Endangered Species vs. Endangered Habitats: A Concept[1]

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Abstract. - Although the great diversity within riparian ecosystems was recognized earlier, their extreme productivity was not discovered until this decade. The highest densities of nesting birds for North America have been reported from Southwest cottonwood riparian forests. Complete loss of riverine habitat in the Southwest lowlands could result in extirpation of 47 percent of the 166 species of birds which nest in this region.

INTRODUCTION

Since 1600 more than 120 bird and mammal species have become extinct while more than 300 are now threatened (Fisher et al. 1969). In addition, dozens of fishes, amphibians and reptiles have become extinct or are endangered to say nothing of invertebrate species. Habitat disruption and destruction have been a major cause of extinction. Only 24 percent of the birds and 25 percent of the mammals became extinct through natural causes. Of the 76 percent of the birds and 75 percent of the mammals which died from human related causes, well over half have been through indirect means, such as introduction of exotic speices and habitat disruption (Fisher et al. 1969 and IUCN Red Data Books issued periodically).

In an attempt to reduce the numbers of species which will soon become extinct, several steps have been taken. A major step involves the formation of recovery teams, comprised of authorities on a given species, such as the Bald Eagle. The activities of these teams have apparently been beneficial in slowing down rates of loss in wildlife species. However, the efforts of recovery teams cannot possibly prevent continued extirpation if we continue to disrupt habitat through activities such as overgrazing, urbanization, "modern, clean" agricultural practices, dam construction and channelization. Continued research is needed to provide answers to questions posed by management regarding means through which critical wildlife habitat may be preserved.

DISCUSSION

Extirpation

The extirpation of wild animal species has been a cause for concern for decades. People only mildly interested in conservation can bring to mind the examples of the Passenger Pigeon (Ectopistes migratorius - extinct 1914), the Carolina Parakeet (Conuropsis carolinensis- extinct 1914), the Dodo (Raphus cucullatus- extinct 1681) and the Great Auk (Pinguinus impennis - extinct 1844). Dates for extinction are from Pettingill (1970) and Van Tyne and Berger (1971). An entire book has been written about the Passenger Pigeon (Schoerger 1955) and people are still trying to find out whether or not the Ivory-billed Woodpecker (Campephilus principalis) is now extinct. Several recent books have been written appealing to citizens of the world to help save these rapidly diminishing species (Greenway 1958, Fisher et al. 1969, Prince Phillip and Fisher 1970, Simon and Geroudet 1970, Tylinek and Ullrich 1972, and Ziswiler 1967). Information from the International Union for Conservation of Nature and Natural Resources (I.U.C.N.) Red Data Books (issued periodically) presents a dismal picture (Table 1).

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Table 1.--A history of species' extirpation. (adapted from I.U.C.N. Red Data Books)

Date	Number of extinctions	Direct[1]	Indirect[2]
1600s	21	86%	14%
1700s	36	84%	16%
1800s	84	24%	76%
1900-1974	85	28%	72%

[1] Direct = Hunting for food or commercial causes.

[2] Indirect = Habitat disruption, introduction of exotics, etc.

Attempts to Prevent Extinctions

The concern over the increasing numbers of species being exterminated in the United States caused the U.S. Fish and Wildlife Service to begin work on classification of "threatened" wildlife in the early 1960's. The 1st edition of the "Redbook" was issued in July 1966. We use the words "threatened" and "endangered" in an unofficial sense (see U.S. Fish and Wildlife Service 1973 for official definition). Endangered species are assigned in the United States according to the Endangered Species Conservation Act of 1969 and listed periodically in the U.S. Federal Register by the U.S. Fish and Wildlife Service. It is not our intent to go into great depth regarding endangered speices programs. The forementioned I.U.C.N., U.S. Fish and Wildlife Service and others (e.g. American Committee on International Wildlife Protection, National Audubon Society and World Wildlife Fund) publish periodic information on endangered wildlife (e.g. Arbib 1976). Other governmental agencies besides the U.S. Fish and Wildlife Service publish information regarding endangered wildlife (Arizona Game and Fish Department 1977[4], Behnke and Zarn 1976, U.S. Forest Service 1975, U.S. National Park Service 1974). Symposia are held periodically focusing on general problems of endangered wildlife (New Mexico Game and Fish Department 1972) or even devoted to a single species such as the Peregrine Falcon (Falco peregrinus) (Hickey 1969) or the Red-cockaded Woodpecker (Dendrocopos borealis) (Thompson 1971). Periodically, reports are issued on endangered species such as the Southern Bald Eagle (U.S. Fish and Wildlife Service 1976). Recovery teams to address the problem of impending extinction have been set up by the U.S. Fish and Wildlife Service for many species of endangered wildlife. For example, several avian species are now being raised by methods of direct intervention such as egg manipulation (Zimmerman 1976). In addition, several agencies are now involved in establishing endangered plant lists.

