HABITATS AND NATURAL AREAS—SOME APPLICATIONS OF THE 1995–96 FOREST SURVEY OF ARKANSAS ON THE CONSERVATION OF BIODIVERSITY IN ARKANSAS

Douglas Zollner[1]

Abstract—The conservation status and trend of rare species groups should be better in landscapes with more forest cover due to the presence of quantitatively more habitat, and in the case of aquatic species, qualitatively better habitat. Arkansas provides habitat for 97 species of plants and animals considered critically imperiled globally or imperiled globally. These 97 species were grouped by broad taxonomic and habitat affinities. The ecoregional distribution, conservation status, and conservation trends of the species groups were analyzed in light of the 1995-96 Forest Survey of Arkansas.

INTRODUCTION

The status and trend of biodiversity conservation should be enhanced in more forested landscapes in relation to less forested landscapes. This expectation is due to the availability of quantitatively more habitat and the positive impact highly forested landscapes have on water quality. Arkansas currently provides habitat for 97 species of plants and animals that are considered critically imperiled globally or imperiled globally due to their rarity. Eight other species are known to have been extirpated from Arkansas but are still extant outside the State. Aggregated data on the conservation status and trends of these 97 species is used to represent biodiversity. The forest cover data from the 1995-96 Forest Survey of Arkansas is used to represent habitat.

A clearer understanding of the status and trend of rare species by ecoregion in relation to forest cover and trend data may reveal concerns or incipient challenges to the conservation of biodiversity and identify information and research gaps.

METHODS

The following 6 questions were asked:
1. What is the distribution of rare species types by ecoregion?
2. What is the conservation status by species type?
3. What is the conservation status by ecoregion?
4. What is the conservation trend by species type?
5. What is the conservation trend by ecoregion?
6. What is the implication of the Forest Survey data on each of the above questions?

A globally critically imperiled species has 5 or fewer known populations, and a globally imperiled species has 6 to 20 known populations. There are 105 critically imperiled or imperiled species known from Arkansas, although 8 are no longer extant. Extinct species were also excluded from the analysis. The 97 rare species were grouped in 4 broad taxonomic classes and 1 functional habitat class. These classes include plants and animals. Animals were further divided into vertebrates and invertebrates. Due to the high percentage of rare species that have aquatic-based life cycles, this further group was developed and also comprises plants and animals.

The data generated in the 1995-96 Forest Survey of Arkansas has been broken down by generalized ecoregions, the boundaries of which follow county borders. These ecoregions include the Ozark Highlands, Ouachita Mountains, West Gulf Coastal Plain, and Mississippi River Alluvial Plain. Forest cover and trend data expressed as percent cover and percent increase in cover by ecoregion are shown in table 1 (Rosson and others, unpublished data).

Using natural history references, Arkansas Natural Heritage Commission rare species occurrence data (ANHC 1996), and personnel field experience, each species was assigned

Table 1—Summary of species type by ecoregion

Species type	Ozark Uplands	Ouachita Mountains	Coastal Plain	Alluvial Plain
Total	54	45	25	17
Extirpated	5	4	2	2
Plants	9	13	4	4
Animals	45	32	21	13
Vertebrates	8	14	3	5
Invertebrates	37	18	18	8
Aquatics	37	20	14	12
Forest cover (percent)	60	73	78	23
Forest trend (percent)	+2.1	+5.0	+5.0	+2.3

[1] Director of Conservation Science, The Nature Conservancy, Little Rock, AR.

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to ecoregions by known range. Many species inhabit more than one ecoregion.

A conservation status of satisfactory, unsatisfactory, critical, or unknown was developed for each species (Zollner and others, unpublished data) and aggregated by type. A satisfactory status means five or more conserved populations. A conserved population is a species that the landowner knows about and is managing for accordingly. Unsatisfactory means one to four conserved populations and critical none. A table was then developed to compare conservation status and forest cover data by ecoregion.

