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Proposal 3—*that funds supporting research in natural life history studies and in ecosystem dynamics should be greatly increased.* We do not have the basic information in most cases to give much more than stop-gap advice on management of natural landscapes. Any action that is done usually sets off a sequence of events most of which are unpredictable at our present state of knowledge. Is fire essential for the management of tall grass prairie in Iowa? It seems so. Are animal inhabitants able to recover from this natural disaster in the small units of prairie landscape that we are attempting to preserve? Many questions of management are unanswered.

Proposal 4—*that educational support be given more broadly in all areas of natural history not dwelling predominantly on the traditional areas of hunting and fishing conservation.* Management of natural areas is ultimately the management of people. Only those who understand the significance of all forms of life in their environment can grasp the purpose of natural landscape preservation and make sound decisions affecting the use of natural resources in a democratic society.

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A Discussion of the Economic Basis for Paid Hunting on Farm Land

WADE H. HAMER

Abstract. Farmers are the nation's principal wildlife managers. They control production, growth, and harvest of wildlife on about 76% of the land. The farmer assigns a personal value to wildlife and regulates its abundance accordingly. His need for game and non-game animals is largely supplied by the amount produced as a by-product of his normal farming activities. The presence of wildlife in numbers greater than the farmer's needs produces conditions that adversely affect the farm business. An example is given of the costs associated with intentional **management** for wildlife and paid hunting on a typical Midwest farm. The farm of 200 acres is under intensive cultivation and

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requires conversion of 7% or 14 acres of cropland to the exclusive use of wildlife. Annual costs are enumerated as \$420 in loss of the former net income from farming the converted acres; \$50 for establishing and maintaining the needed vegetation; \$60 for costs associated with paid hunting; and \$70 as the assumed financial inducement necessary to persuade the land-owner to practice habitat management. The annual price for the hunting privilege is \$600. Whether the farmer could find a lessee at this price is debated. It is believed that farmers will manage their land for greater wildlife production if a fair profit can be obtained. Until that time the farm acreage devoted to habitat is likely to remain at present levels.

The farmer is the nation's principal wildlife manager. He produces about 80% of the game crop and controls about 76% of the area on which it is harvested. His use of the land largely determines the kind and amount of wildlife that will live on his place.

Within the framework of public laws and regulations, the farmer sets his own seasons and bag limits. He decides who will hunt and who will not, whether there will be any hunting or whether there will be none. The farmer cannot harvest or destroy a game animal during closed season except, possibly, under certain conditions, but, with a few exceptions, he can destroy the animal's living quarters at any time. The animal, once born, is public property, but through habitat control the farmer can allow or prevent the birth.

POSITIVE VALUES OF WILDLIFE

Most farmers want some wildlife. Most are hunters or have hunters in their families. Thousands of them across the nation have cooperated with public agencies to improve the lot of game animals. They have devoted land, time, and money to the cause.

That wildlife has a positive value is affirmed by the millions of public dollars spent annually to manage the resource and other millions spent privately on its harvest and on non-consumptive uses of the wildlife crop.

Wildlife contributes to the destruction of weed seeds and harmful insects, but these benefits are difficult to measure and farmers are not fully aware of them. Added to this, farmers can now control weeds and insects with chemicals with predictable and reliable results.

The appeal of wildlife is perennial with sportsmen. However, to many of this group, the intensity of the appeal is short lived but reoccurs each fall. These folks wish to be exposed to an abundance of game and they desire to harvest it in quantity during the very short period they set aside for hunting each year.

For one reason or another, the first two weeks of the open season is about all they use. More sportsmen might take advantage of longer seasons if game populations were more abundant, and a place to hunt was readily available.

NEGATIVE VALUES OF WILDLIFE

A Pennsylvania study, Gamble and Bartoo (1963), showed that deer damage to agricultural crops amounted to \$180 per farm per year. Damage to forest trees in farm woodlots averaged over \$14 per year and hunter damage on the farm came to slightly more than \$6 for a total annual loss due to deer and hunters of about \$200 per farm.

Depredations by wild ducks on mature grain remains a problem in the northern states and Canada; the competition between domestic livestock and big game animals for forage plants frequently results in local controversies; rabbits and deer destroy new orchard and forest plantings; muskrats damage farm pond dams; heavy populations of pheasants cause losses in fields of growing corn; concentrations of popular game animals attract large numbers of hunters to local areas causing temporary congestion; and many landowners consider the hunter's presence on their land as a hazard and a nuisance.

Viewed strictly from the farm-business angle, the present value of wildlife and public hunting is negative. Wildlife must live off the land. Its habitat often includes agricultural crops, and damage by wildlife and hunters, when it occurs, is counted as a loss to the farm business.

MANAGEMENT FOR FARM GAME

The land is the farmer's business property. On it he may grow corn, cattle, trees or other crops of his choice. His production of each has an economic objective. There is an established market for these commodities, and his ability to produce them determines his standard of living. Much of his time and money is devoted to controlling those agents that would reduce production. Like other businessmen, he must keep costs to a minimum.

If the public desire is to be met with abundance and availability of selected game species, and land on which it can be enjoyed through hunting or other means, the private landowner must be given the incentive to cooperate. An economic incentive appears most logical.

Using present technology, the average landowner could increase his production of game animals. However, the incentive for him to do so appears to be lacking. Aesthetics, apparently, and the personal recreational value of wildlife have prompted

some farmers to apply land management practices in an effort to increase wildlife numbers. Such efforts are largely confined to practices that produce only enough wildlife to satisfy the individual farmer's needs. More often his needs are met without the application of special practices. The wildlife crop that appears as a by-product of his normal farming operations is, for him, ample. Greater abundance creates some of the negative values discussed above, and it is at this point that the farmer's interest in habitat improvement declines and the habitat already in existence on his farm may deteriorate.