In addition to teams concerned with the protection of terrestrial wildlife, such as the Peregrine Falcon and Southern Bald Eagle, other recovery teams have been organized to focus on one or more fish species. Recently, however (Johnson[5]) the U.S. Fish and Wildlife Service has designated teams which focus on river systems instead of individual species, e.g. the Colorado River Fishes Recovery Team. This approach has been advocated for years by many of us who have seen the wholesale extermination of species in certain areas as a result of habitat destruction. Nowhere is this chain of destruction more certain than in riverine ecosystems. This has long been recognized by ichthyologists such as Deacon and Minckley (1974), Holden and Stalnaker (1975), Minckley and Deacon (1968) and Sigler and Miller (1963).

Glen Canyon Dam: An Example

The construction of Glen Canyon Dam on the Colorado River above Grand Canyon is an outstanding example of habitat modification. The effect on the aquatic ecosystem has been devastating. The original heavy silt burden which rendered the Colorado River "too thick to drink and too thin to plow" is dropped in Lake Powell before the water enters Grand Canyon. The river waters are now clear. The reddish color for which the Colorado was named can be seen only after flooding from tributaries which enter below the dam. This has created an entirely new riverine ecosystem (Carothers et al. in press, Dolan et al. 1974 and in press, Johnson and Martin 1976,and Laursen and Silverston 1976). The management implications are staggering. On one hand, a new riparian ecosystem has developed, protected from the scouring and siltation of pre-dam floods. On the other hand this white water river has been converted from a stream which was warm in the summer and cold in the winter to a relatively constant 9-10°C (48-50°F) along most of its length. The only insect family recorded using these cold waters are Chironomid midges (Stevens 1976) while the

[4] Arizona Game and Fish Department. 1977. Endangered and threatened species in Arizona; 3 p. memo

[5] Johnson, J. Paper presented at New Mexico-Arizona section meeting, the Wildlife Society, Farmington, N.M., Feb 5, 1977.

small crustacean, Gammarus lucustris, abounds. The cold, clear water is conducive to the rapid growth of exotic species such as rainbow trout, which commonly reach lengths of more than 2 feet and weigh over 5 pounds (personal observation). While exotic fish flourish, our native species are declining. In the 277 miles of the Colorado River in Grand Canyon National Park several species listed in Fishes of Arizona (W. Minckley 1973 and pers. comm.) occur either in low numbers, or cannot be found at all, e.g. the Humpback Chub (Gila cypha), Bonytail Chub (G. elegans), Colorado Squawfish (Ptychocheilus lucius) and Razorback Sucker (Xyrauchen texanus) (Johnson 1977, C. Minckley and Blinn 1976, Miller 1975[6], and Suttkus et al. 1976).

Endangered Species and Related Acts

When the Endangered Species Act of 1973 (PL #93-205) was passed it was hoped by many of us concerned about extirpation of wildlife that this might prevent further wholesale extinctions through degradation of habitat. It seemed that the Endangered Species Act combined with the National Environmental Policy Act of 1969 (PL #91-190) should slow down direct extermination as well as massive destruction of the type that has converted nearly all southwestern rivers to poor or impossible habitat for most native species. Just how effective these laws will be remains to be seen. Legal decisions involving the case of the Tennessee Valley's Tellico Dam on the Little Tennessee River vs. the Snail Darter (Percina tanasi) may have important implications regarding the future interpretation of Section 7 of the Endangered Species Act, including possible amendation by congress (Holden 1977).

It seems inevitable that riverine ecosystems will become the battleground for those advocating the "progress of civilizing processes," e.g. hydroelectric and irrigation projects. Economic interests oppose those who advocate saving a few rivers to protect associated wildlife and recreational values and perhaps, "just to let them run."

