

Arctic-Boreal Wetlands

Within and adjacent to subalpine forests and grasslands are numerous perennial streams and other aquatic situations bordered by shrub willows (*Salix monticola*, *S. scouleriana*, *S. bebbiana*, *S. lorrata*), and other winter deciduous scrub: e.g., Red Elderberry (*Sambucus racemosa*), Shrubby Cinquefoil (*Potentilla fruticosa*), Goose-berry Currant (*Ribes* spp.), Raspberry (*Rubus* spp.), and at lower boreal and cold temperate elevations, Thin-leaf Alder (*Alnus tenuifolia*) (Fig. 153). While these alpine and subalpine riparian scrublands may be punctuated by Blue Spruce (*Picea pungens*), Aspen (*Populus tremuloides*), and other tree species of the subalpine conifer forest, distinctive riparian tree life forms (and hence riparian forests), are generally absent from this thermal zone.

Except for the highest elevations of the Sangre de Cristo, San Juan, San Pedro, White, and Mogollon mountains, the number and length of subalpine streams in the Southwest is limited by the relatively small watershed areas of sufficient elevation, and also sometimes by geologic situations—e.g., the porosity of respective volcanic and limestone structures of San Francisco Mountains and the Kaibab Plateau in Arizona. Nonetheless, a few informative examples may be found in most mountain ranges approaching or exceeding 3,000 m elevation—including those in southern California (e.g., upper Snow Creek in the San Jacinto Mountains and the upper South Fork of the Santa Ana River in the San Bernardino Mountains). Certain north-flowing streams at lower elevations may also have many characteristics of subalpine systems, such as Workman Creek in the Sierra Ancha of Arizona (1,980 m; Fig. 155).

These boreal scrublands along watercourses are important and distinctive biomes, and in the Southwest provide the southern-most breeding habitats for a characteristic northern avifauna such as Lincoln's Sparrow (*Melospiza lincolni*), White-crowned Sparrow (*Zonotrichia leucophrys*), and MacGillivray's Warbler (*Oporornis tolmiei*). The streams themselves are used as breeding grounds for a few amphibians such as treefrogs (*Hyla* spp.) and also are the past or present home of a number of relict, native salmonid fishes (e.g., *Salmo clarki*

spp., *S. apache*, *S. gilae*). These trouts are now largely replaced by introduced species such as Rainbow Trout (*S. gairdneri*) and Brook Trout (*Salvelinus fontinalis*).

Many subalpine grassland meadows possess high water tables, so that small marshy ponds or ciénegas are common features. Beaver dams are locally present, and streamsides are frequently marshy where gradients are not too steep. These streamside ciénega habitats support microtine rodents (*Microtus* spp.), Western Jumping Mouse (*Zapus princeps*), and Water Shrew (*Sorex palustris*), among other small mammals. Both Rocky Mountain and Sierran subalpine marshlands are most often vegetated by high-elevation or other cold-climate sedges (*Carex* spp., *Cyperus* spp., *Eleocharis* spp. and *Scirpus* spp.) and rushes (*Juncus* spp. and *Luzula* spp.). Taller life-forms such Roundstem Bulrush (*Scirpus pallidus*) and other aquatics such as mannagrass (*Glyceria* spp., including *G. borealis*) occupy deeper (and hence more permanent) marshes and lakesides (Fig. 154), providing nesting habitat for several species of waterfowl including the Mallard (*Anas platyrhynchos*), and Eared and Pied-billed Grebes (*Podiceps caspicus*, *Podilymbus podiceps*). Denser stands of bulrush also provide nesting habitat for Sora (*Porzana carolina*) and Coot (*Fulica americana*). High altitude amphibians, treefrogs (*Hyla eximia*, *H. regilla*), Cricket Frog (*Pseudacris triseriata*), and Tiger Salamander (*Ambystoma tigrinum nebulosum*), are characteristic of both temporary and permanent ciénega habitats.

Except in the San Juan Mountains, natural lakes are few and greatly outnumbered by small, artificial reservoirs and tanks designed for recreational fishing and livestock use. Although some of these water bodies may be extremely fertile, long periods of snow cover and resulting oxygen depletion in winter, or elevated pH in summer as a result of special chemical and biological conditions, result in only a few providing a substantial fishery for introduced salmonids. They are, however, extensively used by birds and, if fishes are absent, support large numbers of amphibians.



Figure 153. Subalpine riparian scrub along North Fork of the White River, Fort Apache Indian Reservation, Apache County, Arizona. Prevalent species at this locality near the lower limits of subalpine scrub are willows (*Salix bebbiana*, *S. scouleriana*), Thinleaf Alder (*Alnus tenuifolia*), Blueberry Elder (*Sambucus glauca*) and Hawthorn (*Crataegus erythropoda*). Trees along the stream are Blue Spruce (*Picea pungens*), and Engelmann Spruce (*P. engelmannii*), with Ponderosa Pine (*Pinus ponderosa*) upslope above the temperature inversion layer. Elevation ca. 2,400 m.



Figure 154. Subalpine marshland and submergents at Carnero Lake, Apache National Forest, Apache County, Arizona. The marshland emergent is Mannagrass (*Glyceria borealis*). Elevation ca. 2,750 m.