

STATUS OF BEAVER IN SOUTH CAROLINA AS DETERMINED BY A POSTAL SURVEY OF LANDOWNERS¹

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ABSTRACT

*In 1975, a postal survey of 4,500 landowners was conducted in South Carolina concerning the presence of beavers (*Castor canadensis carolinensis*) on their property. Of the 956 questionnaires returned, 239 (25 percent) confirmed the presence of beaver activity. During the past 10 years beaver populations have increased significantly in the Savannah and Pee Dee River drainages and currently they are distributed in 28 of the 46 counties in the state. Beavers inhabit 747 kilometers of stream and/or lake shoreline and affect a minimum of 7,138 hectares of bottomland. Total estimated damage loss to forestry and agricultural interests in 1974 exceeded benefits by \$225,000. Coordinated efforts by the S. C. Wildlife & Marine Resources Department, the S. C. Forestry Commission, and Clemson University to develop a beaver management program are currently in progress. The overall objective of this program will be oriented towards total utilization of the beaver resource.*

Where significant populations exist, the status and ecology of the beaver have been investigated in all of the southeastern states except South Carolina (e.g. Bailey 1954, Engle 1954, Beshears 1967, Larson 1967, Arner et al. 1969, Linscombe 1974, Godbee and Price 1975). Several of these states have participated in relocation programs during the last 30 years. These programs, combined with the natural dispersal patterns of the beaver, have resulted in major range extensions of the species. Population levels have increased to the point where in many areas the beaver is considered a pest animal. The management of beaver pond habitats may produce beneficial results, however, excessively high populations can cause significant losses to forestry and agribusiness production (Anonymous 1967, Moore 1967, Hill 1976).

In a recent survey, Hill (1976) reported on the status of beavers in 10 southeastern states. Information was not available for all states but minimum estimates indicated 161,877 hectares (ha) of flooded timberlands and \$7,000,000 damage as a result of beaver activity during the past decade.

The beaver was apparently eliminated from South Carolina during the early 1800's as a result of trapping and loss of habitat through the clearing of land for agricultural production (Logan 1859:54, Penney 1949). In 1940 six beavers from Georgia were relocated into the Carolina Sandhills National Wildlife Refuge in Chesterfield county (T. Shell pers. comm.). By 1945, the refuge population was estimated at 50 beavers (Salzer 1946). During this same period, beaver from populations in Georgia dispersed across the Savannah River into South Carolina (Golley 1966:88). By the mid 1960's Golley (1966) reported beaver were established in 12 of the 46 counties in the state.

Several of the natural resource agencies in South Carolina have received an increased number of inquiries relating to beaver damage problems in recent years. Because there was no information concerning the current status and ecology of the beaver in South Carolina, personnel at Clemson University initiated a series of research projects on beaver pond ecosystems in 1973. An initial objective was to determine the distribution, economic impact and landowner attitudes regarding beavers on their property. This paper

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summarizes the major results of an extensive postal survey of South Carolina landowners in 1975.

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METHODS

A questionnaire was prepared by the modification and expansion of a survey form written by E. P. Hill, Alabama Cooperative Wildlife Research Unit, Auburn University. Special efforts were made to design the questions so that responses could be indicated by a check mark or by providing a numerical value. Questions covered a variety of potential interactions between the landowner, his property and the resident beaver population. We were primarily interested in obtaining information on the statewide distribution of the beaver, benefits and/or damages received, types of habitats and number of hectares of land affected, economic impact, control efforts and the overall attitude of landowners toward beavers. Additional information included: years beavers were present on the property, kilometers of streams affected, types of construction activities, number of colonies and the major land-use practices on the property of each respondent reporting beaver activity. A copy of the questionnaire is available upon request from the senior author.

A total of 4,500 questionnaires was distributed to landowners through the assistance of the S. C. Cooperative Extension Service (n=350), the S. C. Forestry Association (n=700) and a 1973 tax list of landowners who owned over 202 ha (500 acres) of property in the state (n=3,400). The senior author also distributed 50 questionnaires to property owners while trapping beavers for ecological studies (Woodward 1977). Available lists of names were checked for duplication. A self-addressed stamped envelope was enclosed for return of the form.

In order to calculate the number of positive returns (landowners reporting beaver activity) as a percent of the total distributed, we requested the return of all survey forms. Individuals who returned incomplete questionnaires were re-contacted by mail or telephone. To determine the proportion of exaggerated damage claims (Hacker 1953), on-site ground truth checks were conducted on approximately 25 percent of the returns positive for the presence of beaver.