The two forementioned acts coupled with the Wild and Scenic Rivers Act of 1968 (PL #90-542) would seem to be sufficient to reduce further decimation of river ecosystems. However, it is a difficult, uphill battle. Prevention of the use of streams for waste disposal is gradually becoming an accepted philosophy. Conversely, industrial, domestic and irrigation demands for water for a growing population continue to escalate.

Major Causes of Habitat Loss

The impact of dams on aquatic ecosystems has long been understood by biologists even if ignored by dam builders and water users. The area above the dam is converted into a lake, rapidly filling with sediment. The area below the dam too commonly becomes a dry stream bed, as is the situation with most of the Salt and Gila River dams of the Lower Colorado River drainage. Neither habitat is conducive to most of the pre-dam riverine plants or wildlife. Other rivers are greatly reduced in volume by practices such as pumping of underground water which dries up spring sources, or by modification of runoff patterns through overgrazing. The latter often results in the development of vegetation types which demand more water than the original vegetation. The area may be denuded, resulting in flash floods followed by quick drying up of streams rather than a slower, steady runoff. The effects of such practices on native fishes have been well documented (Minckley and Deacon 1968). However, we have only recently begun to understand the impacts on riparian ecosystems.

Recent work by various investigators (Boster and Davis 1972, Clary et al. 1974, and Hibbert et al. 1974) advocates the conversion of shrub types, commonly resulting from overgrazing, to grassland. This conversion to grassland usually results in increased water yield which, in turn, often results in an increase in acreage of riparian vegetation (personal observation, Sierra Ancha and Three Bar watersheds).

Some investigators propose large scale "phreatophyte control" projects as well as the conversion of shrub types to grassland (see Ffolliott and Thorud 1974 for discussion). These "water salvage" projects are often advocated even at the expense of both game and nongame wildlife values. Earlier work commonly featured "pure" scientists as well as "applied" scientists, all concentrating on single purpose management of watersheds and their runoff for man, his farms and cattle (Barr 1956, Duisberg 1957, and Warnock and Gardner 1960). In recent years there has been a gradual trend toward multiple use of this critical resource, water (Horton and Campbell 1974). The Arizona Annual Watershed Symposia reflect this change in philosophy (Arizona Water Commission; annually)

6 Miller, R.R. 1975. Report on fishes of the Colorado River drainage between Lees Ferry and Surprise Canyon, Arizona. Unpublished Grand Canyon Natl. Park Res. Rpt. 6 p.

placing increasing emphasis on wildlife values, recreation and even aesthetics (Arizona Water Commission 1972).

Riparian Exploration, Development and Research

It seems incredible that man would so badly mistreat riverine ecosystems. We have used them for exploratory routes, fur trapping, temporary settlements and forts, agricultural land and cities. Finally, we have dammed them up, dried them up, and turned them into sewers and garbage disposals.

Early explorers commonly were army officers, geologists, engineers or "soldiers of fortune" who left incomplete to poor records regarding the riparian habitat. This is true throughout the Southwest. Thus, early notes from rivers such as the Gila (Emory 1858) and even the mighty Colorado (Powell 1961) often mention vegetation and wildlife only in general terms. We do not even have good species' lists for the pre-dam ecosystems, much less information on population densities or other more sophisticated data. Even as late as the 1950's (Woodbury et al. 1959) scientists gathered information regarding the area to be inundated by Lake Powell, above Glen Canyon Dam. However, the more than 250 miles of river between Glen Canyon Dam site and the upper reaches of Lake Mead, which were also to be heavily impacted by the dam, were totally ignored.

Riverine environments, including their riparian ecosystems, have been ignored by biologists as well as geologists, explorers and laymen for many reasons. Riparian ecosystems have several characteristics which make them interesting but involved, difficult systems to study. Riparian habitat may be considered an ecotone between the aquatic habitat of the stream itself and the surrounding terrestrial habitat. As such, the riparian ecosystem contains elements of both the aquatic and terrestrial ecosystems plus retaining unique characteristics found in none of the other ecosystems exemplifying the edge effect. The concept of the edge effect is relatively new. Earlier treatises did not even mention this phenomenon and it was not until the mid-1900s that ecology texts, e.g. Allee et al. (1949) contained a discussion of the edge effect. Odum (1959) defines the edge effect as "the tendency for increased variety and density at community junctions."

