PERSPECTIVES ON MANAGING RIPARIAN ECOSYSTEMS FOR ENDANGERED BIRD SPECIES

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The emphasis of this symposium is the management of endangered, threatened, and other sensitive bird species in western riparian habitats. Riparian areas are limited in their extent, yet are extremely productive and have well documented wildlife values (Gaines 1977, Johnson and Jones 1977, Stevens et al. 1977, Warner and Hendrix 1984). This paper examines the nature of riparian systems from historical and current perspectives, describes the importance of riparian habitats to sensitive bird species, and briefly explores the laws, policies, and regulations designed to protect these habitats.

DEFINITION OF RIPARIAN HABITATS

Located primarily along major rivers and tributaries, riparian forests are usually associated with abundant water supplies, have coarse textured and well-drained soils, and contain high levels of nutrients (Roberts et al. 1977). Riparian habitats may be defined as streamside, riverside, or lakeside communities, extending from high forest to low desert (Pase and Layser 1977). Soil moisture is seldom limiting although surface water may be lacking at times (Pase and Layser 1977).

GENERAL DESCRIPTION

Within riparian forests the density and diversity of vegetation tend to be greater than in adjacent upland habitats because of edge effects. Western riparian forests are complex and structually diverse ecosytems, often having dense understories of shrubs or young trees with canopy layers of more mature trees.

In many western riparian systems early successional stages are pure cottonwood-willow (*Populus* spp.-*Salix* spp.), whereas mid- and late successional stages frequently have cottonwood-willow overstory with an occasional oak (*Quercus* spp.) or sycamore (*Platanus* spp.). Box elder (*Acer negundo* subsp. *californicum*), black walnut (*Juglans hindsii*), and ash (*Fraxinus* spp.) often constitute the second canopy layer in these older stands (Strahan 1984). Should flood-induced scouring of the forest be absent for many years, cottonwood-willow habitats may be replaced by these second canopy (as defined above) species (Strahan 1984). Reproduction is usually by seed, but willows such as sandbar willow (*Salix hindsiana*) also use vegetative means. For a more complete description of riparian habitats, please refer to Johnson and Jones (1977), Johnson and McCormack (1978), and Warner and Hendrix (1984).

HISTORICAL PERSPECTIVE

Historical accounts suggest that along both sides of large, lowland rivers, belts of riparian trees averaged from 3.2 to 6.4 km (2-4 mi.) in width (Thompson 1961). Such conditions prevailed especially in the Central Valley in California, which provides a typical example of modifications that have occurred in riparian areas.

Farmers, noting that the soil in riparian areas was very fertile, cleared riparian vegetation so they could grow crops. The expansion of farming and concurrent increase in the demand for water and flood control prompted large-scale water development and reclamation projects that had far-reaching, adverse effects on riparian systems. Much of the water diverted for crop irrigation was no longer available to support riparian habitats.

Towns developed in conjunction with the rapidly expanding agricultural industry. Seasonal flooding became a major concern because many of these valley towns were built in floodplains. As levees were built higher and higher, water levels rose and water that would have previously overflowed into the natural floodplain basins was now confined within the levees.

Extensive, controversial water projects have been constructed throughout the Central Valley. The once vast riparian forests have been decimated by dam building, river channelization (riprapping, concrete lining, etc.), groundwater pumping, land clearing (for urban and agricultural development), artificial levees, water diversion (irrigation canals), bank protection systems, grazing, road construction, and pooling of water (to water stock and for water diversion) (Carothers 1977, Johnson 1978, Katibah 1984, Katibah et al. 1984).

DECLINE IN DISTRIBUTION AND QUANTITY OF RIPARIAN HABITAT

Bottomland riparian forests are the most highly modified of natural landscapes in California. Most of the riparian forest along the water courses of the Central Valley was rapidly eliminated or greatly reduced in size. Using a map by J. Greg Howe, Katibah (1984) conservatively estimated the presettlement riparian vegetation for the entire Central Valley at more than 373,000 ha (924,000 ac). In 1979 it was estimated that about 41,300 ha (102,000 ac) of riparian forest remained in the Central Valley and 85% of it was in a disturbed or degraded condition (Katiban et al. 1984) (Table 1). Similar losses are evident throughout much of the U.S. (Korte and Fredrickson 1977).

