

## Cottonwood Habitat for Birds in Colorado

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Photo: Verne E. Johnston from N. A. S.

As part of the native woody vegetation of Colorado, cottonwood trees are commonly found in the floodplain of rivers. Additional trees occur on the shores of reservoirs, along irrigation ditches, in areas of shallow water table, and often lining streets in towns. There has been much research in the western states during the past 50 years on the quantity of water that cottonwoods transpire (Meinzer, 1927; Robinson, 1958, 1964; Culler, 1970; McQueen and Miller, 1972). Most of the data has been collected to support water salvage programs that remove riparian vegetation. There has been little research on the ecological impact of such programs. It is the purpose of this paper to examine the extent and importance of cottonwood habitat for birds and to summarize the land use conflicts in Colorado.

### METHODS

This paper represents a review and synthesis of previously published research on cottonwood habitat. All issues of *Audubon Field Notes* and *American Birds* from January, 1947, to December, 1973, (Volumes 1(1)-27(6)) were searched for Colorado winter and breeding bird censuses. The number of bird species and density of individuals or breeding pairs were tabulated for each habitat type. Cottonwood habitat was compared to other habitat types from this tabulation.

To quantify some physical characteristics of Colorado cottonwood habitat, the area and perimeter of thirteen cottonwood groves along the Cache la Poudre River in Larimer County were measured from aerial photographs (U.S. Soil Conservation Service 1963 issue, 1m=7920m).

### RESULTS

#### *Physical Characteristics of Cottonwood Groves*

Harrington (1964:166) lists four species of cottonwoods (*Populus* sp.) as occurring in Colorado (Table 1). All are moisture-loving and grow especially well where the ground water table is near the surface. Plants that depend on the ground water table for their water supply have been called phreatophytes and are the main plants removed in water salvage programs. Robinson (1958:62) believes that cottonwoods are phreatophytes and will grow where the ground water table is within 30 feet (9 m) of the surface. Recent research, however, indicates that cottonwoods may not be true phreatophytes since they can obtain a considerable portion of their water requirements from the unsaturated soil zone (McQueen and Miller, 1972:49).

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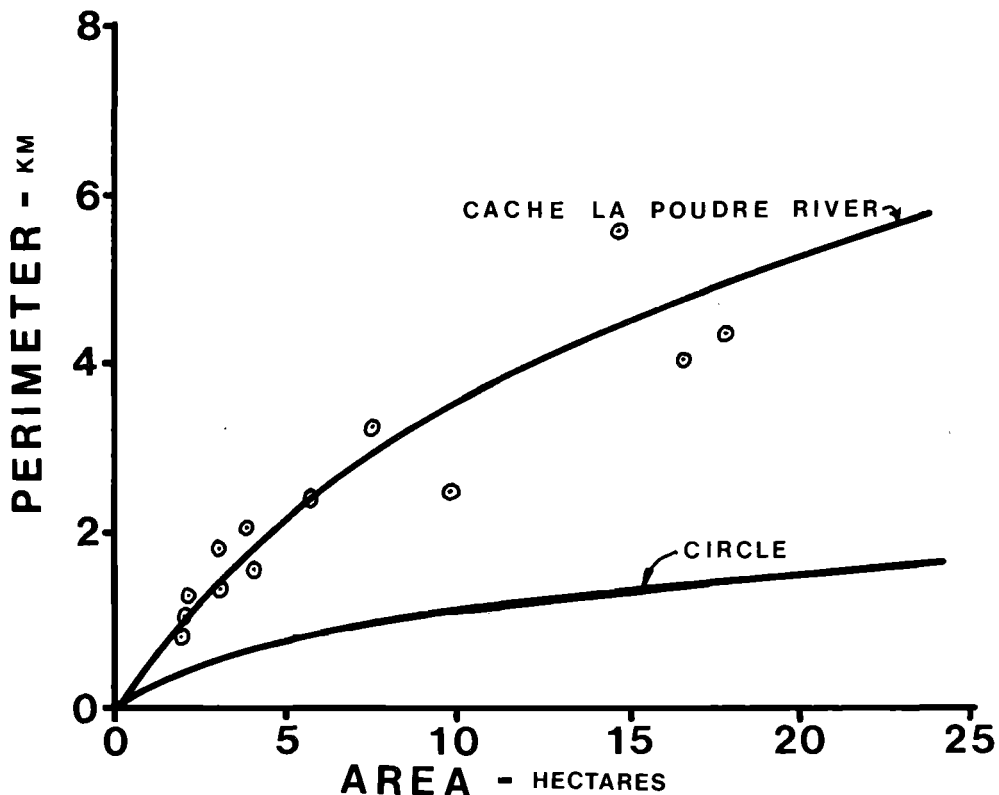


Figure 1. Area-Perimeter relationship for cottonwood groves.