Ornithologists and birders have long recognized the importance of riparian habitats to birds. We chose at random 20 inland Christmas Bird Counts for 1974 (National Audubon Society 1975). Nineteen (95%) of the 20 contained streamside and/or lake side vegetation. The large number of species utilizing riparian woodland has been documented by numerous studies (Carothers and Johnson 1975b). In California, Miller (1951) emphasized the importance of riparian avifaunas, stating "the number of species of birds associated with riparian woodland is larger than that of any other formation." However, the extremely high densities of riparian avian populations was not recognized until this decade (Carothers et al. 1974, Carothers and Johnson 1971 and 1975b, Gaines 1974, Johnson 1970, O'Brien et al. 1976, and Table 2).

The ecological analysis of riparian birds is complicated at best. Studies are further complicated by recent changes, some of which are related to man's activities and others which may be operating independently of man. One cannot help postulating however, that nearly all of the recorded recent changes are due to man's activities. For example, there are records for the arrival of several species of birds which have moved into Arizona as breeding species within historic times. This includes the Mississippi Kite, Inca Dove, Thick-billed Kingbird, Starling, House Sparrow, Great-tailed Grackle and Bronzed Cowbird. The Starling and House Sparrow are European introductions. The Inca Dove, Great-tailed Grackle and Bronzed Cowbird are closely associated with man and his animals. Their movements are discussed by Phillips et al. (1964) and Phillips (1968). Other cases are not as clear but may have profound effects on the native avifauna. The subtleness with which human activity may affect the natural ecosystem can be shown through a discussion of the Brown-headed Cowbird. Phillips (1968) discusses at length the historic expansion of range by Brown-headed Cowbirds. Of the 33 species of Southwestern lowland birds listed by Friedmann (1929) as hosts to the Brown-headed Cowbird, 22 (2/3) are obligate or preferential riparian nesting species. The role of these brood parasites in reducing populations of riparian birds in the Sacramento Valley, California, is discussed by Gaines (1974). Thus, Brown-headed Cowbirds may be suspected of causing problems in Arizona and other southwestern areas similar to those reported for California.

SUMMARY AND CONCLUSIONS

During our recent analysis of the dependency of the breeding avifauna of the Southwest lowlands on water related habitat (Table 3), we discovered some sobering facts. 166 species of nesting birds were analyzed from southern Arizona, southern New Mexico and west Texas, south through the lower

Table 2. -- A comparision of breeding bird densities in selected habitats. (After Carothers and Johnson 1975b).

Habitat Type (Community)	Locality	Authority	Breeding Bird Density Males or Estimated Pairs/40 ha [or 100 acres] nonriparian	riparian
Boreal Forest[1]				
Spruce-Alpine Fir	Arizona	Carothers et al. (1973)	178	-
Temperate Forest				
Spruce-Douglas Fir	Arizona	Balda (1967)	380	-
Ponderosa Pine	Arizona	Balda (1967)	336	-
Ponderosa Pine	Arizona	Haldeman et al. (1973)	232	-
Mature Deciduous	West Virginia	Audubon F.N. (1948)	724 [2]	-
Virgin Spruce	West Virginia	Audubon F.N. (1948)	762 [2]	-
Forest Bird Sanctuary	Germany	Bruns (1955)	5600 [2]	-
Relict Conifer Forest				
Cypress post climax	Arizona	Johnston and Carothers (1975)	93	-
Riparian Deciduous Forest				
Mixed Broadleaf	Arizona	Balda (1967)	-	304
Mixed Broadleaf	Arizona	Carothers et al. (1974)	-	332
Cottonwood	Arizona	Carothers et al. (1974)	-	847
Cottonwood	Arizona	Ohmart (no date)	-	683
Flood-plain Deciduous	Illinois	Fawver (1947)	-	216 [2]
Temperate Woodland				
Pinyon-Juniper	Arizona	Hering (1957)	33	-
Pinyon-Juniper	Arizona	Beidleman (1960)	30	-
Encinal	Arizona	Balda (1967)	224	-
Subtropical Woodland				
Mesquite Bosque (riparian)	Arizona	Gavin and Sowls (1975)	-	476 [3]
Mesquite	Arizona	Ohmart (no date) [5]	236	-
Grassland				
Temperate Grassland	Arizona	Balda (1967)	64	-
Tropical Grassland	Tanganyika	Winterbottom (1947)	4000 [2]	-
Desert Grassland				
Yucca/Grassland	Arizona	Balda (1967)	31	-
Chihuahuan Desert Scrub				
Creosotebush	New Mexico	Raitt and Maze (1968)	8.5-17.7	-
Sonoran Desert Scrub				
Paloverde/Sahuaro	Arizona	Tomoff(1974 & pers.comm.)	105-150	-
Temperate Marshland				
Cattail Marsh	Arizona	Carothers and Johnson (1975b)	-	175-176
Cultivated, Urban and Suburban Lands				
Park (zoological garden)	Germany	Steinbacher (1942)	1170 [2]	-
Bird Sanctuary (Whipsnade)	England	Huxley (1936)	5800 [2]	-
Urban	Arizona	Emlen (1976)	1230 [2]	-
Cottonwood	Arizona	Carothers and Johnson(1975a)	-	605.2 [4]

