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Habitat Improvement Costs on State-Owned Wildlife Management Areas in New York

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Abstract

Estimates of management costs on New York State's wildlife management areas indicate that human-use management is more costly than habitat management. Agricultural agreements and timber sales make a major contribution to habitat enhancement, and a variety of wildlife species benefit.

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Introduction

There is little reliable information on the costs of providing wildlife-related recreational services. Much of the difficulty in securing such data is due to the inherent complexities in quantifying interrelationships between habitat and wildlife populations. The state of the art has not yet developed to the point where units of input can be specifically related to units of output, i.e., basic production functions usually are not well established. Even if reliable biophysical data were available, the level of human satisfaction attributable to various levels of wildlife populations is not clearly understood. As a result, production costs of wildlife enhancement cannot be readily expressed in terms of their influence on wildlife populations or related human satisfaction. There is a dearth of even more basic information on the costs of improving wildlife habitat. In this study, estimates of the costs of specific inputs to the wildlife production process are made.

It should be emphasized that the purpose of this study is not to facilitate benefit-cost analysis for public investment in wildlife habitat. Benefit-cost analysis has been used with varying degrees of success in natural resource planning, but has been most effective as a data-collecting system rather than a decision rule. The data inadequacies cited, the difficulties in specifying where wildlife-related benefits accrue, and the inappropriateness of expressing many wildlife-related values in monetary terms severely limit the usefulness of benefit-cost analysis to justify public investment in wildlife habitat improvements.

However, reliable estimates of the costs of specific wildlife management practices are needed for both public agency planning and budgeting, as well as the benefit of private individuals or organizations that wish to enhance wildlife populations through habitat improvement.

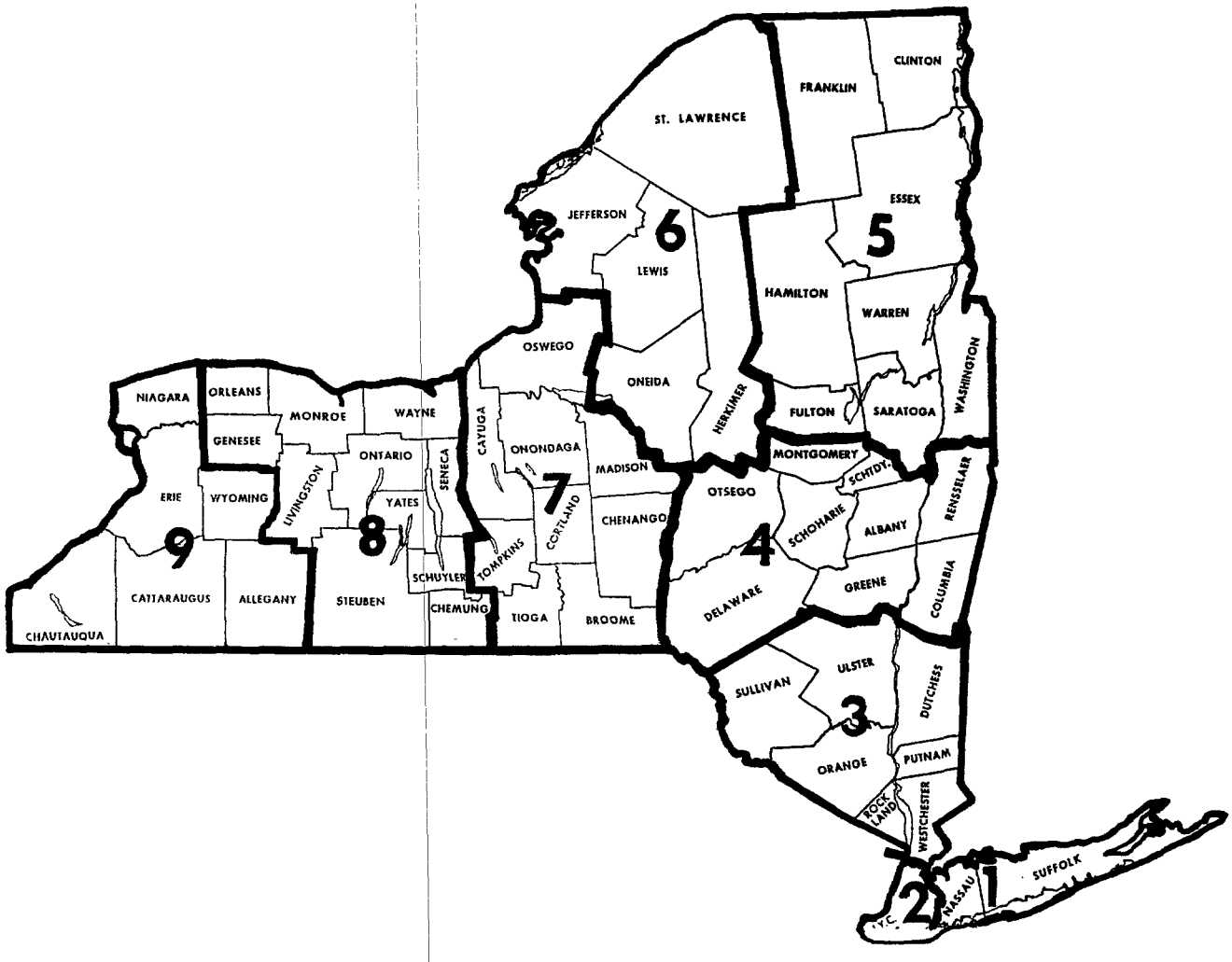

Figure 1.—New York State wildlife management regions.