Cottonwoods are fast-growing, short-lived trees (to 90 years), and intolerant of shade. Pistillate and staminate flowers (catkins) are borne on separate trees and develop early in the spring before the leaves (April-May). The seeds have long silky hairs which make them buoyant in a slight wind and disperse during June in eastern Colorado. Plains cottonwood seed is very small, with 250,000 to 479,000 seeds per pound (Fowells 1965:521).

The areal extent of various Colorado habitat types is given in Table 2 (Miller and Choate, 1964). Cottonwood habitat accounts for 400 km<sup>2</sup> (0.2 percent) of the total land area. Nine-tenths of this habitat is on private land. The estimate of cottonwood habitat is conservative since the sampling technique of Miller and Choate (1964) did not recognize areas smaller than 0.04 km<sup>2</sup> or widths less than 37 m. However, an increase in the total cottonwood area by a number of times would cause little change in its ranking with the other habitat types.

Figure 1 shows the area-perimeter relationship of the 13 plains cottonwood groves located along the Cache la Poudre River. The relationship for a circle is also shown for comparison since a circle has the smallest perimeter for a certain area. Any deviation from a circular shape increases the perimeter. The Cache la Poudre cottonwood groves have a much larger perimeter than for a similar circular area. This indicates that natural

cottonwood groves have a large edge effect and it is expected that bird species and production are high. Irregular perimeters and interspersed open areas add to the edge, but also make for good arrangement of habitat in relation to water.

A cottonwood grove on the South Platte River near Denver, Colorado, had 0.057 km<sup>2</sup> of trees interspersed with 0.041 km<sup>2</sup> of open area and a perimeter of 2440 m. The density of trees averaged 22,000 per km<sup>2</sup> (13,600-73,000 per km<sup>2</sup>) of which 0.3 percent were dead. The trees were 18-31 m tall with an average diameter of 0.36 m (to 1.02 m). This grove had a bird density of 1689 pairs per km<sup>2</sup> during the 1971 breeding season

#### *Bird Use of Cottonwood Groves*

The general characteristics of habitat use by birds in North America has been reviewed by Wiens (1973:241). He found that grassland birds average 4 species and 230 individuals per km<sup>2</sup>, desert birds average 7 species and 150 individuals per km<sup>2</sup>, shrub birds average 12 species and 1150 individuals per km<sup>2</sup>, and forest birds average 24 species and 1310 individuals per km<sup>2</sup>. Grasslands and deserts characteristically have few breeding species and low densities with little yearly variation. In contrast, shrub and forest habitat have a high average number of breeding species and density with wide yearly variations. These characteristics are reflected in the Colorado bird censuses.

**Table 1. Colorado cottonwood characteristics.**

	<i>Populus sargentii</i>	<i>P. angustifolia</i>	<i>P. acuminata</i>	<i>P. wislizenii</i>
Common name	Plains C.	Narrowleaf C.	Lanceleaf C.	Rio Grande C.
Occurrence	East Colo.	Central and West Colo.	Central and SW Colo.	Central and SW Colo.
Elevation (m)	1000-2000	1500-2500	1400-2600	1200-2100
Height (m)	20-30	15-20	10-20	12-30
Diameter (m)	1-2	0.5	0.5	1

The use of Colorado cottonwood habitat by birds was determined by examining numerous past censuses. Between January, 1947, and December, 1973, *Audubon Field Notes* and *American Birds* published 163 summer and winter censuses from various Colorado habitats.

A summary of the mean number of bird species and density by habitat types is shown in Table 3. Cottonwood habitat was used by a mean of 17.8 bird species during the breeding season with a density of 797 pairs per km<sup>2</sup>. Winter use was by a mean of 19.2 species and 620 individuals per km<sup>2</sup>. The cottonwood habitat can be seen to have bird densities well in excess of all other habitat types, except for plains ponds which concentrate waterfowl in winter, and city streets.