BIRD USE OF RIPARIAN HABITATS

According to Miller (1951), the "... number of species of birds associated with riparian woodlands is larger than that of any other formation." Several factors contribute to the avian diversity of riparian habitats, including ecotone and edge effects, as the aquatic stream ecosystem interfaces with the adjacent terrestrial habitat (Odum 1978).

Table 1 Current Sample Site[a] Condition of Riparian Systems in the Central Valley[b]

Condition	Amount (ha)	Percentage
Apparently unaltered	1,239	3
Good	4,956	12
Disturbed	10,325	25
Degraded	12,803	31
Severely degraded	11,977	29
Total	41,300	100

[a]For definition of sample site, see Katibah et al. (1984), pp. 316-317.
[b]From Katibah (1984) and Katibah et al. (1984).

Avian use of riparian systems is well documented (Table 2). Although most of the studies concentrated on breeding birds, similar trends are evident with migrants; both Rappole and Warner (1976) and Stevens et al. (1977) reported that migrants preferred riparian habitat over adjacent upland areas. This is particularly significant because the loss of riparian habitat affects not only nesting birds, but may adversely affect migrating individuals by influencing migration routes, reducing cover, eliminating resting areas, and reducing food supplies (Rappole and Warner 1976, Stevens et al. 1977, Johnson 1978). Riparian habitat also serves as an essential link for long-distance migrants and as wintering grounds (Laymon 1984).

Table 2 Examples of Avian Use of Riparian Areas

Habitat	State	Estimated no. per 40 ha	Source
Mixed broadleaf	AZ	332 pairs	Carothers et al. (1974)
Cottonwood	AZ	847 pairs	Carothers et al. (1974)
Cottonwood-willow	TX	475 birds	Engel-Wilson and Ohmart (1978)
Cottonwood-willow	AZ/CA	84-298[b] birds	Anderson et al. (1983)
Desert riparian	AZ	336[a] birds	Szaro and Jakle (1985)
Willow-tamarisk	AZ	445[a] birds	Szaro and Jakle (1985)
Honey mesquite	AZ	178-200[b] birds	Anderson et al. (1983)
Salt Cedar	AZ	23-146[b] birds	Anderson et al. (1983)
Arrowweed	AZ	111[b] birds	Anderson et al. (1983)
Screwbean mesquite	AZ	92-202[b] birds	Anderson et al. (1983)
Mesquite bosque	AZ	476 pairs	Gavin and Sowls (1975)

[a]Densities varied depending on year and interior/edge area of riparian.
[b]Densities values for spring season; all plots along the Colorado River.

Avian densities and species richness in riparian systems demonstrate the importance of these habitats to birds. For example, riparian forests support more species of breeding birds in California than any other habitat type and at least 100 species use it for food and cover (Gaines 1977).

In analyzing data from *American Birds* for various habitat types, Laymon (1984) noted that riparian areas had the highest density (birds/km^2) and greatest species richness of all habitats studied in both the breeding and winter seasons. During the last 100 years, 83 species are known to have nested in riparian habitats in the Sacramento Valley, and 20 of the regularly occurring species are believed to have their highest densities in riparian systems (Laymon 1984). Several species, such as the Willow Flycatcher (*Empidonax traillii*) and Least Bell's Vireo (*Vireo bellii pusillus*), are no longer known to nest anywhere in the interior lowland areas of California.

Riparian avifaunas also increase the avian diversity of nearby and adjacent communities. For example, it was found that the avian community in a riparian area increased the nearby desert bird community in both species composition and density (Szaro and Jakle 1985). In this south-central Arizona study, contributions from the riparian avifauna ranged from 23 to 33% of the birds along the adjacent desert washes and 7 to 15% within the desert uplands (Szaro and Jakle 1985). This contrasts with a contribution of only 1 to 1.5% from the desert areas to the riparian community (Szaro and Jakle 1985). Likewise, riparian birds exert a stong influence over the bird communities in adjacent agricultural and second-growth fields and pastures (Carothers et al. 1974, Conine et al. 1978). Along the Sacramento River, agricultural land devoid of adjacent riparian areas supported 95% fewer individuals and 32% fewer species than similar agricultural lands bordering riparian habitat (Henke and Stone 1978).