This study concentrates on estimating the costs of specific habitat enhancement activities on New York State's wildlife management areas (WMA). Until research provides information specifying the changes in wildlife populations that are attributable to specific actions[1] and a better understanding is developed on the interrelationship between wildlife populations and human satisfaction, the results of this study can contribute to only one aspect of a complex issue.

The WMA within New York State are under the jurisdiction of the Bureau of Wildlife of the Division of Fish and Wildlife, Department of Environmental Conservation. The state is divided into nine autonomous regions, each of which has a regional wildlife manager (Fig. 1). Those regions with WMA have staff members with assigned responsibilities for their management. Within the context of the Bureau's overall responsibilities, the WMA have a relatively minor role in terms of budget and manpower assignments.

Methods

This study was conducted through a cooperative agreement between the Northeastern Forest Experiment Station and the New York State Department of Environmental Conservation. Initially, all seven of the New York Bureau of Wildlife regions which have responsibility for WMA were visited and data collected on size of areas, habitat management activities, and target species. Additional information on funding sources, aggregate costs, and the organizational structure were collected at the Bureau's headquarters in Albany and the Wildlife Resources Center in Delmar.

Specific data on inputs, costs, and outputs were collected during subsequent trips to the Regional Offices. In general, records were inadequate for a detailed cost analysis except for Region 7, which had more complete data for the 1984-85 fiscal year. Therefore, the more detailed cost analysis in this report is based upon Region 7 data for that fiscal year.

Conceptual Framework of Costs

A discussion of the conceptual framework of costs provides an opportunity to place various costs in the proper perspective with respect to the decisionmaking process. Costs can be separated into various categories for convenience, such as fixed and variable costs. Variable costs refer to those that change with the level of output over a relevant time period: fixed costs do not. Over long periods of time, all costs are variable, that is, mangement is not constrained by past decisions. As decisions are made that cannot be readily altered in the short run, some costs become fixed, i.e., they are absorbed regardless of changes in the level of output. Even if fixed costs are allocated over a period of time, they must be paid regardless of the quantity of goods and services produced. As a result, fixed costs are not germaine to the short-run decisionmaking process.

The managing agency can view fixed costs as given in the short run and concentrate on decisions that involve that portion of the budget which is not previously committed. For example, the orginal cost of land should not influence public agency management decisions relating to output during a given year since the decision for purchase and commitment of funds already has been made. The more important question relates to the additional benefits that will result from the commitment of additional inputs which can be expressed as costs.

The costs of managing WMA can be categorized as land procurement, capital improvements, and "maintenance and operation." Depending on the situation and time frame, elements of each category can be fixed or variable costs, though land and capital investments are more likely to be fixed in the short run.

Considering the purchase price of land as a cost of production is not particularly meaningful to the management of publicly owned lands such as state owned WMA. In some cases, land was received as gifts so there were no initial explicit costs. If land had been purchased, it would be possible to compound the initial investment cost over time and allocate a portion of the costs to specific time periods, but this information would not be particularly meaningful. Further, most lands probably have increased in market value since being procured by the state. In these cases, the state may have incurred only implicit costs such as opportunity costs.

Opportunity costs represent the value foregone when one course of action is chosen over another. If several alternatives are sacrificed, the one with the next highest value to the course of action chosen represents the opportunity cost. Opportunity costs are most often expressed in monetary terms but can be expressed by other measures. For example, the opportunity cost of a reclaimed agricultural land can be expressed in the acreage of wetlands lost. On the other hand, agricultural enterprises forsaken for the preservation of wetlands often can be expressed in monetary terms.

Opportunity costs can provide useful insights for habitat management if they are interpreted within the context of their limitations. For example, a logging plan in an unroaded area might be developed strictly on the basis of "economic efficiency" (i.e., maximizing net revenues) and then be altered to retain critical winter range for deer. The difference

[1]Wildlife populations also are affected when no managerial action (passive management) is taken because the environment is likely to change over time through such factors as natural vegetative succession.

in monetary value between the "economic efficient solution" and the alternative solution which retains the deer habitat is an opportunity cost. Leaving an area for winter deer cover would likely reduce total timber revenues and increase road costs per unit of output. The loss in net revenues that would result by selecting the alternative that retained the deer yard over the highest net income alternative is the opportunity cost. This is an oversimplification since the uncertainty of future events also must be brought into the decisionmaking process.

With respect to statutorily designated WMA, there are no opportunity costs at the Bureau of Wildlife operational level. Since the Bureau does not have the option to put the management areas into other uses, there can be no opportunity cost. However, there are opportunity costs within the management realm with respect to specific habitat management manipulations, such as eliminating mature forests to improve habitat for ruffed grouse. Again, these opportunity costs can be identified conceptually, but are difficult to measure in the absence of reliable data on the effects of habitat changes on wildlife populations and related human satisfaction.

