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ASSESSMENT OF THE ECONOMIC VALUE OF WILDLIFE RESOURCES

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TABLE OF CONTENTS

PREFACE

Planning must always and by definition be for the future. That this is peculiarly true of any plan that is dependent, even in some measure, on the broad Canadian environment is obvious. Modern technology is altering every aspect of the modern world. Changes in farm technology and a growing demand for food is threatening "secondary" uses of land and provides a real alternative use for many marshes, lakes, woodland and rivers.

Agricultural development and production has been supported with massive research programmes throughout the life of Canada as a nation. The same thing has not been true to the same degree with respect to forestry and fisheries, while in the case of wildlife the resources made available for research have been abysmally inadequate.

It is probable that conservative planning tends to be wasteful planning, particularly in a period of rapid and massive change. It is certain that to plan with inadequate and uncertain knowledge is wasteful and can actually damage the resource in the interests of which plans are being made.

Planning for the conservation and the optimum use of the continental waterfowl resource is obviously urgent. The problems are stubborn. The environment upon which the resource is dependent is not only complex but is subjected to demands for an enormous variety of alternative uses. Wildlife research needs to be done in Canada for region-specific results applicable to the problem. The existing biological research is inadequate to define the problem for a causal solution. This is because it, too, represents a first approximation of definition. This is also true in establishing the economic costs and returns of the various products that result from alternative uses

and the use of them to establish a supply cost or charge for the user. Planning is clearly endangered by gaping chasms in the structure of knowledge upon which plans must be built.

The Canadian Wildlife Service has gained approval for a programme of acquiring biologically necessary waterfowl habitat as well as some incidental upland game habitat. Research is to be conducted in conjunction with this programme.

The annual five million dollar budget proposed for this programme is substantial. The effective use of the available money will, in all probability, be dependent upon a large part of this budget -- or additional moneys -- being available for a massive research effort. The first priority should be the refining of the problems of production and management. The second priority should be maintaining or expanding prototype easement programmes with the objective of investigating costs.

This involves some modification of the programme as now designed. Instead of a production programme with incidental research benefits, the programme should be amended to take the form of a massive research programme with incidental production benefits. The revised priorities would presume the use of prototype easement programmes to secure vital habitat threatened by immediate drainage and using this habitat for essentially "test-area" and experimental purposes.

Such a shift would not introduce the danger of the irrevocable loss of essential habitat; a massive research effort centered on the production and management of waterfowl would improve the efficiency of the entire programme and would enable the Canadian Wildlife Service to plan a long-run waterfowl programme with real confidence.

Under such a programme the short-run danger of habitat destruction

would be held to a minimum while the long-run needs of a firmer basis of research knowledge -- the one real essential to long-run planning -- would be built.

Research in production is costly. A programme at least as large as the current habitat easement programme is likely to be needed. Failure to design such a programme could gravely threaten the work that has already been undertaken and is presently going forward.

The attached report is a first step in building research knowledge -- in this instance on the economic side. It has established to the satisfaction of the authors that there is no alternative to the accepted economic technique for the establishment of "value" of waterfowl and that such technique will not result in the placing of a specific value on the individual bird, whether that bird is in a hunter's bag or seen through the lens of a camera or enjoyed by a bird watcher. The report attempts to accomodate this fact to the realities of waterfowl, habitat and public policy as it applies to wildlife in Canada.

ASSESSMENT OF THE ECONOMIC VALUE OF WILDLIFE RESOURCES

The operating term of reference for this study was to examine the existing methods of assessing the economic value of wildlife "with particular reference to waterfowl". The attached report includes an examination of existing methods of economic evaluation, an appraisal of the strengths and defects of these methods and an analysis of improvements that might be achieved.

Prepared
for

CANADIAN WILDLIFE SERVICE
Department of Northern Affairs and National Resources

by

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VALUATION OF THE WILDLIFE RESOURCE

Introduction

The "value" of all North American waterfowl shot in 1958 amounted to $185 million by some estimates. It might have reached $4.2 billions if all waterfowl were worth what goose hunters said (See Table 1) they thought they might pay per goose if they actually had to. However, no one actually paid anything -- with minor exceptions -- directly for waterfowl. That means there is no direct total economic value that can be tied to a species, much less a universally applicable value for each individual.

Even if by an economic miracle we were permitted to say that wildlife was worth $5.00 each it might provide only psychic satisfaction for hunters and naturalists. It would purchase little biological habitat from farmers who are notorious sceptics. Enormous damage might also be done to agriculture from the trauma caused farmers who attempted to cash their wildlife.

TABLE 1

Some Examples of Wildlife "Values"

KIND	"VALUE"	EXTRAPOLATED IN 1958 FIGURES OF RECOVERED AND UNRECOVERED WATERFOWL
Bucks	$42 each 1/	
Migratory Waterfowl	6,112,000 lbs. (food) 2/	
Canada Goose	$200 3/	$4,280,000,000
Waterfowl	$7.25 each 4/	
Waterfowl hunting	$2 - $6 unit day benefits 5/	
Ducks	$5 6/	$105,000,000
Mallard	$2 7/	
Goose	$6 7/	
Arizona Hunter Spending (1960)	$40,151,000 8/	

1/ Charles W. Ramsey - "Potential Economic Returns from Deer as Compared with Livestock in the Edwards Plateau Region of Texas" - Journal of Range Management 18 (5).
2/ The "value" here would be for the money cost of this meat shipped in.
3/ Based on estimates made by hunters as to what they would pay rather than forego goose hunting. (Upton B. Henderson, "Economics of Waterfowl Hunting" - Missouri State Conservationist, Oct. 1965).
4/ "Calculated .... average cost per duck to the hunter on public hunting grounds in Illinois".
See D.N. Omand "An Attempt to Evaluate the Hunting Potential of Land", quoted in above in Proceedings 22nd Midwest Fish & Wildlife Conference, December 5 - 7, 1960.
5/ "Evaluation Standards for Primary Outdoor Recreation Benefits" Ad Hoc Water Resources Council, Washington, D.C. - June, 1964 - p. 5.
6/ "Average Shooting Preserve Price" - The Conservationist, June-July, 1965 - p. 32.
7/ Luna B. Leopold - "Comprehensive Planning and the Dragon to Slay" - two speeches at the Ninth Biennial Wilderness Conference - p. 2 (in context, this was used to illustrate the ridiculousness of attempting to achieve a monetary value for waterfowl).
8/ "Values of Hunting and Fishing in Arizona" - Wm. C. Davis - p. 25.

Analysing economic values of wildlife is a challenging assignment. The answer will not allow the attribution of such precise figures as, for example, $7.25 for a dead retrieved duck, $1.00 for a visible admired duck, or an annual psychic satistaction value of $75.00 for an incurious citizen's knowledge that certain species are not or will not become extinct. Such precise valuation would delight hunters but it would soon be observed to be superficial. There are as many "values" as there are people. Unfortunately there is only one economic value and that is price actually paid presumably covering costs of production or, in economic phrasing, the supply cost. It is relatively easy to determine supply costs for wildlife because it is only necessary to buy habitat on the market. The economic value of wildlife to users is the price they are prepared to pay to preserve that wildlife.

The various "values" placed on wildlife are numerous, conflicting, contradictory and dubious. All that can be said is that there are a lot of them. The most popular "values" are associated ones -- money spent by hunters in the pursuit of particular birds or animals. It includes such things as meals, gasoline and lodging and is in fact, a "cash flow" through a selected region at a time of year when hunting is popular.

A Number of Values

It is instructive to examine a few of the numerous values attributed to wildlife to sort them into those that are and those that are not economic values.

These and other values drop fairly readily into several categories:

1) associated values (measure of spending or cash flow).

2) unit values for birds or animals based on associated values.

3) non-price values based on aesthetics.

$10-00

4) the attribution of a value, on the basis of which policy decisions are made. For example, if the recreation value of a proposed marsh is stated to be ~~$10,000~~ per day per hunter or visitor the anticipated patronage can be built into the economic justification for the expenditure for the creation of the marsh.

5) actual economic values paid for by users on a competitive market.

1. Associated Values

It is estimated that hunters and fishermen spent $40,151,000 in Arizona in 1960.[1/] Expenditures ranged from a high average of $150.00 for each cold water fisherman and a low annual average of $32.00 for waterfowl hunters. Expenditures were by two categories of people -- residents and non-residents. Lengths of time spent hunting and fishing ranged from six days for waterfowl and big game hunting to 12.9 days for small game hunting.

These figures are useful as an indication of where to spend money already budgeted to a Fish and Game agency. They do not, however, of themselves justify that budget. They are not economic values; they are only a basis for government policy decisions for allocation to certain activities.

If the goal of government policy is to increase man-days afield the most appropriate policy would be to support warm and cold water fishing through hatcheries, stream improvement and the like: in Arizona the largest returns in terms of participation by persons presumably would result from such public expenditure.

An economic development agency official, however, presumably would be interested in the fact that non-residents purchased $2,268,002 of goods and services in the state, and so aided income and employment. He would wish to see the State Wildlife Agency spend money on activities designed to bring more

1/ All data are from "Values of Hunting and Fishing in Arizona, 1960" by Wm. C. Davis, April 1962, Special Studies #21, Bureau of Business and Public Research, the University of Arizona, Tucson, Arizona, p. 25.

"outside" sportsmen into the state, perhaps by advertising the trout fishing -- an activity that brought $1,078,000 into the state from other states.

A rancher might see in this data the opportunity to use the agency budget to increase woodchuck hunting because of damage to his alfalfa fields by these rodents. An advertising programme, coupled with a bounty, would control rodents and bring out-of-state dollars to Arizona.

The representative of state sports stores might like to see more budget used to promote fishing and big game hunting activities because of the 82% (32,719,840) of total spending they represent, much of it cash flow going through sports stores.

A hotel owner might be interested in the small number of hunters and fishermen who use motels and cabins instead of hotels and wish to see efforts intensified to encourage sportsmen to lodge in hotels.

These figures are important. They are, however, important to different people with different motives and for widely differing reasons. They provide rough, broad guidelines for parcelling out a budget.

Clearly analyses of "associated" spending, by hunting or fishing day, represent only a first effort to get at recreation demand. They are meaningful if -- and only if -- other elements of that demand are brought in to provide a finer guide for government policy decisions.

Very little of the "associated" spending however finds its way to the farmer or rancher who feels he produces the game and who suffers losses from wildlife depredations.

The only direct economic value attributable to wildlife was the $1.6 million paid in license fees, as distinct from the associated spending. These are separate items and must not be confused. The $40,000,000 is not the economic value of game. It is not a price. It is not a cost. It is an

interesting figure showing amounts spent by some people for their avocation and it is nothing more. It has meaning if a state or province or federal government says it has by a policy decision. The income from license fees is the only tangible figure of any relevance for the province or state, as a direct return attributable to hunting or fishing on public and, perhaps, unposted private land.

The most that can be said for the $40 million is that it represents spending associated with a free good, unhampered by the cost of supply and unrelated to comparative recreation demand.

For example, a cash flow ~~of similar kind~~ could be measured in an area of interesting natural beauty by ~~noting~~ estimating the spending of the number of Sunday drivers who visit the area ~~and estimating their spending~~. This would not establish the economic value of the view: it might provide evidence that the terrain should be zoned, or purchased or otherwise conserved. Mount Park Reserve visitors or recreation-days.

Using associated values as economic values is as nonsensical as establishing the economic value of a free concert by asserting that it was the total of the cost of the transportation plus a fraction of the cost of opera glasses, plus the price of an orange drink at intermission. That amount might be used to measure a demand if compared with all other recreation demands for free goods; it would not be the price, the economic value, or the cost of the programme.