MANAGEMENT CONCERNS AND ADVERSE IMPACTS

A number of activities either modify or have the potential to adversely affect riparian habitats and their avian populations. These include water storage projects that inundate riparian areas, erosion, excessive groundwater pumping (and declining water tables), human recreation (camping, hunting, trapping, etc.), pesticide buildup resulting from drainage and erosion from nearby agricultural fields, flood control projects, and bank protection projects (Johnson 1978, Katibah 1984, Katibah et al. 1984).

Invasions by exotic plants such as salt cedar (*Tamarix* spp.) and giant reed (*Arundo donax*) present insidious threats because the exotics gradually replace cottonwood-willow and other native riparian species. Floodplain management is designed to protect against loss of human life and property, but frequently moves the potential problem downstream by channelizing the water from one locale to another (Johnson 1978). These conditions all serve to reduce native riparian vegetation and portend either the elimination or reduction in avian populations and other wildlife.

Management of riparian areas requires that the natural periodicity of the river flow be sustained to allow the functioning of riparian systems. Depending on its frequency, duration, and intensity, flooding can be beneficial or stressful to a riparian system (Odum 1978). Projects that reduce or eliminate

normal seasonal flooding retard riparian productivity (Odum 1978). Too frequent flooding knocks down vegetation and may prevent it from becoming reestablished. If flooding (and attendant scouring of vegetation) is too infrequent, succession will proceed to climax, to the detriment of species that rely on early successional stages, such as the Least Bell's Vireo. If the flood is too intense or long in duration, extensive scouring and erosion may result, adversely modifying the stream bed. As a conservation policy, any structures that alter river flow so as to cause a substantial negative effect on the riparian ecosystem should be discouraged.

A balance must be maintained between riparian and fluvial systems. We must recognize that flooding is a natural process and should consider channel and floodplain as complementary if we are to maintain the integrity of riverine systems. In some areas natural flooding is no longer feasible and artificial means of duplicating the effects of natural flooding should be considered.

The public must be involved in the management of riparian systems; such involvement could include education, legislation, preservation, and restoration.

A number of laws and regulations are available to manage and protect riparian habitat. These include the Clean Water Act, National Environmental Policy Act of 1969, Endangered Species Act of 1973, Fish and Wildlife Coordination Act, National Wild and Scenic Rivers Act of 1968, and others. In California, several state laws apply, such as the California Environmental Quality Act of 1970, State Wild and Scenic Rivers Act of 1972, and Surface Mining and Reclamation Act of 1975.

A prime example of how laws can be used to manage sensitive species is provided by the Endangered Species Act of 1973, as amended. Federally listed species and the ecosystems on which they depend are protected under the Endangered Species Act through implementation of two of its provisions. Section 9 prohibits "take" (defined as harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct) and states the penalties for violations. Section 7 requires that all federal agencies insure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any endangered or threatened species or result in destruction or adverse modification of any designated critical habitat.

According to the Endangered Species Act, for federally listed species the term "endangered" means "any species (this includes subspecies of vertebrate fish or wildlife or plants and any distinct population segment of any species of vertebrate fish or wildlife which interbreeds when mature) which is in danger of extinction throughout all or a significant portion of its range." The reference to a population segment is pertinent because it enables a distinct portion of a vertebrate species to be listed even though the entire species may not warrant protected status. A federally "threatened" species is one which is likely to become endangered should factors currently reducing the population persist throughout all or a significant portion of its range. The Secretary of the Interior bases the decision to list a species as endangered or threatened on whether it meets at least one of the following criteria: (a) the present or threatened destruction, modification, or curtailment of its habitat or range; (b) overutilization for commercial, recreational, scientific, or educational purposes; (c) disease or predation; (d) the inadequacy of existing regulatory

mechanisms; and (e) other natural or man-made factors affecting its continued existence. Various states maintain lists of endangered, threatened, or rare species with their own standards that a species must meet to qualify for state listing.

To protect riparian habitat all applicable laws and regulations must be aggressively implemented and stringently enforced. A far-reaching monitoring program to assess and evaluate the status of riparian systems should be established by a consortium of federal, state, and local agencies. Only through dynamic, diligent, and innovative actions to manage riparian areas appropriately will this sensitive, valuable, and irreplaceable habitat persist.

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