Capital improvements such as roads, dams, dikes, and other fairly permanent factors of production are fixed costs once a commitment is made to construct or purchase them. As with all inputs, capital improvements are variable costs in the long run but become fixed once this commitment is made. As a result, capital improvement costs are relevant to the decisionmaking process over the period of the expected life of the improvement, but represent a fixed cost for shorter periods of time. When decisions are being made regarding the commitment of funds for capital improvements, costs must be compounded over the expected life of the improvement at the appropriate interest rate. Choosing an appropriate interest rate that reflects the opportunity cost of money and considers risk and uncertainty is a difficult and largely subjective task, and is beyond the scope of this report.

While the recovery of capital investment costs over time can be an important consideration in setting user fees for such facilities as campgrounds (Reiling and Anderson 1983, Gibbs 1980), it has no relevance with respect to state-owned WMA. The Bureau of Wildlife has not been given the mandate to recover these costs and does not charge fees for public use. As a result, the costs of capital improvements are relevant to long-range planning but do not enter into annual budgeting decisions once the initial commitments are made.

For the most part, maintenance and operating costs are variable costs, though they might be fixed under certain circumstances. The usual case is that outputs are sensitive to labor-related inputs and thus are in the category of variable costs. The inputs that are responsible for changing levels of output are paramount to short-run decisionmaking. Given the fixed factors of production, maintenance and operating costs have a direct relationship with the quantity of outputs. For example, the magnitude of the temporary workforce and availability of supplies can be the determining factor in the quantity of wood duck nest boxes that are installed during a 2-week period.

While the Bureau of Wildlife is involved in the budgetary process, its range of options diminishes as the process moves forward. Capital construction financing is appropriated by the legislature, which may appropriate additional funds or commit Conservation Fund monies. Even though operation and maintenance funds are administered by the Bureau, for the most part, it does not own machinery or do the work itself. Tasks are performed by the Department of Environmental Conservation, Division of Operations, which charges the Bureau for the use of its workforce, supplies, and machinery. However, it is difficult to trace costs to actual outputs. Each region submits a list of work priorities to the Division of Operations in the form of an annual "Maintenance, Rehabilitation and Development Plan," with the Division completing the selected tasks until funding is exhausted. In practice, tasks performed by the Division of Operations may be financed one fiscal year but accomplished in another fiscal year. The inability to clearly trace appropriations to accomplishments in any given year contributes to the complications of cost analysis for specific activities.

Management Activities

As an agency of the Department of Environmental Conservation, the Division of Fish and Wildlife receives funding from three sources: (1) a Conservation Fund, which includes license fees, permits, donations, fish and wildlife related fines and penalties, migratory bird stamp revenues, and Return a Gift to Wildlife, a state income tax checkoff donation program; (2) general fund appropriations by the legislature; and (3) federal aid funds such as those originating from the Pittman-Robertson Act. During the 1984-85 fiscal year, the Division of Fish and Wildlife budget was $24.7 million.

In 1985 there were 80 WMA comprising 174,227 acres within seven[2] of the nine Bureau of Wildlife regions (Table 1). Regions 1 (Long Island) and 2 (New York City) do not have such areas. Region 6 has the largest number of WMA, although not the greatest area devoted to this purpose. With respect to total acreage in WMA, Region 7 was the highest followed by Region 6.

The WMA in New York range in size from an acre to the 11,598-acre Connecticut Hill Wildlife Management Area in

[2]The Bureau of Wildlife manages the Rocky Point Natural Resources Area in Region 1 (Long Island), but it is not legally a WMA.

Table 1.—Number and total acres of state-owned wildlife management areas (WMA) by Region, New York, 1985

Region	Counties in region	Number of WMA	Number of acres in WMA
1	Nassau, Suffolk	None	
2	New York City	None	
3	Dutchess, Orange, Putnam, Rockland, Sullivan, Ulster	5	4,281
4	Albany, Columbia, Green Delaware, Montgomery, Otsego, Rensselaer, Schenectady, Schoharie	12	17,477
5	Clinton, Essex, Franklin, Fulton, Hamilton, Saratoga, Warren, Washington	9	12,430
6	Herkimer, Jefferson, Lewis, Oneida, St. Lawrence	18	40,247
7	Broome, Cayuga, Chenango, Cortland, Madison, Onondaga, Oswego, Tioga, Tompkins	13	53,789
8	Chemung, Genesee, Livingston, Monroe, Ontario, Schuyler, Seneca, Steuben, Wayne	13	33,813
9	Allegany, Cattaraugus, Chautauqua, Erie, Niagara, Wyoming	10	12,190
Total		80	174,227

Region 7 (Table 2). Slightly more than one-half of the state's WMA are less than 1,000 acres. The average size of WMA in this category is 256 acres; in total, they account for only 6 percent of the total acreage. The seven areas that exceed 7,000 acres contain over one-third of the total area in WMA. The average size of all WMA in New York is 2,178 acres.

Management activities on WMA can be divided into those concerned with improving habitat for wildlife and those related to human use. Some management activities can be of benefit to both categories, such as roads that provide access to facilitate habitat improvement work and also make these areas more accessible for hunters and other visitors.