**Table 2. Colorado habitat types.**

Habitat Type	Land Area (km <sup>2</sup> )	Per cent Total Area
Non-forest (mainly plains)	177600	66.0
Pinyon-Juniper	18900	7.0
Fir-Spruce	15100	5.6
Chaparral	15000	5.6
Aspen	12700	4.7
Ponderosa Pine	9600	3.6
Lodgepole Pine	8700	3.2
Douglas Fir	5900	2.2
Other Forests	4500	1.7
Timber Pine	600	0.2
Cottonwood	400	0.2
Total	269000	100.0

The bird densities of the 32 summer and winter cottonwood censuses had a wide range of values (summer: 84-1690 pairs per km<sup>2</sup>; winter: 82-1790 individuals per km<sup>2</sup>). Some of the variation is owing to the quality of understory habitat. Grazing or land alterations for agriculture disturbed the understory in five of the eight summer censuses while three were undisturbed. Disturbed cottonwood breeding habitat had a mean of 13.6

species and 356 pairs per km<sup>2</sup> while undisturbed habitat had a mean of 24.7 species and 1530 pairs per km<sup>2</sup>. Seventeen of the 24 winter censuses had a disturbed understory while seven were undisturbed. Disturbed cottonwood winter habitat has a mean of 19.1 species and 563 individuals per km<sup>2</sup> while undisturbed habitat had a mean of 19.4 species and 757 individuals per km<sup>2</sup>.

Many of the 438 Colorado bird species recorded by Bailey and Neidrach (1965:8) are associated with cottonwood habitat. Over the past 8 years, Hugh Kingery (personal communication) has observed 218 species of birds within an area centered along 8 km of South Platte River cottonwood groves near Denver, Colorado. Beidleman (1948) found 99 bird species within a 0.61 km<sup>2</sup> Boulder Creek cottonwood grove after 250 hours of observation. In a later more extensive study, Beidleman (1954) recorded 187 species and subspecies of birds from 16 different cottonwood groves in northeastern Colorado. He concluded that cottonwood groves are one of the most productive habitats in northern Colorado and that overgrazing has an adverse impact on the bird life. In a recent study of birds in the Roaring Fork River watershed of Colorado, Wooding (1973) divided the habitat into 10 groups and determined the number of bird species using each: low elevation riparian (42), ponds (40), scrub oak (29), spruce-fir (29), douglas fir (26), pinyon-juniper (26), aspen (25), sagebrush (13), alpine (12), and high elevation riparian (5). The highest number of species was found in the low elevation riparian habitat which is composed mainly of cottonwoods.

The use of cottonwood habitat by birds and mammals has been documented for many species. Bock (1971) and Hadow (1973) studied the use of cottonwood habitat for breeding and feeding by Lewis' Woodpecker and Red-headed Woodpecker in Colorado. Western Wood Pewees and Barn Swallows have been observed catching drifting cottonwood seed in June. Beidleman (1954) considered the Black-billed Magpie, "Red-shafted" Flicker, and Black-

Table 3. Colorado habitat use by birds (1947-1973).

Habitat Type	SUMMER			WINTER		
	Number of Censuses	Average Number Species	Average Density (pr/km <sup>2</sup> )	Number of Censuses	Average Number Species	Average Density (no/km <sup>2</sup> )
Cottonwood	8	17.8	797	24	19.2	620
Aspen	1	11.0	297	—	—	—
Douglas Fir	5	9.6	182	7	10.1	265
Lodgepole Pine	8	10.2	183	10	9.5	213
Ponderosa Pine	18	14.4	349	22	16.0	361
Isolated Ponderosa Pine	—	—	—	4	2.5	0
Brush-Pine	8	11.1	380	9	20.0	402
Pinyon-Juniper	2	5.5	78	11	14.2	208
Grassland	2	4.0	119	4	9.2	19
Cultivated	3	4.7	124	1	21.0	284
City Park	—	—	—	7	16.9	366
City Street	1	13	1086	4	9.0	514
Plains Pond	—	—	—	4	13.0	15200

capped Chickadee to be the characteristic year 'round residents of cottonwood groves. The Colorado Division of Wildlife makes winter censuses of Bald Eagles along the riparian stands of cottonwoods. Yeager (1959) found that Colorado fox squirrels were dependent on cottonwoods for their survival.