Data from completed questionnaires were analyzed by a computer program (Fortran IV) written by B. P. Gaffney. Although the information was tabulated by county, the following results are presented on a statewide basis.

RESULTS AND DISCUSSION

Return of Questionnaires

Of the 956 questionnaires (21 percent) returned, 239 (25 percent) were from landowners reporting beaver activity on their property. These positive responses comprised the data base from which the following results were obtained. The extension Service/senior author distribution was the most effective method of reaching landowners with beavers on their property. This was expected because questionnaires were forwarded, with few exceptions, to landowners who were known to have resident beaver populations. The return rate from the S. C. Forestry Association membership list was 20 percent, of which 33 percent reported beaver activity. Twenty-one percent of the landowners sampled from the 1973 tax list returned the questionnaire; 15 percent of the returns from this group indicated beaver activity.

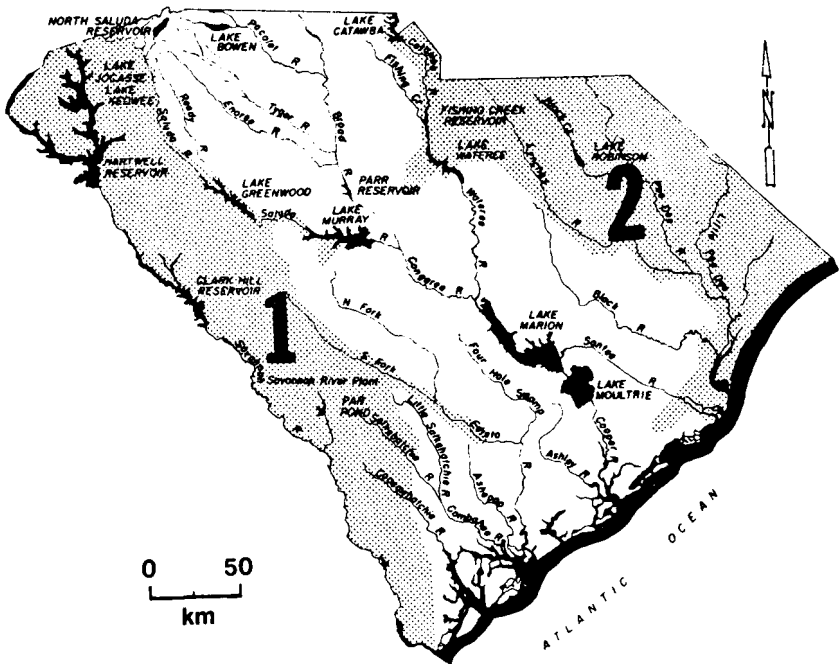
The relatively successful return rate of the questionnaires was probably due to the postage-paid envelope included with each survey form. It is important to emphasize that not all landowners in South Carolina with beaver on their property were contacted.

Therefore, the following results reflect sampling intensity and should not be interpreted as representing total state values. We also recognize the biases associated with damage/benefit estimates as many of the forms were given to landowners with known beaver problems.

Current Range in South Carolina

The beaver's range has increased markedly since Golley's 1966 estimate of its distribution in 12 counties in South Carolina. We have documented that beavers are currently present in a minimum of 28 counties in the state. There may be additional counties which have beaver colonies, but if so, we believe their population levels are low and their effects minimal. The most important drainage systems affected are the Savannah and the Pee Dee (Fig. 1). In addition, there are small populations of beaver on the Edisto, Santee and Saluda Rivers.

Figure 1. The distribution of beaver (shaded area) in South Carolina as determined by a 1975 postal survey of landowners. (Base map prepared by the S. C. Water Resources Commission; (1) = Savannah River drainage basin, (2) = Pee Dee River drainage basin).



Land Resources Survey and Categories Affected

Over 1,618,000 ha of land in South Carolina were included in the questionnaire survey. This represents approximately 21 percent of the total land base of the state. The total number of hectares owned or managed by the 239 respondents that indicated beaver activity was 843,916 ha and ranged from 0.4 ha to 196,633 ha for individual tracts.

To facilitate comparisons, the land areas owned by each respondent were placed into one of eight size classes (Table 1). The majority of the returns were from tracts larger than 202 ha in size. This was a result of the large number of positive returns (44 percent of total)

received from the 1973 tax list mailing. Respondents were asked to indicate the principal land-use practice on their property. Timber production was the most important single land-use reported (22 percent) followed by farming (14 percent), livestock (11 percent) and other (10 percent). A large proportion of the landowners (43 percent) indicated their land was used for more than one purpose.