COSTS OF MANAGEMENT

Wildlife managers frequently point to the need for undisturbed cover on intensively cultivated farms. Here, cover for nesting and for travel lanes is not sufficient to allow reasonable production and access to food supplies which may be abundant on harvested cropland. The exact amount of land that should be devoted to these kinds of cover varies with the kind of wildlife to be favored. However, the figures often used are 3 to 10% of the farm acreage, and more often 5 to 10%. It is usually emphasized that land devoted to wildlife should, for the most part, not be used for other purposes. That is, it should not be grazed, logged, or farmed except, possibly, under conditions that do not interfere with the primary purpose of wildlife production. It is at this point that land management for wildlife becomes expensive.

As an example, let's use a typical 200 acre Midwest farm that is under intensive cultivation. Fall and winter food supplies are abundant but cover, especially nesting cover and travel lanes, is almost non-existent. It is determined that by establishing the required cover on 7% of the land, wildlife production could be increased to the degree that the farm would become an attractive hunting area. Seven percent of the farm amounts to 14 acres. If the 14 acres are normally in crops that yield an annual net return of \$30 per acre, the initial cost of conversion is \$420 per year in loss of net income alone. The usual amortized cost of establishing the needed perennial vegetation plus a charge for its maintenance might add another \$50 annually. The total annual cost to the farm business for converting the 14 acres from cropland to wildlife land now amounts to \$470. If the farmer's advisors are accurate in their evaluation of cover needs, the farm will be producing wildlife at the new carrying capacity within 3 to 7 years. Ignoring the time lag, let's say the farmer now has a new crop to sell. Production costs are \$470 annually. He might use all or a part of the crop him-

self, he might give it away in the form of free public hunting, or he might try to get his costs back plus a profit through the sale of hunting privileges. The odds are that the average Midwest farmer will not incur such expenses without reasonable assurance that a market for the new product does exist. So he will try to sell it.

If he charges a fee for hunting, other costs are added. These include the cost of additional liability insurance, advertising, postage, telephone tolls, and servicing of hunters using the farm. These are estimated at \$60 per year. To equal this return from farming the 14 acres, the farmer now needs \$530 per year.

We have as yet added no financial inducement for him to switch from farming the 14 acres to managing those acres for wildlife and improved hunting. Let's assume that for a profit of \$5 per acre for each of the converted acres — \$70 — he will alter his normal operations to provide for more wildlife. The financial incentive is now included but the amount hunters must pay for the hunting privilege has risen to \$600. This amounts to \$3 per acre for the hunting privilege on the 200 acres.

With the improvements, such a farm in southern Iowa might support quail, rabbits, fox, raccoon, and possibly deer. With a stockwater pond of an acre or more, some duck hunting might be provided.

RETURNS FROM MANAGEMENT

Under an annual lease arrangement, the farm might accommodate 4 to 10 hunters depending upon the quality of the hunting desired and the success of the improvements installed. On a daily fee basis, it might support 8 to 10 times this number.

If 4 hunters leased the land, the cost would come to \$150 each and would range down to \$60 each for 10 hunters. Under a daily fee arrangement, the fee would have to exceed \$6 per hunter.

In some parts of Iowa the farmer might sell the hunting privilege at these prices; in most, considerable advertising would be necessary if, indeed, he could find a buyer at all. The records of conservation agencies show that Iowa farmers are applying considerable habitat management, but their efforts seem to be expended to satisfy personal needs and desires. Fee hunting is not common. Examples of such enterprises are scarce and information on them is as yet inadequate.

It is probable that farmers can be persuaded to grow more wildlife instead of more corn if and when it becomes a profitable venture. Until that time farm acreage devoted to wildlife pro-

duction will largely be restricted to those acres that cannot be managed profitably for a marketable crop, and the amount of habitat on farms is likely to remain at about present levels.

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The Morphometry of Lake West Okoboji¹

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Abstract. A total of 2901 depth measurements were made in Lake West Okoboji, Dickinson Co., Iowa in the summer of 1962 using a non-recording echo sounder. These were used to construct a morphometric map of the bottom topography. The area of the lake was found to be 1540 Ha., the volume 184×10^9 m³, maximum depth 42.7 m, mean depth 11.9 m and length of shoreline 30.0 km. No changes in the morphometry of the lake could be detected since it was last mapped in 1913.

As a part of the teaching and research programs of the Iowa Lakeside Laboratory, a series of depth soundings were made in Lake West Okoboji, Dickinson Co., Iowa during the summer of 1962. These have been incorporated into a new morphometric map for the purpose of providing basic data to be used in future studies of the lake.

This effort represents the second time within this century that the lake has been sounded. From 1905 to 1912 the Civil Engineering Department of Iowa State University conducted an annual two week Summer Surveying Camp at the lake and constructed topographic maps of the lake and surrounding terrain. The original map, containing 732 soundings, was published by Ford (1913). These data were used as the basis for the map which appeared in the Iowa Lake Beds Survey (Iowa Highway Commission, 1916). In the latter publication, only 257 of the soundings were indicated. It formed the basis for the morphometric calculations of Birge and Juday (1922).

Whereas a sounding lead and line were used in the original survey, we used a Transcentury, non-recording, echo sounder mounted on a motor launch. A total of 61 transects were run between known points on the shore with depths being read and

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