A large proportion of the inputs and related costs allocated to WMA are designed to accommodate human use. Property-line boundaries are surveyed and marked. Roads, parking areas, paths, and bridges are constructed and maintained to improve human access. Gates and fences are installed in critical areas to control patterns of human use and protect vulnerable habitats from human encroachment. On some WMA, boat-launching sites are constructed and maintained. There also are observation sites, boardwalks, explanatory signs, and sanitary facilities. A few WMA have beaches that are maintained in natural condition but often used by the public for a variety of water-related sports. On most WMA, the activities associated with human use are far more time consuming and costly than those designed to improve wildlife habitat.

Efforts to improve habitat on WMA are designed to benefit a wide range of wildlife species. On a statewide basis, waterfowl were specified most frequently in the survey as the target of habitat enhancement. Wood ducks were mentioned as the target species in about one-third of the cases involving waterfowl. For species other than waterfowl, there was more diversity regarding the target species, with ruffed grouse and wild turkeys being named most often. By contrast, one area, Bog Brook in Region 3, was engaged in habitat improvement for the benefit of the bog turtle, an endangered species in New York. In many cases, habitat enhancement was designed to benefit a combination of several wildlife species with similar habitat requirements, such as certain associations of song birds. Some species such as the bluebird were given high attention regionally (Region 3) but were not a major concern statewide, largely due to the species' range.

Table 2.—Size distribution of New York's wildlife management areas (WMA), 1984

Area (acres)	Number of WMA	Acres in size class as percent of total	Total no. of acres	Average no. of acres per WMA	Percent of total acreage
0-999	41	51.3	10,486	256	6.0
1000-1999	8	10.0	11,273	1,409	6.5
2000-2999	7	8.8	16,582	2,369	9.5
3000-3999	7	8.8	24,941	3,563	14.3
4000-4999	6	7.5	27,669	4,611	15.9
5000-5999	2	2.5	11,137	5,569	6.4
6000-6999	2	2.5	12,430	6,215	7.1
7000 and over	7	8.8	59,709	8,530	34.3
Total	80	100.0	174,227	2,178	100.0

Specific habitat manipulation practices can be directed for the benefit of one species or group of species on a given WMA but the same practices are implemented for the benefit of different species on other WMA (Table 3). For instance, cropland leases to produce wildlife food were implemented on six WMA to benefit eight species or groups of species of wildlife, but the benefitting wildlife varied from area to area. Some activities such as mowing often are directed at a wide range of wildlife species, while others are designed to benefit a single species. Mowing, the most common habitat improvement practice, was conducted on 31 WMA; installing and maintaining nesting boxes on 29; maintaining water-control structures on 16; and timber sales to benefit wildlife on 12. In relative terms, habitat improvement was not a major effort on most of New York's WMA during the 1984-85 fiscal year, partly because of budget limitations.

Table 3.—Wildlife enhancement activities for benefit of target species, 1984

Enhancement activity	Number of WMA	Target species [a]	Number of WMA indicating target species
Agricultural			
Cattle grazing (goose pasture)	1	Canada geese	1
Cropland leases	6	Deer	4
		Hungarian partridge	1
		Wild turkey	2
		Waterfowl (general)	2
		Ruffed grouse	1
		Small game (general)	1
		Upland game (general)	1
		Upland furbearers (general)	1
Growing hay	3	Waterfowl	3
		Cottontail rabbits	2
		Hungarian partridge	2
		Song birds (general)	2
		Ground nesting wildlife (general)	2
		Ruffed grouse	1
Herbacious seedlings	1	Pheasants	1
		Waterfowl	1
Installing and maintaining nesting boxes	29	Wood ducks	23
		Bluebirds	5
		Mallards [b]	1
Vegetation control			
Mowing	31	Bluebirds	5
		Waterfowl (general)	17
		Wild turkey	5
		Ground nesting wildlife (general)	4
		Ruffed grouse	6
		Pheasants	2
		Upland game (general)	2
		Song birds (general)	3
		Deer	3
		Hungarian partridge	2
		Canada geese	2

Continued

Table 3 (Continued)

Enhancement activity	Number of WMA	Target species[a]	Number of WMA indicating target species
		Birds (general)	2
		Upland birds (general)	1
		Woodcock	1
		Henslow sparrow	1
		Cottontail rabbits	1
Brush clearing	2	Bog turtles	1
		Ruffed grouse	1
		Wild turkey	1
Clearing and bulldozing to create grass areas	1	Wild turkey	1
Controlled burn	3	Deer	1
		Wild turkey	1
		Waterfowl (general)	1
		Ground nesting wildlife (general)	1
		Upland game (general)	1
Herbicide treatment	1	Ground nesting wildlife (general)	1
Maintain open areas and edge	1	Deer	1
		Hungarian partridge	1
		Ruffed grouse	1
		Small game (general)	1
Tree and shrub planting	2	Deer	1
		Ruffed grouse	1
		Snowshoe hare	1
		Small game (general)	1
Timber sales	12	Deer	4
		Ruffed grouse	5
		Snowshoe hare	3
		Small game (general)	2
		Cottontail rabbits	1
		Raccoon	1
		Song birds (general)	1
		Furbearers (general)	1
Water Control			
Maintain dikes, dam, water-control structures	16	Waterfowl (general)	16
Manipulate water levels	3	Bog turtles	1
		Waterfowl (general)	2
		Wetland furbearers (general)	2
Repair potholes	6	Waterfowl (general)	6
		Small game (general)	1
Small marsh maintenance	3	Waterfowl (general)	3
		Muskrats	1

Continued

Table 3 (Continued)

Enhancement activity	Number of WMA	Target species[a]	Number of WMA indicating target species
Beaver dam water level management (piping)	2	Beaver	2
Maintain beaver populations	1	Waterfowl (general)	1
		Muskrat	1
		Mink	1

[a]Although specific actions may be undertaken for certain wildlife species, other species with similar habitat needs also benefit.