## DISCUSSION

The information presented in Tables 2 and 3 and the research completed by others clearly establishes that cottonwood habitat is relatively scarce in Colorado, but that what is available is used heavily by many bird species for breeding, feeding and shelter. Because of its limited extent but large importance, cottonwood habitat is a significant wildlife management problem at present and will continue to be so in the future as land use becomes more intensive. Since nine-tenths of the Colorado cottonwood habitat is on private land, wildlife agencies have little direct control, but must rely on education and legal devices such as zoning or easements to maintain this choice habitat.

Grazing, gravel extraction, agricultural production, water salvage, flood control, dam construction and urbanization are competing land uses with production of cottonwoods for wildlife. It has been indicated above that overgrazing reduces the number and density of bird species. The grazing prevents the natural replacement of old cottonwoods by younger trees. Gravel extraction is common on many streams of eastern Colorado, especially where the streams leave the mountains and flow out onto the high plains. Cottonwood habitat is eliminated directly by the min-

ing operation or indirectly by lowering the water table. Cottonwood trees may grow back on the periphery of the operation if the necessary conditions exist, but commonly either a deep pit is left or the pit is filled with solid waste. Quite often gravel extraction completely excludes cottonwood trees.

The present world food problem also has an impact on cottonwood habitat. One way to produce more food in a world shortage situation is to remove cottonwoods and extend the cultivation closer to the streams. In general, the soil where cottonwoods grow is productive and close to water for irrigation.

Water for irrigation and other new consumptive uses is relatively scarce in Colorado during summer and fall months. Private and public entities have examined many ways to increase the amount of water available. One procedure which is being increasingly considered and has been used on a limited scale in the past is to remove streamside vegetation to decrease the amount of water transpired by phreatophytes. Studies of water use by cottonwoods indicate that their roots may penetrate into the water table and use 1.5 m<sup>3</sup> of water per square meter in one season (Meinzer, 1927:58; Robinson, 1958: 62). Recent studies, however, have shown that cottonwoods may not always be true phreatophytes (McQueen and Miller, 1972:49).

Riparian vegetation is beneficial in its contribution to stability of land and aquatic ecosystems. Removal of vegetation decreases shading of the ground, thus increasing evaporation, salt accumulation and erosion in the soil. Water use by riparian vegetation may be much less than predicted from tank studies because under natural

conditions the water table fluctuates and the water quality may be poor. Unfortunately, cottonwood trees are still considered as phreatophytes by engineers and the transpiration is classed as a non-beneficial water use by Colorado water laws.

In 1971, a Water Judge granted a valid water right for removal of riparian vegetation along the Arkansas River in Colorado. This water right is not subject to the normal priority system that regulates water use in Colorado since it was argued that by removing the vegetation, new water was created not previously available to other water users. Since this water right was granted, a few more have been applied for in the South Platte and Arkansas River basins. The recent research which questions some of the claimed savings and inclusion of cottonwoods in the phreatophyte class has not affected the water salvage plans nor been a factor in water right proceedings.

Dams and reservoirs destroy some cottonwood habitat, but the impact is decreased since often cottonwoods will reestablish groves along the shore. A larger potential impact exists with various flood control plans as proposed by the U.S. Army Corps of Engineers. One active plan includes a 161 km section of the Arkansas River between Pueblo, Colorado, and John Martin Reservoir. It was proposed in 1968 to straighten, dredge and channelize this section to prevent flooding in the floodplain and to salvage the adjacent land for productive uses. This plan would have eliminated much of the cottonwood habitat along this section of river. The Bureau of Outdoor Recreation, however, pointed out that all of the salvaged land could be purchased directly for less than the cost of the project and recommended restudy (U.S. Department of the Interior, 1969). On a smaller scale is the proposed channelization of 760 m of Fountain Creek near Pueblo, Colorado, which includes clearing of riparian vegetation, mainly saltcedar and willows.

Urbanization is a common threat to all wildlife habitat. Cottonwood habitat is affected by direct displacement and indirectly by alteration of the ground water. Urbanization should not be allowed to occur within floodplains, rather these areas should function as wildlife habitat and for passage of floods.

## SUMMARY

Cottonwood habitat in Colorado is relatively scarce, but very important for bird use. Most habitat is privately controlled and subject to

numerous land use conflicts. Agencies responsible for management of wildlife must become actively involved to maintain this habitat since present competing land uses are greatly diminishing the area of cottonwood groves. Water use and control have the greatest potential for adverse impact.

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