However, when concert goers pay $5.00 each for their admission tickets the economic "value" of the concert can be established as at least $5.00 for everyone present. Probably fewer attended at a price of $5.00 than when it was a free good because demand was tempered by the supply cost. The "value" may vary widely; it may be beyond price to some and to others who attended solely in response to family pressures it had no value. This does

not alter the fact that everyone who paid $5.00 accepted that figure as the minimum economic value. That is all that is required in a price system: despite subjective considerations the objective worth in the common medium of money was $5.00 for everyone at the concert. Since supply costs were covered no one really cares that some were better entertained than others or that some amount of money was spent on transportation, orange drinks or opera glasses.

The amount of hunter spending is not the economic "value" of the sport. No cost enters to limit this expression of "demand" as a means of establishing a price or the economic value. The economic value of the game is no more or no less than the amount someone, whether individual or government, will pay for it. It may be of infinite worth but, unless a price is paid, associated measures of value or demand are of little worth since they don't pay for production or maintenance of wildlife populations.

2. Unit Values for Recovered Animals and Birds

There are any number of unit economic "values" asserted for wildlife. They encompass most figures in Table 1. None are really helpful. They are largely based on associated hunter spending but are differentiated by being divided by the numbers of recovered wildlife. If the license fees only were used per unit values might be valid, but even then only to the province or state in question and not, for example, to land owners. The several "values" in the table are based upon spending for things other than the animals or birds themselves. Except for the $42 received by ranchers from hunters for shooting bucks, there is no payment in the table for an economic good.

Another difficulty of per unit figures is that, even if valid, they refer to a special kind of product. The values are not expandable or universal. In the former case, for example, a hunter who leases shooting rights is paying for a dead, retrieved animal or bird at the place he is hunting; a bird watcher

who pays admission to a wildlife refuge is buying access to a concentration of animals at a known place. Dividing the total payments in either case by the number of retrieved or present obviously would not establish a value for all fowl of that species on the continent. However, if an area used exclusively by certain animals during their whole life cycle were bought or leased by hunters, the cost of the lease could be their economic value or their price, but the value would be applicable only to the animals shot on that particular lease.

For migratory birds or game this type of pricing, in an overall or macro form, is very difficult.

Unit value is simply associated hunter spending divided by the recoveries of shot wildlife and is equally meaningless as a statement of economic value. Very few property owners could expect to collect on these unit values and this inevitably means these values won't guide their decisions in making use of their property: where a choice exists between wildlife, timber and crops, most owners of land will choose the form of production that pays money.

Spending $7.25 on other things (cartridges, food, etc.) to get a dead, retrieved bird is not the value of that bird and so it can not be extrapolated to the entire population. The real value would be illuminated if someone would actually pay a producer $7.25 for the bird. There is no such price. Thus not every bird in Canada is worth $7.25 (or $5.00 or $18.00) because no such market exists. Only the license fee is a direct payment for the animal and the license typically serves only as an income producer for government and as a rationing device.

The use of associated spending figures distorts reality. Whether it

is hunter spending or marsh rentals the payment is an associated expenditure and not a payment to anyone for a specified product. The farmer is not paid, nor is any other payment made for products of Crown land. Thus the $7.25 is not a price or a cost or a value unless it is a direct payment for a specified product. Land rented by hunters for shooting frequently is used to establish a per unit value for retrieved ducks. This ignores the fact that, although the birds were harvested on the particular lease, they were not bred, nested or grown on that land. So they represent an externality of farmers or the Crown, captured by hunters with no payment to the farmer. Here hunter payments are merely the charge for collecting a free good produced elsewhere.

3. Abstract Values - Religion, Aesthetics, Non-Price Values

In preceding sections an attempt was made to place an economic value or price on game by associated spending by hunters or by using associated spending figures place a unit value on, for example, a duck in a hunter's bag.

At the other end of the "value" spectrum is the non-price system. This is represented by the traditional conservation movement in hortatory appeals to preserve things because, although they have no economic value, and frequently, because they have no economic value they are so valuable as to be priceless and no home should be without one. Some of these rather glorious appeals are more convincing than others. This example, from a book on waterfowl management that was otherwise quite excellent, is more or less representative.

"First, for all those winged wayfarers of lake and marsh ... etched 'gainst sunset skies ... on hunter hearts ... in the American way." citation?

The best of these exercises often are accompanied by or embodied in a bad poem. This approach to establishing economic value might be called "The Edgar A. Guest School of Valuation".

Appeals to religious values are also used to justify subsidies to

preservation of wildlife "values".

The sincerity of these assessments is not open to question: the attribution of "priceless" economic value to wildlife is a somewhat dramatic way of stating a strong personal preference. The problem arises when this appreciation is expanded into a general value theory applicable to wildlife. One observer esteems ducks, another does not. People appreciate diverse things. They may be prominent or obscure, scarce or plentiful. When vast numbers of people appreciate the same thing or when policy makers assume a bold stance a decision may be made by government to produce the good at public expense.

It is easy to determine how wide or general or common appreciation is for an item by charging a price for it, either directly in an economic market or indirectly through taxes. In the latter case, however, it is based on a policy decision, not, necessarily the economic value. In either case the particular good has achieved an economic value.

A common denominator of price or payment is essential to the provision of an economic value. A finger painting may have "value" to the mother of the little artist. It is not likely to have economic value. Tom Thompson or A.Y. Jackson, as infants, may have produced paintings only a mother wanted. Today a Thompson or Jackson painting is valued and a price and market established. Their works now have economic value.

A flight of Mallards at dusk may be "worth" immeasurably more than watching a Marx Brothers film. This evaluation cannot be challenged or proven. To be meaningful such aesthetic valuation must be followed by the words "to me": generalization of personal values is acceptable only if someone in a position to decide for the public does decide that they should be "public goods" because they are widely wanted or appreciated.

When non-monetary values, aesthetics and religion are employed as a guide to economic values, there is no way of comparing them or generalizing them. "Price" tends to be placed at a minimum that most are willing to pay. The privilege of shooting or viewing will be worth more to some or less to others but when all pay at least a minimum figure for the privilege and the producer receives a payment it can be said to be worth at least that much to all.

4. Arbitrary or Assigned Value

These values are used to permit dollar values to be assigned to otherwise intangible qualities of recreation projects or activities at reservoir or dam sites in order to decide which of several to build. These are "prescribed values" or "administrative prices" used in evaluating projects in public, as distinct from private markets.

If, at a point in time, tangible benefits of all projects under consideration were equal to tangible costs, the size of secondary benefits might tip the scales and dictate the choice of a particular project: the intangible values, however, were described. The arbitrary value now assigned as a benefit, (See Table 1) is the value of a "duck hunter day" for evaluating projects. It is an example of a prescribed value where an intangible value is made concrete relative to a certain place and a particular project by agreement among public agencies with an interest in public projects; a money value that has adequate administration support is agreed upon and used in evaluating the project in question.

A variation of this "value" is the "ameliorative" effect often required in planning and constructing huge public projects. Where a project will destroy some natural feature, such as waterfowl breeding habitat, amelioration

requires a similar amount and quality be protected or to be constructed in another place.

Both methods are possible because a special or "privileged" public market is being used. A policy decision was made and money and authority were issued to enable it to be done.

The following quotations are perhaps the most lucid exposition of prescribed prices.[1/] The full text is in the Appendix.

"Unless a fisherman or hunter actually could be expected to pay for the privilege of hunting or fishing an additional amount equal to his expenditures for associated services /sportsmens' expenditures/ or unless some other direct relationship between the two could be established the economic significance of the user expenditure approach would appear to be limited.

"Since benefits from other project functions such as agricultural production or derive from market prices at which the projects were sold to primary market, the Sub-Committee believed that it would be comparable to evaluate hunting and fishing benefits in a project area in terms of prices at which hunting and fishing privileges might be sold, a difficult proposition since hunting and fishing traditionally have been free and fish and wildlife considered common property in this country.

"The Sub-Committee indicated that the user charge approach showed the most promise for early development into an evaluation procedure comparable to those used in evaluating other project functions. We believe that this conclusion is still valid. Under such a procedure, fish and hunting benefits would be based on estimated charges which the sportsman could be expected to pay for fishing and hunting privileges in project areas. However, sufficient information was not then available on charges actually being made for such privileges to develop a final procedure and the Committee recommended that interim procedures be adopted. Accordingly a panel of recreation values was established to develop an administrative schedule of daily unit values from a review of available sources of applicable information experience and expert judgement. The panel was drawn from the offices of the Secretary of the Interior, the Bureau of Sport Fisheries and Wildlife, the National Park Service and Bureau of Reclaimation, The Corps of Engineers, Soil Conservation Service,

1/ Quotation from James T. McBroom, Assistant Director-Technical Services, Bureau of Sport Fisheries and Wildlife, Louisiana, November 16, 1964 entitled "Putting a Value on Wildlife". From page 9 of this speech referring to the findings of the Sub-Committee on Evaluation Standards on the Inter-agency Water Resources Committee.

Forest Service and the Department of Health, Education and Welfare. The result was a schedule of values for the various types of fishing and hunting which was believed to represent a fair approximation of the net amounts which a hypothetical private operator could realize from providing /them/ /associated with/ fishing, hunting and federal water development projects. For example, it is believed an operator of a reservoir could net from 50 cents to $1.50 for each man day of fishing provided. Also, it was believed that the private operator could net from $1.50 to $6.00 a day for each man day of hunting which he could provide on a project area. Since these values were based on the user charge concept and were intended to represent revenues which could be realized from selling fishing and hunting privileges, they were smaller than previous values which had been obtained under sportsmen's expenditure procedure." (Major points are underlined for emphasis.)

His other comments on the practicability, the basis and effectiveness of setting an administrative price are valuable.

"How has the system of administrative values worked in actual practice? On balance we believe it has worked very well. This conclusion unfortunately is not always shared by all our counterparts in the state fish and game agencies. Some have viewed these values as a "sell-out" of fish and wildlife to the rapacity of the construction agencies. Their conclusion is based on the fact that the new values are substantially lower than the old expenditure values."

It is especially notable that it works because it has acceptance of the Federal government and Congress. That is, it has the sanction of political power and to have that sanction is always quite useful. It does not have an operating price or economic value that would re-allocate any privately held land but it does operate effectively when sanctioned in the privileged public market.

"The important thing is that the simulated market value that we have attached to sport fish and wildlife has acceptance in the kind of economic analysis that is approved by the Federal government as a whole and by the committees of Congress. Without this acceptance, putting a value on wildlife would be an exercise in futility. Wildlife interests are supposed to be an equal partner in the game of water resources development. One of the reasons we have achieved that status is that we can and do validly put a value on wildlife."

5. Economic Value in a Private Market Sale

The only economic value in Table 1 -- in the sense that it is competitive with other economic goods for resources -- is the $42 per buck deer paid to ranchers in Texas. Money was paid to a rancher for shooting privileges for ~~antelope~~ deer /raised on his property. At that price it was competitive with cattle

/Buck/ deer

7

production for land and permitted a valid economic alternative to the rancher; his decision as to whether to produce cattle or deer was based on a money market for buck deer as well as for beef cattle.

ANALYSIS

The difference between an economic good and a free good is that the economic good has a price established by the private market; this price takes cognisance of the cost of making or supplying the good -- the so-called "supply cost". This tells us how much of the good to produce on the basis of the number purchased (demand) and it helps to ration the good between competing consumers. Wildlife has traditionally been a free good in North America because:

1. There was no competition for factors required to produce goods for human use and the same factors necessary for the production of a wildlife population.