1 Arizona vegetation types after Brown and Lowe (1974).

2 Density given in number of adult birds per 40 hectares (100 acres) instead of males or nesting pairs (after Welty 1962).

3 Average density for April and May, the height of breeding activity in the mesquite bosque.

4 Riparian cottonwood habitat disturbed by urbanization. Two years prior, when the habitat was undisturbed, the density was 1058.8 pairs/100 acres.

5 Ohmart, R.D. and N. Stamp. No date. Final report on the field studies of the nongame birds and small mammals of the proposed Orme Dam site. Bur. of Recl. Proj., Boulder City, Ariz. 54 ms. p.

Table 3. -- Nesting birds of the Southwest Lowlands (Modified from Haight and Johnson 1977)[1]

WETLANDS (2%)

1. Clapper Rail Rallus longirostris
2. Black Rail Laterallus jamaicensis
3. American Avocet Recurvirostra americana
4. Snowy Plover Charadrius alexandrinus

WETLANDS AND OBLIGATE RIPARIAN (19%)

1. Least Grebe Podiceps dominicus
2. Pied-billed Grebe Podilymbus podiceps
3. Double-crested Cormorant Phalacrocorax auritus
4. Olivaceous Cormorant Phalacrocorax olivaceus
5. Great Blue Heron Ardea herodias
6. Green Heron Butorides striatus
7. Great Egret Casmerodius albus
8. Snowy Egret Egreta thula
9. Black-crowned Night Heron Nycticorax nycticorax
10. Least Bittern Ixobrychus exilis
11. Black-bellied Whistling-Duck Dendrocygna autumnalis
12. Mallard Anas platyrhynchos
13. Mexican Duck Anas diazi
14. Gadwall Anas strepera
15. Blue-winged Teal Anas discors
16. Cinnamon Teal Anas cyanoptera
17. Redhead Aythya americana
18. Ruddy Duck Oxyura jamaicensis
19. Osprey Pandion haliaetus
20. Virginia Rail Rallus limicola
21. Sora Porzana carolina
22. Common Gallinule Gallinula chloropus
23. American Coot Fulica americana
24. Black-necked Stilt Himantopus mexicanus
25. Killdeer Charadrius vociferus
26. Long-billed Marsh Wren Cistothorus palustris
27 Common Yellowthroat Geothlypis trichas
28. Yellow-breasted Chat Icteria virens
29. Yellow-headed Blackbird Xanthocephalus xanthocephalus
30. Red-winged Blackbird Agelaius phoeniceus
31. Song Sparrow Melospiza melodia

OBLIGATE RIPARIAN (26%)