Because beavers often forage over land to locate food and construction material, landowners were asked to estimate both the amount of area flooded (Table 2) and the total area affected by beaver activity. Timberlands comprised 89 percent of the 4,444 ha of land flooded by beavers. Over 85 percent of the total hectares of land flooded was reported from bottomland areas along the Pee Dee and Savannah River floodplains. This is important because several major timber companies in South Carolina own or lease property in these areas for the production and harvest of commercially valuable species of trees.

A total area of 7,138 ha was estimated by 239 respondents to be affected by beaver in the state. On the average, 30 ha of area (range 0.2 ha to 405 ha) were influenced by beaver activity per respondent. A total of 747 kilometers (km) of stream and/or lake shoreline (range 0.8 km to 64.0 km) were estimated to be inhabited by beavers.

Table 1. Number and size of tracts with beaver activity as reported by 239 landowners in South Carolina.

Size Class		Number of Landowners	(%)
hectares	acres		
<20	(<50)	14	(6)
21 - 40	(51 - 100)	19	(8)
41 - 101	(101 - 250)	23	(10)
102 - 202	(251 - 500)	32	(13)
203 - 404	(501 - 1000)	53	(22)
405 - 1214	(1001 - 3000)	55	(23)
1215 - 4047	(3001 - 10000)	21	(9)
>4047	(>10000)	22	(9)

Table 2. Number of respondents indicating hectare land-use types flooded by beaver in South Carolina.

Land-use Type	Number of Respondents	Total Hectares Flooded	Percent of Total
Timber	180	3935	89
Crops	45	262	6
Pasture	69	239	5
Other ¹	3	8	trace
Total	197	4444	100

¹includes power line right-of-way, roads, etc.

Damage and Benefit Interactions Reported

Seventeen potential interactions were questioned concerning types of benefits and/or damages received from the activity of beavers. To encourage careful reading of each possible interaction, the types were inter-mixed on the survey form.

Each possible interaction was checked by at least one respondent. The number and percent of responses are presented in Table 3. Overall, more damage interactions were checked by a greater percentage of respondents than benefit types. In particular, girdling and flooding of timber, two of the most readily observed activities of beavers, were reported by 90 and 64 percent of the landowners, respectively. Other significant damages reported included: (1) blocking of culverts (34 percent), (2) flooding of pasture (23

percent), (3) flooding of roads (21 percent), and (4) damage to fish ponds by blocking the overflow pipe (21 percent).

Although most respondents checked one or more damage interactions, 24 percent indicated beneficial usage of beaver ponds for waterfowl hunting and aesthetic enjoyment. An additional 18 percent of the respondents used beaver ponds for sport fishing. Less than 4 percent of the landowners stated that they trapped beaver for recreational and/or monetary benefits. This trend may reflect the overall situation in the Southeast and is probably due to a declining number of skilled trappers and/or low beaver pelt prices.

Table 3. Responses of landowners concerning damages and/or benefits received from beavers on their property.

	<i>Potential Interaction</i>	<i>Number of Respondents Affected</i>	<i>Percent of Respondents Affected</i>
Damage Type:	Girdled timber	213	90
	Flooded timber	154	64
	Blocked culverts	82	34
	Flooded pasture	54	23
	Flooded crops	51	21
	Flooded roads	51	21
	Damaged fish ponds	49	20
	Fed on crops	31	13
	Decreased livestock water	7	3
	Benefit Type:	Provided waterfowl hunting	57
Provided aesthetic enjoyment		57	24
Provided fishing		42	18
Provided recreational trapping		8	3
Increased livestock water		6	2
Provided irrigation water		5	2
Monetary return from fur		1	trace
Used meat for food		1	trace

Economic Impact of Beaver

For an evaluation of the monetary impact beavers were having in South Carolina, respondents were asked two questions: (1) "What was the estimated dollar damage caused by beavers during the previous year (1974)?" and (2) "What was the estimated dollar damage for the total number of years beavers have been present on your property?"

Answers from 157 usable returns (respondents reporting a numerical figure of \$0. or greater) indicated damage in 1974 ranged from no damage to \$50,000; total damage value estimated was \$256,755. For the total number of years beavers had been present on their property, 165 landowners estimated a total damage figure of approximately \$1.5 million and individual losses ranged from no damage to \$200,000. Eighteen percent of the respondents indicated they could not estimate the cost of beaver damage although losses were apparent.