2. Killing wildlife was a useful social act that prevented crop destruction; such destruction was frequently further encouraged by the incentive of a "negative price" or bounty.

Wildlife typically are not economic goods and usually no price is charged for their use because:

1. When survival of a species is threatened enough public interest is generated to encourage a policy decision to re-establish the species at substantial cost -- an interesting aspect of scarcity and the price system. Relatively few are needed for species survival.

2. Wildlife is produced and controlled in National or Provincial Parks as ...blic" good by policy decisions that say that their "value" is so obvious and so universal to all citizens that they should be supported by public funds at least in limited numbers.

3. Wildlife is "random production" from unused land or scrub. It is affected by decisions taken to produce other things that are economic goods such as timber or food, but it is not itself so greatly in demand -- at a

price -- as to be anything but the product of land held temporarily in reserve pending its transformation into farm fields or timber berths or permanently held for aesthetic reasons.

4. So little has been known about achieving high productivity and stable production of wildlife, that there would be little return to a producer even if he were paid for it. Moreover to sell it he would have to compete with game produced on public land. Game farms presumably provide more "certainty" of game -- something the hunter prefers -- but price would always be controlled at some point by the less "certain" but "free" random production on public or waste land, or chance outputs from private land.

5. The unknowns, the uncertainties, the randomness, the "chance" nature of wildlife populations made it cheaper and more convenient to administer or "manage" game and bird populations as a non-price good in a non-price market than to actually produce it. This rationing by inexpensive licenses -- sold primarily to provide visible proof of sovereignty and to cover administration and enforcement costs -- is usually based on the widely held assumption that wildlife remains a free good.

This does not say that no value can be ascribed to wildlife -- on the contrary -- it says that economic value, or price, is established only under certain conditions and for the most part these have not been met for wildlife. The cases where the use of wildlife has commanded a payment, although they have not necessarily covered the cost of producing the birds and animals involved, follow:

1. Miniscule license payments -- amounting to about 4% of total hunter spending -- are made and the income is used to administer and to regulate harvesting; token fees are paid at refuges for observation.

Fur-bearers

2. Payments are made for hunting rights on private land and for exclusive privileges to game produced and shot on the land in question.

3. In exceptional cases licenses to shoot scarce trophy game produced on Crown land are sold for relatively large sums.

Only in the last two instances has wildlife become or approached the status of an economic good. This occurs when the price of purchasing private hunting rights or trophy rights is high enough to bid the land away from an alternative and profitable use. This occurs in Great Britain in the sale of shooting rights; this report has noted a case in Texas where it may be more profitable for ranchers to sell shooting rights for antelope and buck deer than to use the same land to raise cattle.

The critical question is whether wildlife can command a price that is high enough to change the land-use pattern so that the production of wildlife will become a rational substitute for the current production of some other economic good. Only then wildlife has an economic value and only then does it represent an economic good rather than a free good. This being true it is not helpful and may be misleading to speak of unit values of wildlife: one may say a buck is worth $42 but it has no possible validity unless money actually changes hands in sums sufficient to command the use of private land for producing deer, at least where the deer herd must compete for the use of private land.

The use of local "opportunity cost" of land as a method of establishing the cost of wildlife breaks down when we examine waterfowl in the Prairie Provinces. Many kinds of land and water are used by migratory waterfowl. These resources are located in several countries. The price of shooting rights in certain private marshes, therefore, is a relatively insignificant part of total

production cost. No money -- except collection under the U.S. stamp programme that benefits U.S. farmers -- pays to preserve the original breeding, nesting or migratory habitat that might otherwise be drained for cultivation. This means that no payment is made that will retard the draining and filling of potholes despite purchase by some hunters of shooting rights during the fall hunting season. The purchase of duck stamps in the United States is an example of an economic value that is high enough to change land use (by purchasing drainage or filling rights) by farmers. This is effected through the easement programme. It is also obvious, however, that the persuasion is limited to American farmers and that stamp payments of American hunters do not purchase breeding or nesting habitat in Canada. Unlike migrating waterfowl none of those payments cross the border. They are irrelevant as an influence on the use of private agricultural land in Canada.

Clearly the full cost of Prairie waterfowl is not "purchased" in the sense of paying the Canadian farmers the opportunity cost of land retained in a state that results in waterfowl production. In this sense Prairie waterfowl are not an economic good and they have no persuasive economic value and failing achievement of that economic value, private land use should not be expected to change. Only when the hunting consumer pays a price sufficient to persuade farmers to preserve natural habitat will waterfowl have a meaningful economic value. Several "values" have been used in connection with game and waterfowl. They were examined in earlier sections of this study and though some had limited significance it was concluded that most are meaningless. Most were a record of hunters' expenditures and were not the value of the wildlife. They are used to "justify" programmes by policy decision and to establish indirect measures of "demand"; the "demand" however, is never compared with any other recreation form

to establish, for example, which might be most widely enjoyed or, comparatively, which should get a subsidy. Also, this is for a "demand" for a free good unlimited by a supply cost: this alone renders it meaningless.

The associated spending is also used as "demand" by dividing it by the number of hunter days or retrieved animals and using that as the "economic" value and the demand. Most other values attributed to wildlife are equally meaningless. They do not influence land use and they do not measure "demand".

To be quite specific about this the usual way of imputing value to waterfowl is to add up the spending for everything but waterfowl; the daily expenditures of hunters means that there is a demand for shot-gun shells, for food, for lodging and other goods and services and is not necessarily revealing of a demand for waterfowl.

There are two ways of establishing an economic value:

1. By using a market mechanism such as in the waterfowl stamp programme in the U.S., in which inputs are, in effect, bought and the product is sold to consumers.

2. By government purchasing the good and supplying it to everyone and paying the cost from general revenues.

In either case an economic value is determined. A price is established because:

1. There is a demand for something, and

2. There is a supply of it;

3. The equilibrium establishes a price that "clears" the market on payment.

An economic price or value for one product is not established nor is cost covered by measuring the cost of purchasing some other product. It should

not be necessary to insist further that a price or value is actually the objective answer to a number of questions including "How much?" or "How many?", and is a means of making subjective values meaningful because potential buyers may purchase or refrain from purchasing, just as they choose.

It is highly effective in allocating resources in a market system that uses private land in circumstances that involve opportunity costs.

The public market, used to allocate resources, frequently is motivated by non-price values. Education, for example, involves costs but the economic value of the private market is not the most meaningful quality here as long as a generally acknowledged need can be used to justify the policy decision resulting in the allocation of resources from the public sector.

Under various circumstances public spending for wildlife support on the basis of a policy decision could be undertaken:

1. A government policy to redistribute regional income and to provide local jobs during the autumn could be effected by the indirect method of improving wildlife habitat to increase waterfowl, to increase hunting, to increase jobs. The cost of such a policy can be established although its economic value cannot. Income redistribution -- for that would be the goal -- might be achieved by a less circuitous and more effective means but the objective of job creation could be used as an indirect justification for habitat improvement.

2. A policy decision could be made that waterfowl or game attract enough foreign hunters who spend enough foreign exchange to make it desirable to expend public funds to assure game for their recreation and, indirectly, to help to ameliorate balance of payments problems and give support to a region. It would increase the cash flow through a region at a point in time. (See Table 2).

TABLE 2

Numbers of United States
Waterfowl Hunters Who "Imported"
Canadian Hunting Privileges

	1963-1964	1964-1965
Duck Hunters	4,225	4,727
Goose Hunters	1,347	1,456

Source: "Summary of American Hunter Game Imports and Participation in Canadian Hunting 1964-1965", Bureau of Sports Fisheries and Wildlife, Minneapolis, Minn.

Region 3 ONLY

3. A policy decision could be taken to the effect that wildlife habitat destroyed in one area by public projects will be replaced by other habitat in some other site or area.

4. A policy decision could be made that a general value will be used to help measure and compare recreation values of wildlife for public projects -- to establish an administrative "price" because government feels recreation is so generally accepted to have value that it can be calculated for projects built by public funds as part of their justification.

5. A policy decision might be made to reduce social costs by reverting marginal land to wildlife purposes or accepting that water shed protection measures or other conservation measures are socially significant and are justified without consideration of market criteria. This would mean that wildlife or waterfowl production was achieved as a by-product of a social policy decision. Eliminating marginal agricultural land use through land closure, and using wildlife production as the reason, would be meaningful because government policy said it was. Even then, however, the service that would actually be purchased would not be wildlife production but purchasing and eliminating the right to be poor and to be a charge on society, as a consequence of use of poor land.

6. A policy decision might be made that, based on evidence available, certain wildlife or waterfowl are likely to become economic goods within some time period and this is certain enough to justify support of large populations through the interim. The cost of this would be the purchase of breeding habitat by government and/or hunters or other users. The purchase decision wouldn't be made on the basis of present economic values for wildlife because they don't exist, in part because no charge is made.

7. Some thought needs to be given to the relative requirements for establishing wildlife populations in particular, with specificity, predictability and certainty, at a place, in terms of providing a product for people in metropolitan areas that is marketable whether it is used for hunting or viewing. A great deal of attention should be given to these possibilities.

There are then two ways of reaching the goal of maintaining or increasing wildlife production:

1. Using market values and competing in the private land market for habitat with the consumer paying the opportunity cost of producing waterfowl or;

2. Using government policy decisions as a basis for getting and using the resources necessary but only on the results of a particular programme that could be costed to produce or maintain wildlife not on the spurious basis of their unit or economic value of dollars and cents. It bears repetition that money spent in an area in association with some recreation activity, such as hunting merely measures the amount of money spent on that particular form of consumption as distinct from another. Under certain conditions this can be meaningful in budget allocation, but it cannot appropriately be used for budget justification unless a policy decision says so. As any "economic value" is concerned it may be interesting but is essentially irrelevant.

Conclusion

It is not difficult to establish the cash flow resulting from the presence of hunters in an area. The multiplier effect can be determined. Indeed, this frequently has been done as justification for government recreation investment. If a policy decision is made that such spending is reason enough to produce wildlife then no economic value is needed nor, indeed, can it be established. The cash flow from spending is not the economic value of the

wildlife.

It might also be asked whether the relevant experience exists to permit predictability of production for wildlife, particularly waterfowl. Wildlife management thus far appears dependent on hunting rules to affect animal populations used for hunting purposes, rather than on mass production -- as in the case of cattle. A move into actual production and management appears to require a different order of experience and research and probably implies a tremendous increase in costs. Stamp sales in the U.S. programme of habitat acquisition, for example, cover only some 1/3 of the total costs even if one calculates the administration costs conservatively and eliminates the interest cost on money advanced by Congress in anticipation of future stamp sales.

The conclusion is unavoidable that the only means of establishing a price or value for wildlife is:

1. By confronting the consumer with the cost and observing whether he will pay it, or

2. By establishing an administrative price of very limited applicability for use on government projects.

It would appear that because we know nothing of the cost of a wildlife or specifically waterfowl programme it could be legitimate to ask to establish the cost of such a programme, and the biological predictability of waterfowl produced from it to use as the cost or supply side of the equation. This cost could legitimately be used as a basis for a stamp programme to determine whether there was sufficient demand to actually cover the cost of production. This could also require a tax on hunters or the purchase of special stamps for the privilege of hunting certain species. With that money going to the producer and with the cost known and with the cost covered by consumers, wildlife or waterfowl would become economic goods.

It might be noted that the cost of supplying U.S. hunters is not known in terms of the opportunity cost of Canadian land. It should be established. Filling the American hunting system with waterfowl at the expense of Canadian agriculture is not a Canadian obligation; or, if it is, it should become an explicit part of the supply cost equation so that it can be recognized as a part of what we are purchasing.