[b]Although not the typical situation, mallards use nesting structures on Howland Island Wildlife Management Area in Region 7.

Habitat Enhancement Costs

As discussed previously, the Bureau of Wildlife submits its annual "Maintenance, Rehabilitation, and Development Plan" for each WMA to the Division of Operations for implementation. The Bureau of Wildlife retains records of its work plans, the amount accomplished, and the estimated costs of those activities performed by the Division of Operations. While the actual budgetary allocations to the Division of Operations are known, accomplishments are based on cost estimates made by the agency staff. These estimates do not include the inputs of the Bureau of Wildlife for planning, supervising, monitoring, and the like.

Nonetheless, interesting insights are gained from the cost records maintained by the Bureau of Wildlife. It is noteworthy that no costs are incurred by the Division of Operations for two major habitat manipulation activities — agricultural agreements and timber sales. The most costly activity per acre ($349) was the general category of "habitat work" (planting agricultural row crops), but this involved only 44 acres statewide. In absolute terms, more money was allocated to mowing than to any other activity but the cost was less than $24 on a per-acre basis statewide. On a per-acre basis, impoundment drawdown can be one of the least expensive activities, but little was accomplished during the 1984-85 fiscal year due to administrative decisions to postpone these activities until the following year and to unfavorable water conditions. The nature and extent of the costs incurred to manage human use also are noteworthy.

While statewide data do not reflect all of the costs incurred for specific activities conducted on WMA, Region 7 made a special effort to collect this kind of information for the 1984-85 fiscal year (Table 4). From these data it is possible to calculate variable and capital improvement costs associated with specific activities. For example, records maintained on the actual accomplishments of the Division of Operations during that fiscal year indicate that habitat improvement costs were $42,436 compared to $76,504 for human management (Table 5). Thus, human use-related activities such as boundary maintenance, trash pickup, parking area and road maintenance, and sign placement account for nearly two-thirds of the costs of the work accomplished by the Division of Operations.

For actual wildlife management activities in which the Division of Operations was involved, mowing was the largest cost item. However, this resulted from the extent to which mowing was practiced, not from the unit cost ($47 per acre). While mowing costs in Region 7 were $23 higher than the statewide costs, it is expected that there would be considerable variation among regions and WMA due to accessibilty, physical differences, and location relative to other areas serviced by the Division of Operations. Other than mowing, the remaining activities of the Division of Operations were directed, at least in part, toward waterfowl. Mowing also is used to enhance waterfowl habitat in some locations.

Besides monies paid to the Division of Operations, the Bureau of Wildlife incurred costs for planning, monitoring, and other management activities. However, these data are available for Region 7 alone (Table 5). During the 1984-85 fiscal year, the total labor cost incurred by the Bureau of Wildlife the region for the management of WMA was $39,577. Of this, $25,566 (64.6 percent) was spent on habitat management and the remainder on activities related to users and two wildlife population studies. In total, variable costs for uplands management ($16,046) exceeded those for wetlands ($9,520).

Table 4.—Costs charged by the Division of Operations for work activities on New York's wildlife management areas (WMA), Region 7, 1984-1985 fiscal year

Work activity	Number of WMA	No work activity units	No. of man-days	Labor cost			Nonlabor cost				Average cost per unit of output including labor and nonlabor costs	
				Salaries and wages	Fringe benefits	Total	Travel	Supplies	Overhead	Total	Excluding overhead	Including overhead
Human management				*Dollars*							*Dollars*	
Boundary maintenance, roadside	7	19.8 miles	71.4	3,934	1,276	5,210	1,889	1,035	1,719	4,643	411	498
Boundary maintenance, other	9	50.9 miles	188.3	10,374	3,364	13,738	4,983	2,370	4,533	11,886	414	503
Gates and barriers, maintenance	7	27 units	27.0	1,488	482	1,970	714	392	650	1,756	114	138
Parking area maintenance	10	97 units	67.9	3,741	1,213	4,954	1,797	985	1,635	4,417	80	97
Public roads, maintenance	8	22.1 miles	64.1	3,532	1,145	4,677	1,696	929	1,543	4,168	330	400
Signs, identification	13	36 units	36.0	1,983	643	2,626	953	522	867	2,342	114	138
Signs, rules and regulations	11	50 units	11.0	606	197	803	291	160	265	716	25	30
Trash pickup	14	42 units	84.0	4,628	1,501	6,129	2,223	1,218	2,023	5,464	228	276
Vehicle bridge maintenance	2	4 units	8.0	441	143	584	212	116	193	521	228	276
Subtotal			557.7	30,727	9,964	40,691	14,758	7,727	13,428	35,913		
Habitat improvement												
Dikes, maintenance	6	78 units	54.6	3,008	976	3,984	2,064	792	1,315	4,171	88	105
Drop inlet box maintenance	6	36 units	8.3	457	148	605	219	120	200	539	26	32
Mowing	9	665 acres	226.1	12,457	4,040	16,497	5,983	3,278	5,444	14,705	39	47
Overfill spillway maintenance	4	14 units	3.2	176	57	223	85	46	77	208	26	32
Wood duck boxes maintenance	1	43 units	10.8	595	193	788	286	160	260	706	29	35
Subtotal			303.0	16,693	5,414	22,107	8,637	4,396	7,296	20,329		
Total			860.7	47,420	15,378	62,798	23,395	12,123	20,724	56,242		