1. Common Merganser Mergus merganser
2. Mississippi Kite Ictinia mississippiensis
3. Cooper's Hawk Accipiter cooperii
4. Zone-tailed Hawk Buteo albonotatus
5. Gray Hawk Buteo nitidus
6. Common Black Hawk Buteogallus anthracinus
7. Bald Eagle Haliaeetus leucocephalus
8. Spotted Sandpiper Actitis macularia
9. Red-billed Pigeon Columba flavirostris
10. Yellow-billed Cuckoo Coccyzus americanus
11. Violet-crowned Hummingbird Amazilia verticalis
12. Buff-bellied Hummingbird Amazilia yucatanensis
13. Broad-billed Hummingbird Cynanthus latirostris
14. Green Kingfisher Chloroceryle americana
15. Red-shafted Flicker Colaptes auratus cafer
16. Rose-throated Becard Platypsaris aglaiae
17. Tropical Kingbird Tyrannus melancholicus
18. Thick-billed Kingbird Tyrannus crassirostris
19. Kiskadee Flycatcher Pitangus sulphuratus
20. Black Phoebe Sayornis nigricans
21. Willow Flycatcher Empidonax traillii
22. Western Wood Pewee Contopus sordidulus
23. Vermilion Flycatcher Pyrocephalus rubinus
24. Northern Beardless Flycatcher Camptostoma imberbe
25. Bank Swallow Riparia riparia
26. Cliff Swallow Petrochelidon pyrrhonota
27. Bridled Titmouse Parus wollweberi
28. White-breasted Nuthatch Sitta carolinensis
29. Bewick's Wren Thryomanes bewickii
30. American Robin Turdus migratorius
31. Bell's Vireo Vireo bellii
32. Yellow-green Vireo Vireo flavoviridis
33. Tropical Parula Parula pitiayumi
34. Yellow Warbler Dendroica petechia
35. Hooded Oriole Icterus cucullatus
36. Northern Oriole Icterus galbula
37. Bronzed Cowbird Molothrus aeneus
38. Summer Tanager Piranga rubra
39. Blue Grosbeak Guiraca caerulea
40. Painted Bunting Passerina ciris
41. White-collared Seedeater Sporophila torqueola
42. Lesser Goldfinch Carduelis psaltria
43. Albert's Towhee Pipilo aberti

PREFERENTIAL RIPARIAN (26%)

1. Peregrine Falcon Falco peregrinus
2. American Kestrel Falco sparverius
3. Gambel's Quail Lophortyx gambelii
4. White-winged Dove Zenaida asiatica
5. Mourning Dove Zenaida macroura
6. Common Ground Dove Columbina passerina
7. White-fronted Dove Leptotila verreauxi
8. Greater Roadrunner Geococcyx californianus
9. Groove-billed Ani Crotophaga sulcirostris
10. Barn Owl Tyto alba
11. Common Screech Owl Otus asio
12. Ferruginous Pygmy Owl Glaucidium brasilianum
13. Lesser Nighthawk Chordeiles acutipennis
14. Black-chinned Hummingbird Archilochus alexandri
15. Anna's Hummingbird Calypte anna
16. Gila Woodpecker Melanerpes uropygialis
17. Golden-fronted Woodpecker Melanerpes aurifrons
18. Ladder-backed Woodpecker Picoides scalaris
19. Western Kingbird Tyrannus verticalis
20. Cassin's Kingbird Tyrannus vociferans
21. Wied's Crested Flycatcher Myiarchus tyrannulus
22. Ash-throated Flycatcher Myiarchus cinerascens
23. Rough-winged Swallow Stelgidopteryx ruficollis
24. Green Jay Cyanocorax yncas
25. Common Raven Corvus corax
26. Verdin Auriparus flaviceps
27. Northern Mockingbird Mimus polyglottos
28. Long-billed Thrasher Toxostoma longirostre

29. Curve-billed Thrasher Toxostoma curvirostre
30. Crissal Thrasher Toxostoma dorsale
31. Black-tailed Gnatcatcher Polioptila melanura
32. Phainopepla Phainopepla nitens
33. Common Starling Sturnus vulgaris
34. Lucy's Warbler Vermivora luciae
35. Lichtenstein's Oriole Icterus gularis
36. Brown-headed Cowbird Molothrus ater
37. Cardinal Cardinalis cardinalis
38. Pyrrhuloxia Cardinalis sinuata
39. Indigo Bunting Passerina cyanea
40. Lazuli Bunting Passerina amoena
41. House Finch Carpodacus mexicanus
42. Olive Sparrow Arremonops rufivirgatus
43. Rufous-winged Sparrow Aimophila carpalis

SUBURBAN AND AGRICULTURAL (4%)

1. Black Vulture Coragyps atratus
2. Rock Dove Columba livia
3. Inca Dove Scardafella inca
4. Barn Swallow Hirundo rustica
5. House Sparrow Passer domesticus
6. Great-tailed Grackle Quiscalus mexicanus

NON-RIPARIAN (23%)