RECOMMENDATIONS

Frequently what we do not know is more important than what we do know -- if we know it. It is as vital to define the magnitudes and margins of our ignorance as to define our areas of knowledge. Without knowing both we cannot bound uncertainty and calculate risk. Such knowledge makes it possible to accomodate uncertainty and risk in a programme equation and to judge the probability of achieving desired goals. In short, the goals become predictable.

Research into questions, assumptions and alternatives is a way of finding what we do know and what we don't know. As the cliché has it "today's research is tomorrow's common sense". The outlines of the elements of a research programme follows. The implication is that it might be better to examine the problems of costs and biological variables and to establish some bounds and estimates of risk, scale, cost, predictability and quantity before proceeding too far on a full scale programme. Not all the biological, economic or ecological returns are in yet. Setting the highest immediate priority on research including the use of prototype programmes, and secondary priority on a large scale acquisition programme accomplishes several things.

1. Placing short term easements on essential habitat likely to be drained will, at minimum cost, provide waiting time to make final decisions.

2. Data that is not now available that will be essential for determining how large the programme is to be or can be will become available.

3. By buying time (or "hedging") the most popular constraint, breeding habitat, can be tested and refined.

4. Time is bought cheaply to more thoroughly evaluate the constraint to reduce the risk of acting on the wrong constraint or acting ineffectively on it in attacking.

5. By supporting a research priority instead of full scale acquisition, we are essentially purchasing time for research which will permit more qualitative and efficient decisions to be taken at a future date.

Besides buying time to make a "better" decision, a research programme explores the cost of alternative procedures so that the right policy or combination of policies can be selected to meet future needs; policies can be revised as new needs and goals become apparent.

It is essential to understand that the Canadian Wildlife Service is confronted by a dynamic situation. Both requirements and needs will change. It may be unnecessary now to make the "once and for all" kind of decision that the U.S. acquisition programme is forced to make. Indeed, by going all out on what appears to be the relevant historic constraint, the vital present or new constraints may be all but overlooked. Only a low cost, short-run decision that protects "vital" habitat in the short-run may be needed. Demands may change. We may find there is (or is not) danger from agricultural innovation and expansion. Hunters and others who shoot game may become willing to pay for its production or to use less of it, or to undertake greater "ritual" hunting.

The examination of alternative policy directions based on good data and with defined goals is extremely important because it prevents serious and costly errors.

What we have tried to emphasize in these recommendations is that there are ways in which risk can be minimized and uncertainty bounded. This is accomplished by using experimental programmes as well as probes into perhaps unrecognized and critical basic assumptions to further illuminate the opportunities and hazards we face in making choices.

Not the least of the hazards is the acceptance of simple assumptions such as the assumption that the only way to meet game and waterfowl "demand"

is to increase the number of birds and animals.

One relevant and meaningful programme would be to place a cost on hunting by a programme of licensing, taxing or stamp sale. This approach is the only meaningful way of establishing how many to produce, how much to charge and who to charge. It does not establish a value or price for individual waterfowl but it does the same thing as a price does; by providing a payment to the producer for production it is a guide to allocation of production factors. Where allocation of private land between agriculture and waterfowl is necessary, only a cash payment is effective and that, will eventually be -- if it is not now -- the opportunity cost of the land in agriculture.

If problems are to be solved and meaningful programme results achieved for waterfowl, the immediate need is a research programme to ascertain the outer limits of both biological and economic possibilities for maintaining or increasing numbers of waterfowl. Also needed is a thorough understanding of what can be accomplished, the costs involved and a revision of established goals in the light of these research results. Both time and research are required to establish whether agricultural drainage in Canada is actually of the same order of severity as in the U.S. and whether or not it requires the same type of programme, and whether the investment in easements results in waterfowl production that would not have taken place in any event.

A five year research programme, including continued experiment with pilot project acquisition programmes and evaluation of results, would help to establish the full costs of producing waterfowl. Potential sources of user financing could be investigated during this period to compare costs and potential income.

The goal of such a programme would be to find the most effective biological methods of producing waterfowl at the lowest money cost.

It is clear that the cost of such research could be held to a minimum by using the U.S. acquisition programme in the Plains States as a means of testing assumptions, priorities and goals. A much more concise definition of problem and ways of effecting it is needed and there would be merit in evaluating the American programme to help refine and clarify Canada's priorities and acquisition goals.

Waterfowl research done in the U.S. is a costless commodity for Canada and it does not crystallise into political obligation when imported to Canada. The potentially useful research on Prairie waterfowl presently being undertaken at Jamestown should not be ignored as an aid in revising goals for Canadian programmes when results are achieved from some of the waterfowl research programmes. This also applies to the Denver Experiment Station. These are recommended not in place of, but in addition to Canadian biological research on Prairie waterfowl although co-ordination might help to avoid duplication.

An appropriate research programme for establishing costs of wildlife production might be maintained for several years to refine and test the effectiveness of present tentative priorities established for the Canadian programme. Necessary easements and inputs might cost much more or much less than anticipated; environmental pollution and plant succession might make a revision of acquisiton priorities necessary to include only areas where "natural" habitat remains, and where agriculture is not established and is not likely to be established. The point is that very little is known biologically or economically. This would permit sufficient time to write answers to a number of critical questions.

Recommended Parts of a Biologic-Economic Research Programme

Some Reference Points for Policy and Pricing

1. How much money to supply only Canadian Hunters? - What are the economic costs of obtaining sufficient easements in Canada to provide breeding population for only the number of waterfowl shot in Canada? This question would be designed to establish the annual cost of meeting Canadian needs, how much of Canada's hunting needs would be met by its Crown land, and how much money would it cost to purchase the balance of habitat needed for Canada. Would farmers relinquish future drainage and filling rights? Is this opportunity cost, net return, land market price or above market price? Do farmers wish payment now or later, and, if, how much later? How much of the cost iceberg can we see now and is the whole acceptable? Extrapolation of these costs will give a rough idea of the total cost of supplying Canadian hunting and viewing needs. Anything additional to that is a cost incurred to provide game for U.S. hunters.

2. What cost effectiveness is there in managing hunters instead of producing birds? - Hunter management has apparently proved successful for game management in the past. Prediction of the cost and the effect on population is more likely to be successful now despite the necessity of more "political judgements" in setting hunting regulations than in designing policies to produce game. The number of biological variables are vastly great. This does not make biological estimates ineffective: it underlines the need for real biological precision to reduce the probability of political error. Hunter management, because of fewer variables, has the advantage of producing the most predictable results at least cost. Hunter management inevitably requires detailed knowledge of the size of the game herd or flock and its major characteristics. It does not require

knowledge of how to manipulate all the biological, environmental and climatological variables that influence population. Investment in perfecting tools for managing hunters efficiently might be best until the production methods, costs and efficiency are known.

3. Examination of game "products". - There is lack of specificity as to what kind of game product is wanted. Game and waterfowl admirers have different objectives with respect to game. Their wants may be competitive. Indeed, many who wish to see live waterfowl or to retrive a dead one must often forgo that pleasure because they live in a metropolitan area or because they cannot afford to travel to Banff or Baffin Bay. An examination should be made of ways to establish game "products" within 100 miles of a major city.

In short, wildlife management in general would continue by federal and provincial government regulations but they would be refined to yield a greater specificity of "product". This could include watching resident waterfowl or game at refuges, and shooting resident game or waterfowl at hunting preserves near large cities.

Specific projects of this sort would produce wildlife for defined purposes -- a predictable, saleable, "product" supported by user fees. This could make game and waterfowl products economic goods by refining demand. Such projects serve a particular public need and help generate public support for use of government financing. In the past wildlife in general was managed generally with the hope that large numbers would then supply particular needs. Now specifics are needed.

4. Examining future hunter demand and present assumptions. - Research should examine two factors: the effect of city living on hunting activity, the elasticity of hunting demand when there is a substantial price increase, and

the elasticity of substitution of one kind of hunting for another, given a price increase for one. The U.S. stamp programme could provide data on those hunters that the cost of the stamp programme eliminated from hunting. These might be examined to determine explicit reasons why people stop hunting when faced with an increase in cost. Obviously, this would not be easy. But extrapolation of hunting requirements (and use of this as a foundation for a costly programme) based on hunting experience from a rural past and free game is a very crude technique and is not trustworthy. "Demand" is not autonomous and it does not always go up.

5. Sponsor research into habitat loss rates. There is much speculation but little data on the amount, extent and future of Canadian drainage. Habitat will be affected by changed agricultural technology and land use, but there is little firm data. A properly planned five year research programme would provide needed data. This should be undertaken.

Several large water projects will eventually be established on the Prairies with reservoirs and dams. Some effort might be made to find whether these are likely to be adaptable for waterfowl breeding habitat.

We also recommend a survey made over a five year period to establish actual trends in drainage by ranchers and farmers. We would also recommend that all drainage irrigation and reservoir projects be analysed for their likely effect on waterfowl habitat and the possibility of providing amelioration. This should also incorporate best estimates of when projects will be built and of all projects likely to be established under a twenty-five year planning horizon. Effects should be analysed.

6. Investigation of an administrative price ("fiat price") for project planning purposes and for amelioration. - It is recommended that the possibility and

feasibility of establishing an arbitrary value to be used in benefit cost procedures in planned projects be investigated. Presumably these would have to be acceptable to provinces and agencies, as measures of loss from impoundment areas, together with acceptable procedures for amelioration and replacement. The assessment for replacing habitat lost by destruction might be the most valuable examination that could be made, assuming it could gain administrative acceptance (See Appendix).

7. Thoroughly examining magnitudes of various causes of waterfowl mortality to establish research and spending priorities. - We recommend a thorough assessment of the magnitudes of causes of waterfowl mortality. It is clear that some -- hunting is an example -- are a major cause but others, such as parasites, are relatively minor or their importance is unknown. A ranking of the cause of mortality with the relative efficiency and cost of control would greatly aid in establishing priorities as to what needs to be done and what could be done at a certain cost. This will help policy planners to decide what can be done in terms of cost and efficiency.

8. How many waterfowl are "enough"; what is the total cost of the upper limit; with what probability can it be reached; what is the cost? - A problem not adequately dealt with is the question "how many?". This is explored in part in the Appendix. Its importance lies in the amount and the cost of land and water necessary for a flight of 17 million ducks compared with the land and water inputs needed for a flight of 100 million ducks. There does not appear to be agreement on the necessary number of waterfowl among scientists in Canada, much less between Canada and the U.S. It appears that an effort is being made to prove that no matter what figure is proposed, more waterfowl are required. The crux is that a planning goal of a minimum flight of 17 million can be planned for, but an

indeterminate, open-ended goal cannot. A smaller figure is probably also easier to guarantee by preplanning than is a larger one, given such massive and unpredictable variables as drought.

A specific goal can also be more easily costed under a variety of assumptions. To answer the question of "how many" we recommend a macro approach with a "reasonable" upper limit. The objective would be to determine the amount of land necessary and its cost, the effect of drought on production and the probability of effectiveness, given the unknowns. A target and an upper limit makes planning possible. The allocation of funds also becomes easier. An open ended goal is not easy to plan for or to justify where there are competing uses for the resources needed to produce waterfowl.

The goal of the "maximum feasible production of waterfowl" is so loosely a definition as to be almost meaningless. But an annual flight of a specific number of birds can be analysed in terms of cost and using a variety of assumptions.