Landowners were also asked to estimate the monetary benefits gained from beaver activity on their property. Only eight questionnaires indicated a dollar figure greater than zero for each part of this question. Total benefits gained by these eight landowners was approximately \$32,000 (range \$50 to \$30,000) for the year 1974 and \$304,000 (range \$100 to \$300,000) for the total number of years beavers had been on their property. The single highest estimate by a respondent indicated their benefit was due to increased ecological diversity which in turn provided a 'unique educational opportunity'. An additional 19 landowners recognized a monetary benefit but were unable to estimate a dollar value.

In Colorado, Hacker (1953) found the majority of reported damage claims were either exaggerated or non-existent. We conducted ground truth checks regarding damage claims on the property of 50 landowners. Forty claims were substantiated by the interviewer as reasonable estimates of damage incurred as a direct result of beaver activity. These ranged from a loss of \$50 for two imported ornamental trees felled by beaver, to a loss of \$30,000 from flooding of a 61 ha bottomland agricultural area over a period of 10 years. Three claims were exaggerated, but three other claims were underestimated because of the landowners' lack of familiarity with the actual extent of damage to their property. The remaining four claims could not be properly verified because of difficulty in placing a dollar amount on the loss of aesthetically valuable trees and shrubs. The sampling of investigated damage claims indicated the majority of those landowners claiming monetary loss actually sustained a loss comparable to that claimed.

Potential extensive losses of bottomland hardwood species is greatest on the lands within the floodplains of the Savannah and Pee Dee Rivers. It was from these areas that the highest damage claims in both total area flooded and monetary loss occurred. Hundreds of hectares of seasonally-flooded bottomlands are presently kept inundated throughout the growing season by beaver dams which are often less than 0.5 meter high. Effective beaver control in these areas is made more difficult by the extended foraging range of the animal.

Control Methods

Various methods of beaver control were attempted by 123 landowners. Trapping was the most successful method employed for the removal of nuisance animals (Table 4). Shooting and dynamite were also frequently used but the results were less satisfactory. No attempts to poison or chemically repel beaver were reported. Successful control methods included: (1) persistent breaking of dams, (2) installation of electric "shocker" fences, (3) mechanical elimination of food sources, and (4) the use of dogs to discourage the continued presence of beaver activity.

Two landowners reported excellent control of beaver by hiring professional trappers. Of those respondents who attempted to control beaver by trapping, 60 percent used conventional jaw-traps. The remainder used the #330 Conibear. However, during personal interviews with landowners, very few indicated knowledge of this trap.

Sixty-three percent of the respondents stated they would prefer to have all beavers removed from their property, but 26 percent wanted no removal or were undecided. Of those desiring removal, 84 landowners stated they would be willing to pay an average of \$8.75 per beaver (range \$1. to \$30.), \$8.62 per affected hectare (range \$2. to \$30.), or both for effective control. Sixty-eight landowners indicated they would pay for removal of beaver from their property but did not state an amount.

When asked the question, "Would you be willing to devote some of your land to beaver and associated benefits such as waterfowl hunting, fishing and increased wildlife diversity?", 56 individuals (23 percent) responded positively and of these, 42 (75 percent) indicated they would be interested in technical assistance in developing such an area. In addition, seven landowners expressed an interest in the relocation of beaver onto their property.

Table 4. Methods of beaver control and success rates as reported by 123 landowners in South Carolina.

<i>Control Methods</i>	<i>Attempts</i>	<i>(%)</i>	<i>Successes</i>	<i>(%)</i>
Trap	48	(42)	19	(40)
Shoot	50	(44)	10	(20)
Poison	—	—	—	—
Dynamite	46	(40)	6	(13)
Other ¹	29	(25)	11	(38)

¹see text for examples.

MANAGEMENT IMPLICATIONS

Our survey has established that beavers have significantly extended their range and increased their population in South Carolina. We believe the environmental and economic impact of this expansion has not been fully realized. Extensive tracts of suitable habitat remain unoccupied within the interior portion of the state. However, in many areas of South Carolina presently inhabited by beaver, detrimental effects have exceeded reasonable economic thresholds. This indicates that an effective management program is needed.

In 1975, the Forestry Study Committee of South Carolina recommended the implementation of a cooperative management program for beaver as soon as feasible (Wallinger 1976). Coordinated efforts by the S. C. Wildlife & Marine Resources Department, the S. C. Forestry Commission, and Clemson University to develop such a program are currently underway. The overall objective of this program will be oriented towards total utilization of the beaver resource. In particular, it will emphasize: (a) the education of the landowner relative to the benefits and/or damages received from beavers, (b) the establishment of a "loan system" for traps, and (c) the provision of technical assistance in the form of information, inspection and demonstration.

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