Table 5.—Labor input and costs by Bureau of Wildlife staff for activities on wildlife management areas (WMA), Region 7, 1984-85 fiscal year

Activity	Biologists		Technicians		Seasonal		Total cost
	Number of man-days	Costs[a]	Number of man-days	Costs[a]	Number of man-days	Costs[a]	
		Dollars		*Dollars*		*Dollars*	*Dollars*
Habitat management							
Uplands							
Agricultural agreements	1.7	184	2.8	193	—	—	377
Coordinate with Operations Unit	4.4	477	18.6	1,283	—	—	1,760
Develop snag plan	0.9	98	—	—	—	—	98
Forest products sales	38.8	4,210	31.1	2,146	—	—	6,356
Mowing, burning, and clearing from forest products sales	11.1	1,204	42.8	2,953	—	—	4,157
Update management plans	7.7	835	35.7	2,038	—	—	3,298
Total	64.6	7,008	131.0	9,038	—	—	16,046

Continued

Table 5 (Continued)

Activity	Biologists Number of man-days	Biologists Costs [a]	Technicians Number of man-days	Technicians Costs [a]	Seasonal Number of man-days	Seasonal Costs [a]	Total cost
Wetlands		*Dollars*		*Dollars*		*Dollars*	*Dollars*
Agricultural agreements	1.8	195	0.8	55	—	—	250
Coordinate with Operations Unit	1.7	184	4.4	304	—	—	488
Forest inventory	—	—	1.3	90	—	—	90
Maintain dikes, ditches, and control structures	2.5	271	21.8	1,504	—	—	1,775
Mowing and burning	3.9	423	1.4	97	—	—	520
Monitor and maintain duck nesting structures	0.3	33	32.4	2,236	—	—	2,269
Rehabilitate wetland structures	0.1	11	13.4	925	—	—	936
Update management plans	16.1	1,747	6.2	428	—	—	2,175
Update and revise maps	0.2	22	3.3	228	—	—	250
Water level control	0.2	22	10.8	745	—	—	767
Total	26.8	2,908	95.8	6,612	—	—	9,520
All habitat management	91.4	9,916	226.8	15,650	—	—	25,566
Human management							
Administer field trials	2.6	282	—	—			282
Boundary line maintenance and development	7.2	781	22.7	1,566	11	572	2,919
Controlled waterfowl hunts	10.9	1,183	15.2	1,049	—	—	2,232
Establish regulations	0.3	33	—	—			33
Maintain roads, parking areas, and trails	2.3	250	36.4	2,511	—	—	2,761
Rehabilitate roads, parking areas, and trails	0.3	33	5.8	400	—	—	433
User survey, WMA	6.7	727	13.1	904	—	—	1,631
Total	30.3	3,298	93.2	6,430	11	572	10,291
Wildlife populations							
Canada goose productivity survey of WMA	0.2	22	11.1	766	—	—	788
Waterfowl banding productivity study on WMA	4.7	510	35.1	2,422	—	—	2,932
Total	4.9	532	46.2	3,188	—	—	3,720
All activities	126.6	13,737	336.2	25,268	11	572	39,577

[a] Based on daily wages of $108.50 for biologists, $69 for technicians, and $52 for seasonal employees as reported by Bureau of Wildlife, New York State Department of Environmental Conservation, Albany.

Adding the costs charged by the Division of Operations to those incurred by the Bureau of Wildlife gives the total variable costs for specific actions accomplished in region 7 (Table 6). Since data were not maintained in a similar manner by these two Divisions of the Department of Environmental Conservation, it was necessary to consolidate some categories of work accomplishments. For example, the Bureau of Wildlife did not differentiate between roadside and other boundary maintenance, so it was necessary to combine these categories. Thus, an average cost of $543 per mile was calculated for boundary-line maintenance, though it can be expected that roadside maintenance is somewhat lower than that for less accessible areas.