9. Analysis of sources of user revenue. - We recommend that an analysis be made of potential sources of user revenues and the possibility of tapping these sources. Clearly the provinces will be of major importance in this and that fact should be considered in any such assessment. FIRST IDENTIFY THE USER

The preceding recommendations for costing and efficiency of the wildlife programmes assume user fees will be used in substantial amounts, or that a policy decision has or will be taken that provides federal government backing and funds. Establishing a programme cost will provide an objective basis for assessing users, or for a policy decision to absorb cost. Probable sources of user revenue furnish the actual "demand" side of the equation; used together with estimated programme costs or "supply" this can establish the amount of habitat

(the number of waterfowl) that can be bought with income from users, when this cost to users indicates the personal value they place on birds and rations the quantity taken.

10. Combining social and economic purposes with an acquisition programme. - There are many situations where it is possible to combine a programme such as habitat acquisition with significant social goals. The social value of preventing the use of some submarginal land (because of the poverty cycle that results) may be greater than the value of any game or waterfowl produced on the land after closure. This is also true of removing some types of land from production. The social goal helps justify the "chance" wildlife produced by closure.

We recommend an examination of points where meshing of complementary social goals might be used to reserve land for wildlife by examining randomly selected agricultural areas in conjunction with the Canada Land Inventory. It might also be highly useful to work with Council of Resource Ministers on this and to establish in conjunction with ARDA the amount and location of land subject to closure. Other social needs might be meaningful for this purpose. These include watershed protection, retention of "wildland banks" for possible "future" uses, green belts, land reserves and so forth. Such land "closure" to eliminate the source of rural poverty was a feature of U.S. Depression policy. Closing down large chunks of the Lakes States "cut over" to eliminate attempts to farm the poor land has resulted in a "social benefit" in the fifties as the regrowth or amenity resource began to draw recreationists there.

This should have a research priority second only to establishing ameliorative values and "fiat prices" for project evaluation.

There appear to be two eventualities: one, the possibility of closing

down land or putting it into "negative management" when there is no rational way of using it for agriculture. This runs into the old problem that if land has insufficient nutrients for agriculture, it probably, though not necessarily, also has insufficient nutrients for producing or maintaining waterfowl. Perhaps a programme of research on the use of poor land for waterfowl production should become a prime objective.

The second possibility would appear to lie in the direction of land rationalization. Only "rational" drainage of sloughs and potholes would be done. This might mean "rational" in the sense of technology, market conditions of land value, and so forth.

Another possibility would appear to be in government land acquisition and resale. In these circumstances the responsible government could retain drainage easements on rationalized land. Already a large number of provincially-controlled wetlands exist as Crown water; if it is possible to prevent drainage on these alone, (through court orders or other means) it reduces the drainage problem considerably.

These proposals for a research programme could be significantly modified and, quite conceivably, could be improved through such modification. Disagreement with details as to the most appropriate research programme should not, however, be permitted to cloud or obscure the one over-riding conclusion of this study -- the conclusion that the absence of a body of research data is prejudicial to good game management in Canada and that the failure to initiate a very large biologic-economic research programme would, in the view of the authors of this study, be a very grave mistake.

LIST OF APPENDICES

APPENDIX A

GOALS, ALTERNATIVES, PRIORITIES, ASSUMPTIONS

Wildlife is not usually a direct source of wealth or employment, nor an economic good whose sale will cover the cost of its inputs. Wealth is something that can be used to promote human welfare. Wealth also has to be related to human ends that are wants or needs and will be "paid for" by taking something and giving up something else. Wildlife is a "residual" of expanding agriculture that replaces natural habitat with agricultural production.

We are really asking the question: what wealth is provided by wildlife or waterfowl that can justify removing land from agriculture either by direct purchase or by preventing the sale of Crown land?

Waterfowl is a consumers' good that is wanted as a free good. It is becoming increasingly scarce with hunting pressure and as natural habitat is shifted to agricultural production. The following sections examine briefly some aspects of a wildlife or waterfowl programme, whether purchase is made by individuals through payment for hunting privileges or by government programme or by use of Crown land. They are designed to illuminate goals, alternatives, priorities, and assumptions if answers can be got to establish great specificity, and some bounds to existing needs and wants. Some of the questions could be answered by use of a pricing mechanism that confronted consumers with the cost of their selection. Many decisions, however complex, can help to direct us toward the same ends.

Land and water of certain kinds, amounts and in certain configurations are required to produce the mallard hunting duck on the Prairies. Land without water is required as arable and grazing lands to produce wheat and cattle. More

land can be "created" by filling potholes and sloughs. Land with the control and limitation of surface water, as well as land creation by filling, is necessary for cattle production. These uses being often at the same time or place often conflict and a choice must be made between producing wheat-beef, or waterfowl. As wheat or grazing uses are extended they change the natural habitat of breeding, nesting and moulting potholes and sloughs in the same way that droughts do; wheat production also changes natural environment because machine efficiency now requires very long, flat and dry fields; cattle production also requires changes such as fencing of natural potholes and sloughs because of production intensity; intensity also requires control of natural potholes and sloughs because they may have become poisonous from pesticides, fertilizers, other residue and algae. Ground water sources are safer, and control of location of surface water sources for cattle is required in order to properly distribute cattle to equalize grazing pressure.

The point here is that Crown and private land and water may be used in many ways, and at least two of these ways produce a money income for the farmer. They are wheat and cattle. If they were not used at all they might produce waterfowl.

As the demand for the economic good, beef, increases and land prices rise, more land will be removed from natural waterfowl habitat.

The only sensible solution if more waterfowl are wanted is to purchase the private right to drain or fill -- to purchase (at opportunity cost) potholes and sloughs biologically defined as necessary for waterfowl. This would not reduce the personal income of private farmers but would replace it. Public lands that are less susceptible to private market prices or opportunity cost (national or provincial parks or other reserves and unsettled or sparsely

settled land) will always provide minimal habitat for numbers of waterfowl.

Wealth that is meaningful is that which satisfies human needs. It is often established in two ways: people wish it and purchase it privately or it is so widely wanted that a government or other politically representative revenue gathering organization produces it, or purchases and distributes it at cost or without cost to its public. (This is the case with national defense, services of some crown corporations, social security, some aspects of education and roads.) In short when a thing has value it will either be paid for privately or it will be publicly produced and distributed. In the latter case it has to be widely wanted. Indeed, a decision to hold Crown land for public recreation use is a conscious decision not to use that Crown land for agriculture or forestry and to forgo an increase in public wealth from lease or stumpage fees. If it is withheld the cost is the price the private sector would have paid for it.

Quite obviously this returns to the question of allocation of scarce resources or the use of things that can be used to produce other things. It is possible to use natural configurations and amounts of land and water to produce waterfowl; it is also possible to change the natural configurations by draining, filling, etc. (thereby creating new "area") to create personal, regional, and national wealth relative to what was produced before from wildland. Actually the choices or causality are not that clearcut. They are relative: the lapse involved in draining and filling means the land recovered can be used for the new purpose for only a portion of, for example, the following ten year period. It is not an absolute, but a relative change.

Should the export of ducks produce a payment to the land holder from southern sources that was of such size that it persuaded farmers to hold the

land in natural form for waterfowl production, then waterfowl would become an economic good and as such would counter the re-allocation of land that is occurring.

If certain varieties of waterfowl are to become economic goods and if they can be produced only by the purchase of drainage rights, a high enough price will have to be paid farmers so they will not allocate their land to production of the, as yet, more certain income from wheat and cattle. In short, if federal or provincial governments decide that returns to recreation industry justify a policy of purchase of waterfowl habitat to protect it from agricultural changes, that is acceptable. Waterfowl production becomes economically productive because the government payments to farmers made it so. The government payment, however, cannot be used first, to establish the economic good and then to justify the programme on the basis that waterfowl are an economic good. The onus, then, is on others in accepting hunters spending as a suitable basis for this governmental subsidy. If the source of monies were hunters and payment were directly or indirectly to farmers, then waterfowl would legitimately be an economic good. Their legitimate value would be the cost of acquiring their habitat if someone paid it. If general revenues alone were the source, then payment to farmers would have to be based or justified on the basis of subsidy to spending as aid to a part of a regional recreation industry (or more specifically to those operators of cabins, camps, restaurants, sporting goods stores, that benefit from such short bursts of spending.) This may or may not be justified. The point is moot. Is there political support for it?

Several significant points emerge from this and should be emphasized. The first priority for Canadian government programmes are to those that aid its own citizens. In the Prairies and the west, rural income and livelihood

are heavily dependent on meat and grain production. This has increased steadily with development of lucrative, firm foreign markets for wheat and domestic markets for beef. The Prairie waterfowl habitat is also in this area and the agricultural transition to both breaking more ground and to greater intensity of production can't be halted without payment, without a detrimental effect on the region's income. Therefore the prospective income must be replaced. Land values are rising steadily and so the cost of purchasing drainage and filling rights will become higher and higher.

That income has to be replaced is not arguable because the decisions of private land holders can only be effected through persuasion and/or a money payment. Provincial decisions on the uses of Crown land -- except where closure is economically desirable -- may not shift land into economic uses any more than will the decisions of private owners. Provincial changes may involve a loss of tax revenue.

If additional habitat for duck production is desirable it will have to periodically be bid away from agriculturalists for some amount up to a maximum of the gross amount the land would bring to the farmer in another use. No one really knows the full cost of such a programme or the number of waterfowl it will save, the amount of uncertainty and risk involved, the probability of success, and whether the proper number and type of alternatives are being looked at.

The causal management of wildlife is a most perplexing and difficult undertaking. There is vast complexity and uncertainty of prediction and causality of the biological factors for production alone. When budgetary limitation interacts with the biological complexity, the prospect becomes depressing. The following questions and examination of assumptions and

alternatives attempts to more closely structure the problem to re-emphasize important questions and illuminate difficult decisions. Some could be answered now and others after we know more about costs or have more money to use. In this way we can arrive at the intent of the terms of reference (the allocation of factors by price; the number to produce by amount paid) by another channel than the presently impossible task of establishing a price or value for a traditionally free good without use of a market mechanism or a payment by the consumer.

The goal is seen to be maintaining or increasing waterfowl populations to supply hunter, observer and treaty requirements, for an unspecified number of years. The governing questions are: how many are enough? of what kind? for whom? at what cost? paid by whom? No matter what number is decided there may be alternatives that should be considered. Economics is interested in alternative ways of reaching goals and their costs. It is also interested in costs.

There are several production and management alternatives that may be chosen and these have costs of greater or lesser magnitudes:

1. Ignore drainage and restrict hunting kill to acceptable limits of the waterfowl population and attempt to shift hunters to "free" upland game, and other birds and animals.

2. Buy enough of the system to provide for an increasing number of hunters, or the same number of hunters, or a decreasing number.

1. <u>How much is enough? Some alternative goals and assumptions.</u>

There are several major alternatives that can be selected for Prairie waterfowl. These are:

(1) Ignore the destruction of natural habitat and merely ensure that

hunting kill is low enough so that remaining habitat is used to maximum capacity. In other words, manage hunter pressure only within the trend itself, at least until we are sure hunter pressure is not itself a causal factor of decline. This is a costless alternative.

(2) Attempt to halt or to reverse the trend by the purchase of large amounts of the system. This amounts to purchasing the existing production system and may cost a lot now and more in the future. In fact, it is hard to estimate how much this alternative would cost. Think of "buying back" and reflooding Iowa, as an example to "reproduce" the previous natural conditions. Not the least of the difficulty is that the "natural habitat" is no longer there, and the present environment may not be reversible to a previous condition because of the succession of ecological plant communities that occurs even independent of man.