A conservation trend of stable, improving, declining, or unknown was developed for each species (Zollner and others, unpublished data) and aggregated by type. A table was then developed to compare conservation trend and forest cover data by ecoregion.

RESULTS

What is the Distribution of Rare Species Types by Ecoregion?

Table 2 shows the distribution of rare species by type. More than 80 percent of the rare species are animals, and, of the animals, fully 75 percent are invertebrates. Nearly two-thirds of the species are aquatic and therefore depend on the maintenance of high-water quality and hydrologic regime for the completion of their life cycles. These factors should be enhanced in more heavily forested landscapes. Table 1 shows the distribution of rare species groups and forest cover by ecoregion (Rosson and others, unpublished data). Most of the rare species are located in the Ozark and Ouachita uplands with substantially fewer in the Alluvial and Coastal Plains. Rarity is due to evolutionary history, as well as recent habitat loss and ecosystem process modification. The highlands represent an old landscape with many conservative and endemic species. Conservative species have narrow habitat niches that are very susceptible to alterations due to scarcity across the landscape. The Coastal and Alluvial plains are relatively young landscapes with few conservative species that require unusually narrow habitat niches but have been subject to extensive habitat alteration.

What is the Conservation Status by Species Type?

Table 3 shows conservation status by species type. As can be seen in the table, it is relatively good to be a rare plant. Most rare plants have a conservation status that is satisfactory. Alternatively, it is not good to be a rare invertebrate or a rare species with an aquatic life cycle. Rare invertebrates and species with aquatic life cycles suffer a high proportion of unsatisfactory and unknown conservation status. The conservation status of animals, as a group, is lowered by the high number of rare fish (aquatic life cycle) with unsatisfactory conservation status.

Table 2—Summary of rare species by type

Rare species	Total	Extirpated	Extant	Aquatics
All species	105	8	97	60
Plants	22	2	20	5
Animals	83	6	77	55
Vertebrates	21	2	19	11
Invertebrates	62	4	58	44
Aquatics	62	2	60	—

Table 3—Conservation status by species type

Species type	Satisfactory	Unsatis-factory	Critical	Unknown
Total	36	12	8	41
Plants	13	2	1	4
Animals	23	10	7	7
Vertebrates	7	6	2	4
Invertebrates	16	4	5	33
Aquatics	16	10	6	28

What is the Conservation Status by Ecoregion?

Table 4 shows conservation status by ecoregion and the forest cover and trend data from the 1995-96 Forest Survey of Arkansas (Rosson and others, unpublished data). As could be expected, the conservation status of rare species in the Delta is poor. Massive habitat loss, a low percentage of forest cover, and poor water quality characterize the Mississippi River Alluvial Plain. Of the rare species with a known conservation status, nearly half are unsatisfactory or critical. Forty percent of the species have a conservation status of unknown.

The situation is reversed in the Ouachita Mountains. A large percentage of the landscape is forested, and the water quality is high. Consequently, as could be expected, nearly three-quarters of the rare species with a known conservation status are satisfactory. Only 20 percent of the rare species have a conservation status of unknown. This is most likely due to the large amount of Federal land in the Ouachita National Forest that has been consistently inventoried and studied.

The Ozark Highlands fit somewhere between the Ouachita Mountains and Delta landscapes. Less forested than the

Table 4—Conservation status by ecoregion

Conservation status	Ozark Uplands	Ouachita Mountains	Coastal Plain	Alluvial Plain
Satisfactory	14	24	4	5
Unsatisfactory	5	7	4	3
Critical	4	2	2	3
Unknown	26	8	13	6
Forest cover (percent)	60	73	78	23
Forest trend (percent)	+2.1	+5.0	+5.0	+2.3

Ouachitas but more so than the Delta, 60 percent of the rare species with known conservation status are in satisfactory shape. The large number of unknowns in the Ozarks may be explained by the high proportion that is also troglobytic. It is simply more difficult to study and analyze species that spend their life cycles underground.