It must be considered that some activities are completed over several years, but only the 1984-85 portion of the expenditures

Table 6.—Summary of variable costs of specific activities on wildlife management areas (WMA), Region 7, 1984-85 fiscal year

Work activity	Work activity units	Cost to Division of Operations	Cost to Bureau of Wildlife	Total variable cost	Variable cost per unit
		Dollars			
Habitat management					
Uplands					
Agricultural agreements	250 acres	—	377	377	1.51
Coordinate with Operations Unit	—	—	1,760	1,760	—
Develop snag plan[a]	1 report	—	98	98	98.00
Forest products sales	555 acres	—	6,356	6,356	11.45
Mowing, burning, and clearing from forest products sales	52 acres	—	4,157	4,157	79.94
Update management plans	—	—	3,298	3,298	—
Subtotal	—	—	16,046	16,046	—
Wetlands					
Agricultural agreements	70 acres	—	250	250	3.57
Coordinate with Operations Unit	—	—	488	488	—
Forest inventory[b]	1 area	—	90	90	90.00
Maintain dikes and control structures	114 structures	9,740	1,775	11,515	101.01
Mowing and burning	665 acres	31,202	520	31,722	47.70
Monitor and maintain duck nesting structures	63 structures	1,494	2,269	3,763	59.73
Rehabilitate wetland structures	3 structures	—	936	936	312.00
Update management plans	13 areas	—	2,175	2,175	167.31
Update and revise maps	—	—	250	250	—
Water level control	3 improvements 66 acres	—	767	767	11.62
Subtotal	—	42,436	9,520	51,956	—
Total	—	42,436	25,566	68,002	—
Human management					
Administer field trials	22 trials	—	282	282	12.82
Boundary line maintenance and development	70.7 miles	35,477	2,919	38,396	543.00
User survey	1 survey	—	1,631	1,631	1,631.00
Establish regulations and post	50 signs	1,519	33	1,552	31.00

Continued

Table 6 (Continued)

Work activity	Work activity units	Cost to Division of Operations	Cost to Bureau of Wildlife	Total variable cost	Variable cost per unit
			Dollars		
Controlled waterfowl hunts	4 areas	—	2,232	2,232	558.00
General maintenance and trash pickup	13 areas	39,608	3,194	42,802	3,292.46
Subtotal		76,604	10,291	86,895	—
Wildlife populations					
Canada goose productivity survey on WMA	2 areas	—	788	788	394.00
Waterfowl banding productivity study on WMA	2 areas	—	2,932	2,932	1,466.00
Subtotal		—	3,720	3,720	—
Total		119,040	39,577	158,617	—

[a] Only seasonal report on month-year project accomplished during 1984-85 fiscal year.
[b] Most work accomplished during 1983-84 fiscal year.

are included here. For example, the forest inventory listed under wetlands was undertaken on Cicero Swamp Wildlife Management Area, and most of the work — and thus costs — were incurred during the 1983-84 fiscal year.

Much of the management activities on uplands were related to agricultural agreements and timber sales. While these involved costs to the Bureau of Wildlife for staff work, they did yield net monetary returns and provide for additional accomplishments through habitat manipulation and services in kind.

For wetlands management, the role of the Division of Operations in providing services to the Bureau of Wildlife was relatively greater. Maintenance of dikes, of which there were 69 covering 28,424 feet in total length, and water-control structures, of which there were 45, was second to mowing and burning by measure of total variable costs. Nonetheless, this maintenance cost only amounted to slightly more than $100 per unit for the fiscal year. The total variable cost for all wetland management activities in Region 7 for the fiscal year was $51,956.

The total variable cost for habitat management alone on all 13 WMA in Region 7 for fiscal year 1984-85 was $68,002, an average of $5,231 per management area. The total variable cost for all activities, including both habitat and human-use mangement, was $158,617 or $12,201 per WMA in the Region for the fiscal year.

To facilitate habitat improvement with restricted budgets, agricultural leasing of land and timber sales have provided a means to achieve many desired management objectives and a source of net revenues, though the latter are not returned to the specific management areas, Regions, or even the Bureau of Wildlife, but go to the state Conservation Fund. However, a maximum of 50 percent of the revenues from timber sales may be taken in the form of services. In Region 7 during the 1984-85 fiscal year, an agricultural lease of 320 acres provided $3,500 in services to the WMA, enabled desired habitat diversification to be realized, and was the source of net revenues in the amount of $1,550 (Table 7). This was achieved with managerial costs of $377 for that fiscal year. However, the lease was for 5 years so it can be expected that start-up costs, which tend to be considerably higher, were incurred at the outset. Costs over the 5-year period are not available. Timber harvesting alone provided a means of gaining habitat diversification by returning woodlands to earlier stages of succession, providing openings, and securing uneven-age management. In addition, services in kind received from these timber sales included road construction, mowing, brush clearing, parking area construction, and timber stand improvement. Again, cost information for earlier years is not available but the Bureau of Wildlife no doubt obtained net revenues from these sales.

Records on the costs of capital improvements are not available for the fiscal years prior to 1984-85 so appropriate shares of previous investment commitments cannot be allocated to that

Table 7.—Cash income from sales and leases of wildlife management area (WMA) resources to improve wildlife habitat, Region 7, 1984-85 fiscal year

Product	Number of WMA involved	Number of acres	Units of output	Cash income	Value of services provided	Total income
				----------*Dollars*----------		
Timber sales						
Firewood	6	304	1,520 cords	23,790		23,790
Poles	1	33	1,141 trees	5,268		5,268
Pulpwood	2	130	651 cords	2,604		2,604
Sawtimber	2	13	3.9 Mbf	195		195
Seed tree and selection cut	1	75	135 Mbf and 600 cords	11,122	8,500	19,622
Maple taps	1		44 taps	20		20
Apiaries	2		82 hives	396		396
Agricultural lease	2	320		1,550	3,500	5,050
Total	8			49,945	12,000	56,945

fiscal year. As discussed previously, this is not an important consideration once funds are committed and no attempt is made to finance future capital investments through user fees. However, information on initial investment costs, compounded end costs, and equal annual equivalent costs are important ingredients in making the initial decisions on the merits of a given capital investment.