(3) A combination of the two approaches. In short, the answer to "how many?" may be best and most easily answered by "as many as consumers will pay for". It is instructive to question the assumptions, criteria and goals underlying the question of "how many?" These follow:

i. <u>The "quality" of certain popular kinds of hunting sport depend on large numbers of wildlife.</u> Emphasizing skill and "ritual" aspects (See Appendix G) of the sport can temper enthusiasm for this "quality" making it independent of quantity alone. This has been done through licensing procedures on the Continent. The emphasis on pretested skill and of recognition rather than numbers could satisfy the fewer hunters with a smaller population.

ii. <u>Hunters are the only major clientele considered.</u> There are actually at least two other groups to be considered: people who enjoy observing birds and people who care nothing for birds but wish assurance that a species will not become extinct through failure to supply funds for their preservation.

"How many?" for each group. Are watchers' wants reduced by the high hunting kill? Should more wildlife (waterfowl) sanctuaries be established near cities so visible concentrations can be established? Would the latter's wants be satisfied anyway if hunting kill were lower?

iii. Should U.S. hunters be supplied with waterfowl from Canadian breeding sources? Large numbers of waterfowl said to be necessary for continental hunting may depend upon maintaining the many breeding potholes and sloughs in the U.S. and Canada. (About 15% and 85% of the total respectively.) Number i above has already asked whether hunting quality depends on numbers. Large numbers are also wanted of a particular kind because many U.S. and Canadian hunters wish to hunt a particular kind of waterfowl that, unlike others, has a high agricultural opportunity cost. The political boundary between the U.S. and Canada is highly meaningful to establish who pays opportunity cost. The two political jurisdictions mean there are two programmes and clientele. The goals and priorities of each should be studied independently. At minimum it should be asked if the large numbers wanted by U.S. hunters should be produced without payment at the expense of Canadian agriculture or by Canada's government. This is critical because Canadian land has another use and a very highly paying one from wheat and cattle in an area -- the Prairies -- where low per farm agricultural income is still all too prevalent.

iv. Canadian goals and priorities are the same as those of the U.S. Canadian priorities and goals should be examined from the point of view of Canadian interests and wishes and needs. The unequal 15/85 division of breeding and nesting habitat was not always those proportions, it developed without any plan. Individual and government decisions were consciously taken to increase agricultural production and income and this resulted in a reduction of the waterfowl

"residual" through drainage and filling. As fewer waterfowl were bred on land and water under U.S. political jurisdiction the breeding burden fell on Canada.

v. Canada has a waterfowl habitat breeding shortage with 85% of the total. Having made these decisions the U.S. now has only 15% of the breeding habitat and their acquisition program is legitimately grounded on the fact of scarcity of breeding habitat. Does Canada, with 85% of the breeding habitat, have the same needs and the same priorities? Presumably the U.S. acquisition programme will accumulate sufficient land and water to provide a visible population but it will not be one that can be hunted. This is perhaps regrettable but is it really Canada's problem? Should it legitimately have anything to do with Canadian goals and priorities?

Or, if it is Canada's problem, then the problem of costs re-emerges. The opportunity cost of purchase of drainage and filling rights on private land has to be paid by someone either individually or collectively or it will not be done. This opportunity cost at present is a Canadian payment to U.S. hunters. Should this be? If limited breeding habitat is the problem and land purchase the solution the question of "how many?" re-emerges. Should the provincial governments forgo taxes or individual farmers forgo agricultural income, or should Canadian governmental revenues be used to buy drainage rights to provide satisfactions for American hunters? With 85% of breeding habitat it is not clear that there is a Canadian shortage or a high priority for habitat acquisition.

We may deplore that line that exists over "autonomous natural areas", that it fragments the "unity" of the migratory system. But, it is there. At least it establishes a relevant bargaining point. We therefore question whether the goals and priorities of a Canadian programme for wildlife are the same as those of the U.S. programme.

vi. U.S. hunters payments cannot be made in Canada for habitat purchase. Although American hunters pay for the privilege of hunting waterfowl through purchase of duck stamps, which translates itself into the American farmer's pocket (and obviously some of the money seeps into Canada by various means) this doesn't pay a single Canadian farmer. That such payment would probably affect the formal devision of duck numbers and reduce the take of Canadian hunters is not an answer. There are persuasive reasons for disallowing U.S. hunters purchase of Canadian land. The effect of this refusal, however, combined with lack of a charge to Canadian hunters, means the farmer does not get paid. Canadian hunters don't pay either so the farmer does not get their money; if general revenue is used to maintain a large bag for Canadian hunters, only they benefit.

vii. Canadian sources should supply free waterfowl as their share of maintaining the continental system. Another effect of not asking "how many?" is that U.S. hunters, despite their payments to American farmers, are getting a free good to the degree that they shoot waterfowl produced in Canada. It is little wonder that they, like anyone else, (Canadian hunters are an example) who enjoy a free good, wish more of it - a lot more. The policy question is "should they get it at no cost?".

It can be argued that U.S. operation of a series of refuges for migratory waterfowl, and state and private investments in marsh and habitat is a major contribution in maintenance to the whole continental system. Hunter payments for acquisition programmes do help maintain the system and so in equity at least they are more advanced but, a counter argument would be as follows:

Canadian breeding habitat is really the vital nexus of the entire system. Take away state and federal maintenance of refuges, and the waterfowl themselves

would find (nesting habitat) somewhere in the new reservoirs, on the U.S. or Gulf Coast, or in South America. It can also be argued that the maintained refuges really serve as baits to waterfowl for benefit of U.S. hunters ensuring predictability of kill because of the birds' familiarity with the location, protection and food and hunters' recognition of that fact. It is an interesting question as to whether refuges might be defined as the newest form of "baiting".

viii. Canadian sources should supply birds in amounts necessary for the full scale operation of the U.S. waterfowl hunting system. The numbers of birds necessary to fill up and make efficient the U.S. migratory waterfowl control system could require a great many more than at present. Intensive management of refuges and other habitat could double again the capacity of their system to serve U.S. hunter population. That is very large indeed. The operating efficiency of the large scale of the U.S. waterfowl hunting system is not necessarily the highest priority for Canada or for the Canadian farmer. If the quality of hunting remains a function of the number of waterfowl destroyed Canada's furnishing those numbers will be a truly grand international gesture.

If the American "pot" is to be filled with Canadian waterfowl it is well to remember it is a big pot and a great many waterfowl are required to fill it. There is a definite decision necessary here as to just what population level is necessary, who is to be served and who is to pay.

ix. Numbers should not be rationed by price. The question of "how many?" is governing and crucial. Is the answer for Canada to be "enough for Canadian hunters", or is it to be "enough for Canadian and American hunters"? No matter how it is answered there will be a substantial cost involved and it is better that it be paid by the consumer because it will limit appetite, regardless of the nationality. "How many?" then, goes back to goals and objectives. Is the

goal to produce enough waterfowl to make the very large American hunter serving system efficient? Is it to produce waterfowl for Canadian hunters? Is it merely to sustain waterfowl themselves as a goal, or what?

x. Are increased numbers or a predictable supply the prime need? The need may actually be a more stable supply of waterfowl at a place convenient for hunters where both waterfowl and hunter populations can be controlled with a high degree of predictability. This is necessary in order to return a big enough breeding population to use up available habitat. This is a continental problem. For watchers, an observable or visible number of waterfowl is needed close by large population centers. This has little to do with total numbers however. An aviary or zoo is an extreme form of establishing a visible population concentration and trap shooting is the extreme of supplying a predictable huntable supply of something.

The need may be to explore ways of meeting specific wildlife goals, at minimum cost, where they are needed i.e. to establish huntable numbers within 100 miles of cities and visible numbers within 10 miles. The need may be to produce wildlife in particular, while managing wildlife in general. The latter goal seems to respond best to people management. The former probably requires some research and experiment with "docile" homing species. The point is that the numbers that are wanted now are not related to costs, but to what hunters say they want when it is a free good. The relevant questions once again are: "how many?" and "how much?". If hunters are to pay a higher price for their sport they will probably wish a greater assurance that they will get a "product" when they pay it. This explains the expensively maintained shooting clubs at waterfowl concentration points. Which species can be managed to provide waterfowl in particular?

xi. Waterfowl production or hunter management? Should more ducks of a specific species be produced or should the goal be to gain such hunter control that pressure can be switched by license fees and regulations when some numbers of wildlife species become overabundant. The most useful tool may be managing hunters because their actions are much more easily calculable than to increase the production of wildlife predictably despite the unknown variables of hunter action. Instead of attempting to produce wildlife to conform with hunters wishes as a given fact (requiring increased numbers) it might be better to accept the possibility that we do not now know enough to predictably produce and manage animal and bird populations at a known cost. Managing kill within the determining factor of the wildlife population would reduce the problem to the fierce enough one of accurate inventory and political harassment if a closed season were established. This would be the most "certain" way and the most cost effective way. At least, that is, until we can produce wildlife population responses as predictable as exist for poultry. (The latter took many years of study, and much treasure to produce, and it is still a field full of disappointing little production surprises.)

xii. Wildlife or waterfowl; now, or later. The time preference for production goals is important because it bears on two connected questions. Should funds be invested in research, production, or both; when, and in what amounts? If time preferences for production now are very high, funds may be fed for actual production now at the expense of more efficient later production when more is known. Thus, production later might have been higher and more efficient had funds been put into research now. This would perhaps imply that only limited budgetary funds should be invested in production and management research except for the candidates (species) most likely to become economic goods; and, that

most of the available funds should be invested instead in research until they become economic goods at which point budget and other sources can be used for production. This more or less asks the question: How much wildlife can be produced now -- above the number that would exist anyway -- by investing a million dollars? And could more be produced later if we invested that million in research now? In short what new is really being achieved with a million dollars?

2. Of What Kind?

The mallard has been the most popular and numerous hunting duck in North America. It does not necessarily follow, especially considering the high opportunity cost, that their numbers must be maintained at previous levels or that they can be. In the first place no one really knows how much it would cost. One answer may require trained hunters who are flexible, versatile, and so skilled that hunting kill can be made selective as to sex and species. Thus, when one species get out of hand hunters are loosed on them like the avenging Furies of old. This again is a costless alternative and makes hunters a tool in population control rather than a determinant whose requirements have to be met at a great cost. This really depends on which wild game, or hunting sport, is the end in view. Also to the extent that Prairie waterfowl are a species with special habitat requirements it may be cheaper to use those numbers of them produced on unthreatened Crown land or species produced in remote places where habitat is not threatened. The costless alternative of "free goods" of upland game birds or woodchucks or other local game that can use an annual thinning can also be considered. Or, both alternatives can be provided but with a money or "effort" price to reduce kill of the species that has become scarce.

We are suggesting that it may be very costly to manage "causally" and intensively a population and that it may be more efficient and "costless" to manage hunters compared to purchasing the existing production system. At the least these alternatives should be carefully analysed.

The answer to "of what kind?" and "how many?" could be solved through a pricing mechanism by the amount that would be paid for an item that uses scarce inputs and by focusing kill on particular animals, birds, species and sex as population control requires. The land necessary to maintain the prairie ducks in huntable numbers is very expensive. Some expensive habitat, needed for breeding, nesting, moulting and migrating, could be used for agriculture. Whether it is an economically valuable fowl or not, it is by measure of opportunity cost, a very expensive one to maintain. It may be best to look for fowl with less particular and competitive needs. In short, mallards are now costly where once they were free goods because the resource that was a free input, can now be used for something else that can be sold. It may now be time to use other animals that are free goods to satisfy hunter needs. This will require a better, more flexible hunter, if that clientele wish "free" game.