1. Turkey Vulture Cathartes aura
2. Red-tailed Hawk Buteo jamaicensis
3. Swainson's Hawk Buteo swainsoni
4. Ferruginous Hawk Buteo regalis
5. Harris' Hawk Parabuteo unicinctus
6. Caracara Caracara cheriway
7. Prairie Falcon Falco mexicanus
8. Common Bobwhite Colinus virginianus
9. Scaled Quail Callipepla squamata
10. Great Horned Owl Bubo virginianus
11. Elf Owl Micrathene whitneyi
12. Burrowing Owl Athene cunicularia
13. Long-eared Owl Asio otus
14. Poor-will Phalaenoptilus nuttallii
15. Pauraque Nyctidromus albicollis
16. White-throated Swift Aeronautes saxatalis
17. Lucifer Hummingbird Calothorax lucifer
18. Costa's Hummingbird Calypte costae
19. Gilded Flicker Colaptes auratus chrysoides
20. Say's Phoebe Sayornis saya
21. Horned Lark Eremophila alpestris
22. Purple Martin Progne subis
23. White-necked Raven Corvus cryptoleucus
24. Cactus Wren Campylorhynchus brunneicapillus
25. Canyon Wren Catherpes mexicanus
26. Rock Wren Salpinctes obsoletus
27. Bendire's Thrasher Toxostoma bendirei
28. LeConte's Thrasher Toxostoma lecontei
29. Loggerhead Shrike Lanius ludovicianus
30. Eastern Meadowlark Sturnella magna
31. Western Meadowlark Sturnella neglecta
32. Scott's Oriole Icterus parisorum
33. Varied Bunting Passerina versicolor
34. Brown Towhee Pipilo fuscus
35. Grasshopper Sparrow Ammodramus savannarum
36. Lark Sparrow Chondestes grammacus
37. Rufous-crowned Sparrow Aimophila ruficeps
38. Cassin's Sparrow Aimophila cassinii
39. Black-throated Sparrow Amphispiza bilineata

166 Total

(Information from A.O.U. 1958, Bailey 1928, Bent-various dates, Hubbard 1970 and 1971, Johnson et al. 1973[2], Johnson et al.-manuscript[3], Monson and Phillips 1964, Monson-personal communications, Oberholser 1974, Phillips et al. 1964, Rea 1977, Todd 1975 and undated, Wauer 1973, and Wolfe 1956)

[1] Haight, L.T. and R.R. Johnson. Paper presented at annual meeting of the Arizona Academy of Science, April 17, 1977.

[2] Johnson, R.R., S.W. Carothers and D.B. Wertheimer, 1973. The importance of the Lower Gila River, New Mexico, as a refuge for threatened wildlife. Unpubl. Rpt. to U.S. Fish and Wildl. Serv., Albuquerque. 53 p.

[3] Johnson, R.R., J.M. Simpson and J.R. Werner. Unpublished manuscript. Birds of the Salt River Valley, Maricopa Co., Arizona

Rio Grande Valley. Habitats up through desert grasslands were considered, stopping at the lower edge of woodland and forests. 127 (or 77%) of the 166 nesting species were in some manner dependent on water related habitat. Of this 77% dependent on water related habitat well over half, 84 of the 166 species, are completely dependent on water related habitat. Only 39 species are non riparian nesting birds. Thus, if water dependent habitats were completely destroyed in the Southwest (not including suburban and agricultural) we could completely lose 47% of our lowland nesting birds while only 23% of our lowland nesting species would probably not be affected. 43 (26%) of the 166 species would be partially affected. Granted, several of the species which are preferential riparian at lower elevations, such as the Western and Cassin's Kingbirds, extensively use non riparian habitat at higher elevations. Still, the overall populations of these species would diminish with the reduction or loss of riparian habitat at lower elevations. In a dissertation on "Historic Changes in the Avifauna of the Gila Indian Reservation," near Phoenix, Rea (1977) uncovered the following information. Through the use of archaeological, ethnographic and historic sources he found that 101 species breed or have bred on the reservation with 5 more species that probably bred and 7 species that could have bred, based on biogeographic distributions. During the past 100 years, 22 breeding species were extirpated of which 18 were related to the former riverine ecosystem. Six speices of non-nesting birds dependent on the Gila River, now dry, are also gone. At least 13 species have recently recolonized the area as a result of reestablishment of a depauparate form of the original riparian habitat. This newly established habitat has developed as a result of the use of the Salt and Gila Rivers for disposal of effluent from the Phoenix sewage treatment plants.

Others, e.g. Hubbard (1972) have pointed out the lack of attention given to song birds when designating threatened and endangered species. However, to our knowledge, ours is the first attempt to quantify the number of species threatened or endangered by practices which greatly modify or destroy riparian habitat.