The surprise shown by table 4 is the situation on the West Gulf Coastal Plain. More highly forested that the Ouachita Mountains, unexpectedly on the West Gulf Coastal Plain, 60 percent of the rare species have a known conservation status of unsatisfactory or critical. More than half the rare species have an unknown conservation status. The situation can be partially explained by the lack of inventory and research on rare species on private lands. There is relatively little Federal land on the Gulf Coastal Plain.

What is the Conservation Trend by Species Type?

Conservation trend is the direction that the population of a species is moving. Status and trend are both critical but independent variables. A species with a critical status may have an improving trend and a species with a satisfactory status may be declining. Table 5 shows conservation trend by species type. The large number of unknowns provides so much noise that little information can be gleaned from this table beyond the paucity of information about the population trends of rare species. It is somewhat better to be a plant or a vertebrate animal than an invertebrate or aquatic species. This situation may be partially explained by the differences in relative ease of study.

What is the Conservation Trend by Ecoregion?

Table 6 shows the conservation trend of rare species by ecoregion. This table shows that, as may be expected, conservation trends are good in the highly forested Ouachita Mountains. Eighty-five percent of the rare species that have known trends are stable or increasing. The Ouachita Mountains also have a relatively high percentage (65) of rare species with known conservation trends. The conservation trends for rare species are also good in the Ozarks, but the high percentage (78) of unknowns is worrisome. The large number of unknowns in the Ozarks is probably due to the high percentage of rare species that live underground. Conservation trends on the Coastal and Alluvial Plains are mixed with a high proportion of unknowns. On the heavily forested West Gulf Coastal Plain, fully 70 percent of the rare species conservation trends are unknown. This is likely due to the small amount of land in Federal ownership.

Table 5—Conservation trend by species type

Species type	Stable	Improving	Declining	Unknown
Total	29	5	7	56
Plants	11	2	2	5
Animals	18	3	5	51
Vertebrates	7	2	2	8
Invertebrates	11	1	3	43
Aquatics	13	1	4	42

Table 6—Conservation trend by ecoregion

Conservation trend	Ozarks Uplands	Ouachita Mountains	Coastal Plain	Alluvial Plain
Stable	8	21	3	4
Improving	1	2	2	1
Declining	2	4	2	1
Unknown	38	14	16	9
Forest cover (percent)	60	73	78	23
Forest trend (percent)	+2.1	+5.0	+5.0	+2.3

CONCLUSION

The hypothesis that more forest cover may be good for the conservation of biodiversity cannot be confirmed with the data analyzed. Although the predicted pattern holds for the Ozark Highlands, Ouachita Mountains, and Mississippi River Alluvial Plain, the data for Arkansas's most heavily forested landscape, the West Gulf Coastal Plain, is decidedly mixed. This is most likely due to the lack of biodiversity information for large blocks of industrial forest land. The large percentage of rare species with unknown conservation status and trend information overwhelms much of the analysis.

There is an opportunity and challenge here in working with forest industry to determine the effects of good forest management on the maintenance of biodiversity. In 10 years, after the next forest survey, the conservation status and trends of rare species on the West Gulf Coastal Plain should be known. It should be proven that the conservation of biodiversity across the landscape is compatible with industrial forest management when best management practices are used.

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REFERENCES

Arkansas Natural Heritage Database. 1996. Element Occurrence Data. Biological Conservation Database.

Rosson, James R., [and others]. [Written in 1997.] Preliminary data, 1995-96 forest survey of Arkansas. [Unpublished draft on file: Starkville, MS: USDA Forest Service, Southern Research Station, Forest Inventory and Analysis Research Work Unit.]

Zollner, Douglas [and others]. [Written in 1996.] Arkansas Report on G1 (critically imperiled) and G2 (imperiled) Species; 1996 update. [Unpublished draft report on file: The Nature Conservancy, Arkansas Field Office.]