3. For Whom? Will Hunter Numbers Increase?

A common assumption that also applies to "how many?" is that the increase in number of waterfowl will necessitate more wildlife and waterfowl. This assumption may be accurate. However, consider that there is a rapid movement of people from isolated rural places where hunting is popular such as towns, and small cities to large clustered cities. This movement will probably continue for a time. A glance at hunting participation (Table A1) suggests that a much higher per cent of total population in the small cities, towns and rural places hunt than do residents in metropolitan places. Of course 3 per

TABLE A1

Per Cent of Hunters with Residence in Cities, Towns and Rural Areas

	Per Cent of Hunters		Annual Hunting Trips of more than 1 day	
	1955 (%)	1960 (%)	(000)	(%)
Big Cities	2	3	273	1.2
Small Cities	6	6	731	2.1
Towns	12	13	607	2.9
Rural Areas	16	17	2,692	3.2

Source: "1960 National Survey of Hunting and Fishing" U.S. Department of Interior.

cent of the population of large, growing areas is a lot, but to suggest that hunting is a rapidly growing sport without looking at underlying bases is not convincing.

One might infer, for example, that hunting is a sport acquired by individual tutelage from adult males of farm origin who train their sons and nephews to hunt. In cities there is less opportunity, fewer such teachers, more money for other recreation pursuits, many more forms of recreations, etc. This set of conditions may very significantly affect hunter numbers by 1975. The number of hunters in general or hunters of particular kinds of animals and birds could as easily decline as increase in ten years despite expected population increases.

Hunting is also related to the availability of game. That alone restricts its effective production for that use to a radius within 100 miles of the city. When game or places to shoot it in that radius are limited there is probably also a reduction in hunter numbers.

Nearly as good a case can be made for the decrease in numbers of hunters as for an increase. Therefore, in projecting demand, it would be well to treat the number of hunters as a conditional variable rather than as a predictable rate of increase on which need for increased numbers of game are based. This will certainly have a major effect on the question of "how many?". Indeed, an attempt to assess the effect of city living on people born in the country might be most desirable in evaluating the validity of present demand estimates or for projecting new ones.

The question of "for whom?" also relates to conflict between hunting and observing clientele. Traditionally, hunting clientele have been served as a first priority in contrast to observers. Those interested in wildlife

(called clientele) have traditionally been conceived as a unitary group, although this may be quite inaccurate. The competition between hunters and wildlife observers, for example, is in the tendency of the former to reduce total numbers and perhaps, therefore, visible wildlife. The two groups, then, may conflict in goals and interests. A relevant question is "for whom?" the total number of waterfowl is to be increased.

Another question is whether, as intimated in some (especially conservation) literature, wildlife are or should be maintained for their own sake. If it is that, it is a quite different goal and the role of hunters would be only a management one to prune numbers as required.

Whichever the goal, its clarification would help establish the priorities assigned to hunting and observer groups as clientele. If hunting is a management tool, research is probably necessary to make it much more selective than it is now.

These questions relate to goals. The question "for whom?" applies also to the question of producing for American or Canadian clientele. This question also has a great deal of relevance if a "dynamic" is applied to clientele. Are waterfowl to be produced for hunters as they were defined twenty years ago, ten years ago; observers as defined during that period; is a re-definition and re-assessment required to find out who future clientele are likely to be, their requirements, necessary locations and, most important, programmes that can be undertaken to provide the requirements. One need, then, is a new dynamic definition of clientele group since it is not a static thing.

4. <u>At What Price?</u>

Perhaps the greatest unknown in waterfowl management is the cost of management. Some fallacies of "value" in literature have been noted. We have

established that a price cannot be "given", for it is itself the "product" of a market interplay of demand and a supply cost, except in certain privileged instances such as public markets where a policy decision has been made and an administrative "price" established. A price or economic value finds use for rationing scarce things and for establishing how to use money best to do something most efficiently. In short, it is useful for allocation.

The question "at what price?" relates back to the question of "how many are enough?". If we do not know the cost of causally producing waterfowl, then no real price can be established with which to confront the consumer irrespective of whether he will then actually pay it. The point is, however, that after biological definitions of habitat and causal production methods have been so precisely defined that the supply of waterfowl is predictable (except under defined conditions of uncertainty, such as drought) we will then know the cost to be included as a price component. It is essential to determine that overall cost and whether someone will pay it. If it is not paid for, we will also know its economic value to is clientele group. If waterfowl are wanted only as long as they are a free good, a chance "output" associated with natural habitat, switching pressure to "free" species, or "managing" hunting kill within constraints of autonomous population trends may be called for unless someone is willing to establish a government subsidy -- that is, make a case for cutting back hunting or for a policy decision at political levels to increase public contribution to maintaining the margin of the system necessary to produce waterfowl in sufficient numbers to meet production goals. In summary, it is first necessary to know the cost of a predictable effective production system before consumers willingness to pay can be tested. A high priority for research, then, is to determine the economic cost of the production system from the biological determinants for that production.

5. Paid By Whom?

The policy decision of some importance that can be solved by consumers paying costs involves determination of who receives benefits. Those who "use" wildlife and waterfowl are Canadian and American hunters, Canadian and American observers of wildlife and waterfowl, and Canadians and Americans who merely wish the species to be continued. Only the first two are relevant. Who is to pay and in what proportion? The underlying assumption here is that the consumer has to be faced with the cost of a commodity before he can decide the amount he requires. This is also true of wildlife and waterfowl consumers. Should waterfowl and wildlife observers be assessed because they are getting some commodity (although they do not reduce stock representing a non-consumptive use)? Should hunters be assessed some or the balance of the cost because they greatly reduce populations? Who should be assessed and how much?

An important question here is of equity. Outdoor recreationists are not so numerous in Canada or the U.S. as to constitute an overwhelmingly convincing argument for recreation subsidy. It could easily be argued that considering benefits by government educational subsidies and other subsidies to the affluent, that an outdoor recreation subsidy only further benefits the affluent who don't need it. Minimum equity at least would be achieved if the favourite form of recreation of all citizens were provided by equal per capita subsidies. This is obviously another policy question that will not likely be decided on equity but sources of possible future criticism should be made manifest.

The question "paid by whom?" is extremely important because of its interaction with all other questions that have been asked previously. The answer to the question would help establish meaningfully the inter-related question of "how many?".

6. Summary

It has been argued here that all of the questions, "how many are enough?" "of what kind?" "for whom?" "at what price?" "paid for by whom?" are inter-related and could be answered simultaneously by a price mechanism. It is unrealistic to expect that now, but answers to these questions using policy decisions and existing data would be helpful. Merely establishing the principle that a price for hunting privilege should be levied would be a major advance. The price equivalent to that paid by United States hunters for stamps, or a larger charge, would illuminate magnitudes of the problem at least and establish some of the answers to these questions. For example, a payment for hunting prairie ducks, the income used to acquire parts of the production system, might well shift hunting pressure from the then economic goods to free goods of upland game, or other surplus game. In a very real sense it would aid definition of the magnitudes of the problem by establishing the amount of money that would be willingly spent in the private market for this particular type of game. Meaningful management alternatives using these private funds and/or public funds if they were justified by policy could then be allocated to the most meaningful programmes for effecting production and control. Without answers to these governing questions there remain many dangerously obscure points.

APPENDIX B

AGRICULTURAL TECHNOLOGY AND LAND USE PATTERNS AS DETERMINANTS FOR WATERFLOW PRODUCTION

In order to determine the necessity for a programme of land acquisition for waterfowl production and its consequent costs it is necessary to make the analysis using several assumptions about changes in Prairie agriculture. The very fact of the proposed easement programme assumes change will be detrimental to waterfowl production. Some enlightened speculation can be got here by asking what would happen to waterfowl if nothing at all were done to change agricultural practices. (If we continue to assume that breeding habitat is the vital constraint.)

To grow things profitably in commercial agriculture certain things have to be done to increase production: the use of equipment may help; changes can be made in the land itself to conform to equipment; the intensive or extensive management of the land and new production technology can be applied.

For example there is evidence that equipment will become larger and heavier and corresponding changes will be required in the land itself to efficiently use heavy equipment and achieve maximum soil productivity. Expensive equipment implies large costs if stopped through breakage, miring in a slough or even turning around a pothole. Maximum efficiency is achieved with straight, long fields free of potholes and with a minimum of fence lines.

On the other hand, lighter equipment that works shallowly and adapts easily to terrain could conceivably be developed so that little actual modification of land is necessary. As for demand, there is likely to be an intensification and extensification of grain production as foreign and domestic markets increase for grain and livestock.

The land of the Palliser Triangle (including the brown and much of the dark brown soil zone in Alberta and Saskatchewan) -- an area of about 62,000,000 acres -- frequently harbors 60-65 per cent of the breeding ducks of the Prairies. Production trends are changing within the beef-wheat economy there. One expert expects changes to have only a small effect on the land use pattern -- changes will occur within the land now used and will not require new land. But he expects the filling and draining of potholes on cultivated land will continue throughout the entire area, irrespective of size of farm. He also feels that ranchers will not try to fill potholes -- although they will try to consolidate smaller ones -- because they prefer to have "as many watering sites as possible on their property".

As this land has only an annual fifteen inches of rainfall it would appear at first glance that reservation of surface water would be an important consideration. Consequently there would be a costless way (a socially useful way) of preserving potholes, waterholes and sloughs because of their value to cattle production. This does not help much where there is intensification and extension of wheat production.

One article[1/] points out that the quality of water is particularly important for livestock, particularly:

"in hot weather when large amounts are required -- and when animals may have to rely on water from sloughs and ponds -- parasites such as flukes, round worms and tape worms may be transmitted through water, as may bacterial infection such as leptospirosis, salmonellosis and Johne's disease."

Other problems are involved from contamination of natural sloughs and water sources by faeces and urine. Water from new dug-outs, sloughs and alkali lakes, if high in nitrates which turn into nitrites, cause death by suffocation

1/ See The Water Needs of Livestock by J.S. Cram, from Family Herald, No. 23, November 11, 1965, p.28.

and from sulphates and chlorides. Finally, the water sources may be contaminated by heavy growths of blue-green algae, which sometimes produce a toxin fatal to livestock.

All of this means that existing natural water sources have to be under control either by pumping water from the sloughs or ponds into drinking troughs, using ground water instead of surface water and fencing livestock out of lakes or sloughs or eliminating those lakes or sloughs. Naturally the overall effect of all this on surface water sources as cattle production increases cannot really be known.

For these reasons it would appear that natural habitat that is used for waterfowl, at least in the agricultural zone specified in Map I, will likely undergo change as agricultural production increases and as waterfowl becomes more and more a "change product" in the Prairies. Certain counter trends are visible although their full effect is not known.

Not all drainage is a one-way street. The following table summarizes some examples of the replacement of waterplaces on the Prairies. (Table B1).

In addition there are borrowpits from road construction. These may or may not provide habitat. Moreover a great many water storage projects are likely to add thousands of square miles of surface to the total.

The provision and control of water is important as a growth element for the industry. This will affect the Prairies in two ways. First, the discoveries of potash deposits are in a strip coterminus with that of waterfowl breeding habitat (on either side of the C.N.R. track) between Brandon and Edmonton. To build this industry will require tremendous increases in the amounts of surface water. The east central multi-purpose river development recently proposed by the Saskatchewan Government at an estimated cost of

TABLE B1

Construction of Individual Dugouts, Stockwatering Dams, Community Water Storages, and Future Estimates

	Past	Future (by 1975)
Dugouts	38,411	(
		(
Stockwatering Dams	2,967	(30,000
		(
Community Water Storages	482	(

Source: Courtesy P.F.R.A., Canada Department of Agriculture

$10 million is an example of the kind of manipulation of surface water and supply that can be expected in the future. 1/ The proposed system "would supply water to potash mines east of Saskatoon, create a large lake in the Black Strap Valley 30 miles south of Saskatoon, and would provide many small towns and villages with an assured water supply -- something they have been worrying about for years. It is not known whether this kind of development is significant for waterfowl production. It does indicate that there will be greater control over water in environment than has been the case until now. It will, at least, increase the migratory habitat.

