0126wp.sc.blm.gov

Riparian Resources Homepage

http://quarles.unbc.edu/nres/ackerman/riparian-res.htm

Southwest Riparian Expertise Directory

http://ag.arizona.edu/AZWATER/swexpdir/riparian.html

U.S.D.A. Forest Service

Alma Winward
U.S.D.A. Forest Service
324 25th Street
Ogden, UT 84401

Riparian Stream Ecosystems Intermountain Research Station
Forest Service Laboratory
Attn: Nancy Shaw
316 East Myrtle Street
Boise, ID 83702

Pacific Northwest Forest Plan Riparian Topics Bibliography
http://glinda.cnrs.humboldt.edu/wmc/rip_bib/rip_index.html

Interagency Watershed Analysis Center
USDA-Forest Service, Six Rivers National Forest
4886 Cottage Grove Avenue
Mckinleyville, CA 95519-9433 (707) 839-6275
M.J. Furniss, Coordinator

Stream Corridor Restoration: Principles, Practices,and Processes
The Federal Interagency Stream Corridor Restoration
Working Group
http://www.usda.gov/stream_restoration/

Utah Division of Wildlife Resources

Frank Howe, Avian Program Coordinator
Utah Division of Wildlife Resources
1594 West North Temple, Suite 2110
Box 146301
Salt Lake City, UT 84114-6301
Phone:(801) 538-4764
Fax:(801) 538-4709
E-mail:fhowe@email.state.ut.us

Scott Walker
Utah Division of Wildlife Resources
Great Basin Research Center
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Phone:(801) 283-4441

Jimmie Parrish
Utah Partners in Flight Coordinator
Utah Division of Wildlife Resources
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Utah Riparian Management Coalition

Utah Riparian Management Coalition
George Hopkin,Chairman
Environmental Quality Section
Utah Department of Agriculture
350 North Redwood Road
Box 146500
Salt Lake City, UT 84114-6500
Phone:(801) 538-7177
Fax:(801) 538-7126