During the 1984-85 fiscal year, a limited number of investments were made for capital improvements in Region 7 (Table 8). To make meaningful allocative decisions, these costs must be considered over the expected life of the improvement and the initial costs compounded at an appropriate interest rate. In this case, the discount rate used by the U.S. Water Resources Council for 1984 (8 percent) is used. If data were availble on returns, a comparison of costs and revenues compounded to the final year of the expected life, or discounted to the initial year, would be a useful planning tool. Comparisons also can be made on an annual basis through the use of equal annual equivalent net revenues (Christianson 1979) but, again, more reliable data on costs and returns are needed. Of course, both capital improvement costs and variable costs are relevant since the time period is sufficiently long that the level of output varies with both.

Table 8.—Cost of capital improvements implemented in 1984 over expected life using 8-percent interest rate, Region 7

Capital improvement	Initial cost	Year cost incurred	Expected life	Initial cost compounded over expected life	Equal amount equivalent cost
	Dollars		*Years*	----------*Dollars*----------	
Parking area	1,000	1984	15	3,172	117
Public use survey	1,743	1984	10	3,763	260
Road rehabilitation	17,000	1984	10	36,703	2,538
Slash burn	1,182	1984	10	2,552	176

Discussion

During the 1984-85 fiscal year, nearly two-thirds of the variable costs incurred by WMA in Region 7 were directed toward human use compared to wildlife habitat enhancement. By comparison, the revenues from agricultural agreements and timber sales nearly equaled the expenditures allocated to all other habitat improvements, though these monies are not returned to the WMA but go to the Conservation Fund. Since the 1984-85 fiscal year may represent a low budget situation, it would be useful to examine expenditures over a longer period.

Since historical data are not available, it is not possible to examine the implications of some long-run capital investments. Such calculations are most meaningful when deciding whether to make specific capital improvements and have little relevance to annual budgetary planning unless cost recovery from users is an objective, which is not the case with New York's WMA. Historical data can provide insights with respect to plan formulation for future investments.

Even if more reliable data were available on land acquisition, they would not be particularly relevant to current planning and budgetary efforts. Land acquired in the past represents a fixed cost and likely is worth more in today's market than when obtained. Neither are opportunity costs relative to land use appropriate considerations, since the public sector is restricted with respect to the alternatives that it can pursue, and has a broader spectrum of objectives. In the initial planning stage, the anticipated flow of costs and returns over time might provide useful input, though it is difficult to measure returns in terms of public objectives.

The information that is most readily available through Bureau of Wildlife records pertains to variable costs and these are most relevant to short-run decisionmaking. It would be helpful to have data on both a wider range of management activities and a greater number of observations for those cost components analyzed. Costs of implementing specific habitat improvement measures can be useful to budget planning, but there is an obvious need to relate specific actions to changes in biophysical outputs and related changes in human satisfaction.

Since the inception of this study, the Bureau of Wildlife has developed a cost-accounting system for the share of WMA costs paid by Pittman-Robertson funds. While this system meets the Bureau's reporting needs, the cost estimates reflect only payments to the Division of Operations and do not include costs absorbed by the Bureau of Wildlife.

To achieve cost data on a statewide basis similar to that collected in Region 7, the recording system must be modified. This might be done on a sample basis and yield adequate information to enhance decisionmaking. Information required on the Bureau's time and attendance reports is too general to relate to specific management accomplishments. Records must be kept relative to actual inputs to specific jobs, but would not necessarily be a continuous process. Once more accurate cost estimates are established, periodic monitoring would likely be sufficient to detect significant changes. Likewise, Division of Operations can be monitored more closely to determine actual expenditures for specific work activities. Again, a simple sampling process can facilitate such data collection at a minimal cost. Together, more realistic operating cost estimates for the Bureau of Wildlife and Division of Operations will enable agency staff to plan more effectively to maximize accomplishments within budgetary constraints. Simulation modeling is an alternative approach to developing more accurate cost estimates for specific wildlife enhancement manipulations. An advantage of this technique is that many of the factors responsible for cost irregularities can be identified and neutralized.

Besides land acquisition and investment in large-scale structures, both of which have numerous payoffs in addition to wildlife enhancement, the amounts expended to manage New York's WMA is relatively low. In Region 7, the total variable cost for the management of wildlife habitat, as well as human use, averaged $2.60 per acre during the 1984-85 fiscal year. If revenues received from agricultural agreements and timber sales are considered, the net cost of management was only $1.96 per acre. It should be noted that these figures can vary considerably from year to year, particularly if budgets are sufficient to accomplish additional management practices identified by agency staff. Low costs can be a manifestation of the available funding rather than a reflection of the costs to operate at the optimal level. Again, it would be advantageous to examine costs over a longer period so that irregularities between the incidence of costs and the time that accomplishments are recorded could be overcome.

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Estimates of management costs on New York's wildlife management areas indicate that human management is more costly than habitat management. Agricultural agreements and timber sales make a major contribution to habitat enhancement, and a wide variety of wildlife species benefit.

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