Some proponents of water salvage projects have pointed out that many breeding species of the Southwest lowlands are at the northern limits of their range. This, of course, is an attempt to justify phreatophyte control, channelization, dam construction, grazing and other practices which reduce riparian vegetation and consequently riparian wildlife. The main populations are found in Mexico for a large percentage of the birds that also occur in the Southwest lowlands. Thus, it is argued, even complete loss of riparian and marshy habitat should cause no great problem at the total population level for that species. No argument could be further from the truth. The destruction of riparian habitat in northern Mexico is progressing at an alarming rate. One need but drive a few hundred miles south from the United States-Mexico border to observe the frantic rate at which Mexicans are draining their streams and clearing riparian forests and woodlands in an attempt to feed a rapidly expanding population. One reads with nostalgia Sutton's book, "At a Bend in a Mexican River" (1972). His accounts from travels in Mexico only four decades ago tell of ferrying across rivers such as the Rio Purificacion and of the lush growth in the Valley of the Rio Corona. The riparian groves along these rivers are being cut at a rapid rate to make room for houses and fields. Rivers throughout Mexico as well as the United States are being dammed to provide water for municipal and industrial use and for large irrigation projects.

Thus, the same basic stages of "development of natural resources" which took place in the United States during two centuries promise to occur in Mexico in a matter of decades. When adding the available improved technology to Mexico's great wealth of natural resources, synergism may result. This may effect an even greater cummulative ecological disaster in a much shorter period of time than we have experienced in riverine ecosystems in the United States. Thus, when evaluating the ecological health of riparian species we must approach the problem from the standpoint of a systems analyst. One may start with his or her area of responsibility whether it be a few yards of small stream or several hundred miles of a large river. However, we must be cognizant of the resources up and downstream from our area. We must show concern for the entire drainage system, even if primary responsibility for its management rests elsewhere. The managers of resource plots, cities, counties, states, and countries need to recognize that streams commonly flow thru lands in different ownership and across political boundaries.

MANAGEMENT RECOMMENDATIONS

1. <u>The riparian habitat is the most productive and possibly the most sensitive of North American habitats and should be managed accordingly</u>. Due to the complexity of riverine ecosystems, scientists have only recently

developed techniques to document the importance of these ecosystems to wildlife.

2. In addition to the importance of riparian habitat from an ecological standpoint, other values include:

(a) Recreational uses including hunting, fishing (Meehan et al. this symposium) and bird watching.
(b) Reservoirs for preservation of gene pools and to allow recolonization of areas hit by disasters such as forest fires, severe droughts and storms.
(c) Aesthetic values including painting, photography and just looking, listening, smelling, etc.

Thus, recreational, wildlife, and aesthetic values should be weighed against other values and alternative uses. This is especially important in land use planning for a habitat which has high pressures from alternative uses such as water for industrial and domestic purposes, irrigation, grazing and urbanization.

3. Use interdisciplinary teams, including recreation specialists, economists, etc., to develop improved means for determining wildlife values. This is especially important in figuring cost-benefit ratios for determining the best use for an area. We hope there will never be a need for putting a dollar figure on everything in order to establish its "value." (What is the value of 2 or 3 days vacationing along a streamside?) However, economic values have been placed, in part, on recreation such as hunting, fishing, and "general rural recreation" (Davis 1967, and Martin et al. 1974). Attempts to quantify these values should make them more competitive with other uses, such as those mentioned in No. 2 (above).

4. Finally, encourage investigations to clarify areas of knowledge which are currently poorly, if at all, known. We have discussed the complexity of riverine ecosystems and further reasons for the late development of this area of ecology.

Problems which need to be solved include:

(a) The minimum area and suitable configurations necessary to retain both plant and wildlife values in different riparian habitats.

(b) The maximum distance which can separate islands of a given habitat type before the loss of wildlife species or a great reduction in populations occurs.

(c) Optimal as well as minimal requirements for enhancing wildlife values for a given habitat type. These include ground cover, trees and shrubs per hectare, foliage volume, plant species present, and disturbance types and frequencies.

We will close by quoting Carothers and Johnson (1975a),

> "Determining these factors may be the most important problem facing us today. All the 'threatened species recovery teams' we can possibly amass will not prevent many species from becoming extinct in their native habitat if we degrade their habitats past the point of no return."

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