As with several other productive factors in agriculture, water requires very close control if its use is to be planned. The uncontrolled presence of surface water (as shown with respect to cattle) may be a detriment and, similarly, random rainfall may be a detriment. It is out of "control" and so may determine the use of everything else. It is not predictable. Little planning can be done. Therefore, we must speculate that management of water for agricultural production will reduce the chance of natural sloughs and water-holes as water becomes more thoroughly controlled.

The implication here is that within some time period natural habitat that is unfarmed or undrained may be reduced significantly. The implication is also that since parameters of this magnitude are involved, it is necessary to learn to manage waterfowl production within the overriding needs of the project or, alternatively, to come up with waterfowl management projects that are designated for management programmes, are costed out and achieve public support for waterfowl production. This would be similar to support for water management in certain areas. The question might become "what changes are planned for the

1/ See The Financial Post, October 2, 1965, p. 23.

management of water area, that can also be used for producing waterfowl, that would formerly be produced environment or 'natural' environment?". The other relevant question is "what is the degree of adaptability that can be assumed for the mallard and other dabbling ducks?". There has been remarkable adaptability in other animals such as the muskrat, the fox, the white-tail deer and other animals and birds that live in close proximity to people. Their original environment changed greatly but some of these species found the changes beneficial.

We may conclude that there will be much greater "control" and management of the two physical resources of land and water in the future than has been true in the past. We may speculate as to whether it would be wise to retard that process significantly.

Some changes in "natural" environment are beneficial and some are harmful depending on personal conviction. Changes in natural environment were beneficial to wheat producers but harmful to buffalo. Changes in natural environment resulting from forest spraying may be beneficial to trees but harmful to many animals and to people at the end of the food chain. Use of pesticides in California, for example, have resulted in warnings to hunters of upland game that it may be harmful to eat that game. Whatever the case for "natural environment", many of the changes of the natural environment have been highly beneficial to waterfowl and other game as well as being harmful. Therefore, it is not wise to categorically state in a misanthropic way that things must remain only as they are. The opportunities within the proposed changes have to be investigated to see the optimum choices that might be made.

We are more or less certain that there will be changes in "natural environment" from changes in agriculture. A major point, however, is that we

do not know how fast this will occur. The slower it occurs and the harder we work to find the opportunity in the change the better result achieved from the problem defined. In short, if the changes are going to be made very fast we do not know what the results will be. It is difficult to figure out whether we should select those alternatives about which we now know little when we do not know how fast the changes in agriculture will come. If the changes come slowly we have ample time to evaluate those changes and make the best decisions, compatible with costs, if we act to direct research to those questions now.

Those who look upon the drainage as a "destruction" of habitat and not as a net gain in terms of food production have assumed that drainage will eliminate habitat completely. This is in line with agriculturists and other experts, who use single factor analysis to interpret technology and changes that might be made in agricultural production. They too assume these will happen tomorrow. It is possible, for example, to increase various forms of agricultural production by at least 30 (if not 100) per cent merely by defined changes in management, right now. Similarly there are technologies and systems of farming and cultivation that would revolutionize agriculture right now. The point is that each one of these changes and opportunities has to work within a context of many problems, many opportunities, many factors as well as certain costs or losses from choosing one alternative instead of another. It may be possible, for example, to immediately use a new farm production system but it also requires borrowing money, assembling land, training operators for that system, changing marketing arrangements and arranging support facilities. One must never underestimate the impact of Murphy's Law on change: "If there exists the slightest chance of a malfunction in a new system, one may expect it with a probability of 1.0". All these things will affect the speed and efficiency with which that technology is introduced. Similarly, the water factor requires

integration with many other problems and many other opportunities. There is a whole complex of things involved in establishing and operating an irrigation function.

Not the least of the problems of introducing something new and the speed with which it is introduced, is the resistance of the people affected. Labour that has been trained to certain technologies and certain production forms tends to prefer these despite new opportunity for improvement. Indeed, this may be the optimum course for them because they expect Murphy's Law to operate. Therefore, even with new opportunity in management, technologies, machine technologies, use patterns and agricultural rationalization schemes, there is a probability of a lagged response. This means that there is probably enough time to find what to do for waterfowl. Change sometimes comes rather slowly.

Contradicting this is that, given certain imperatives or new markets or "demonstration effects", there is the possibility of extremely rapid change. The response of agriculture to the imperatives of the second World War is such an example.

It can, of course, be argued that the change would have come as rapidly in peace time. Obviously, the key here is in the speed with which people will change or respond to incentives. How fast will individuals respond to imperatives of government programmes for farm consolidation and how soon will intensive management occur? Even where farms are purchased and consolidated an interesting question is whether the farmer operates them extensively, or whether he will change and manage the units intensively. It is likely that there is a lag here. That lag may not destroy natural habitiat for waterfowl.

A calculation is needed as to what we will accomplish if we act im-

mediately on perhaps ungrounded assumptions with a possibility of our being wrong in habitat selection. That is protecting the wrong thing; can the natural land be controlled? The remarks of several experts familiar with the conditions in the prairies and especially with the Palliser Triangle differ in estimates of time required for consolidation and intensification. This relates to their assumptions. Perhaps the most reasonable thing to do is to define as many of the unknowns and imponderables as we can and revise our estimates of options as more information, data and analysis become available in the short-run.

One of the most significant questions that should be resolved at some point is this: where only price incentives (at the opportunity cost of agriculture) can be used to change the habitat constraint, can we be sure enough that this will produce results? With what predictability? Could the same amount of money be used with greater efficiency and more predictability in some other way?

We may conclude that there are many new options available in agriculture, to which rapidly expanding markets may be basic. These options provide the potential for transforming natural landscapes into highly productive agricultural enterprise. The speed with which this transformation will occur (including the levelling and filling of land for wheat production, use of chemicals, control of water and potholes to control cattle grazing), is debatable. For the short-run that pace appears glacial. It would be foolish, however, to merely extrapolate past trends even where they are known. It does seem safe to predict that surface water will increase rather remarkably in the relevant area through the use of dams and reservoirs. This will become the most significant factor within the next ten to twenty years in amelioration. For the rest, we need to know whether habitat is threatened and at what rate. That should be determined.

APPENDIX C

THE VALUE OF SPORTING RIGHTS

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The presence of good facilities for sport enhances the value of any estate, but by how much it is difficult to say. The weather plays an important part in governing the productiveness of most sporting estates, and this can have a bearing on the prices that purchasers or lessees are willing to pay in any one year. For example, rod-fishing can be affected appreciably by adverse conditions of weather and water, and much shooting appears to have suffered this year as a result of last winter's bitter weather and the poor summer we have just experienced. In general, however, it pays most estate owners to exploit the potentialities to the full, for the cost of doing so will usually be less than the extra revenue that is produced or the additional value when the property is sold.

A case in point is the establishment of a shoot in a growing timber plantation: the revenue from the shooting helps to defray the growing costs until the plantation becomes commercially profitable in its own right. Rents or prices paid for shooting depend entirely on size, facilities and situation, but a gun in a pheasant or partridge shoot can fetch anything from £250 to £750 a season, and in the best shooting areas (Hampshire, East Anglia and Berkshire) the cost of a gun in a syndicate may be anything from £500 to £1,000, depending on the quality of the ground and the extent to which it is keepered.

Grouse Moors: Much the same is true of the grouse moors of Yorkshire, Westmorland and the Highlands. On a good driving moor a rent of £3 per brace shot can be obtained -- on a 500-brace moor this would mean £1,500 a season, or about £200 to £250 a gun in a syndicate of six or eight guns. Sales of grouse moors in recent years have fetched prices ranging from about £3 an acre in the Highlands to as much as £6 an acre in Westmorland.

The value of fishing rights is nothing if not unpredictable. Good trout fishing fetches about £5,000 to £10,000 a mile of single bank, and salmon fishing anything from £10,000 to £20,000 a mile. But it is not realistic to relate price to length of fishing, because there may be many yards -- or even miles -- of unproductive water. On the other hand, particularly in the case of trout fishing, certain stretches of perfectly good water are probably being under-fished on some estates, for no other reason than that the beats were defined years ago when the river was heavily fished for a long period each season, and no one has thought to change them now that most fishing is done at weekends. The same is not so true of salmon beats and pools, because the rise in values in recent years has resulted in many beats being divided into as many productive lettings as possible.

Good salmon fishing can command rents of up to £100 or more per rod per week, and for freehold salmon fishing rights the price can be as much as £200 for each salmon in an average season's catch.

River Boards: Apart from weather conditions, the actions of river boards and anglers' associations can have an effect on the value of fishing rights. A year ago the Hull and East Yorkshire River Board opened up 100 miles of new waters to the general public, and the action of the Anglers' Co-operative Association in preventing pollution of the River Dove in Derbyshire recently has resulted in 20 miles of fishing being opened up for the first time in 20 years. Several river boards have also planted out eggs and fry in attempts to re-establish populations of salmon and sea-trout. The more waters are opened up to the public, the less is likely to be paid for fishing on private stretches of fashionable rivers.

On the other hand, the establishment last year by the Avon and Dorset River Board of a salmon hatchery on the River Avon at Standlynch Mill, on the Earl of Radnor's estate, is likely to have a beneficial effect on values. Previously about 2,000 salmon entered the river each year, and the average rod catch was about 500. The hatchery's introduction of 250,000 eggs is expected to result in a further 750 adult salmon returning eventually.

Scottish Salmon Fishing: Salmon and sea-trout fishing is included in two Scottish estates that are currently for sale through Knight, Frank and Rutley. The first is the Borve Lodge estate on the Isle of Harris in the Outer Hebrides. The lodge was rebuilt in 1911 by Lord Dunmore and was later owned by Lord Leverhulme. It has nine principal bedrooms, three staff bedrooms, four reception rooms and three bathrooms. Fishing in the River Laxdale, Loch Fincastle and Loch Laxdale shows average catches of 20 salmon and 175 sea-trout, and in addition there is shooting for snipe, woodcock, duck and a few grouse. The lodge is for sale at £25,000 with a cottage and 114 acres of land.

The second is part of the Aldbar estate, near Brechin, Angus, for which the London agents are acting in conjunction with William Finlayson, of Aberfeldy. Aldbar Castle, which is included in the sale, is at present divided into five flats, but the agents state that it could easily be converted back to its original state. There is a mile of salmon and sea-trout fishing on both banks of the South Esk, together with 51 acres of woodland, 122 acres of arable land and a lease on 66 acres of adjoining farmland. Offers in the region of £32,500 are being invited.

Partridge and Pheasant Shoot: The Humby Hall estate, near Grantham, Lincolnshire, which is for sale through Hodgkinson and Son, of Bourne, includes a small pheasant and partridge shoot. The estate extends to some 1,629 acres, all but 70 acres of which forms Humby Hall Farm, a dairy holding with a farmhouse, farm manager's house, nine cottages and a range of modern farm buildings. In addition, there is the 24-acre Hurn Wood and a small holding of 48 acres, both let, although the shooting rights are in hand.

Wrottesley Hall, near Wolverhampton, Staffordshire, is for sale through Strutt and Parker, Lofts and Warner, acting in conjunction with the local firm of Duncalfe, Hatton and Gardner. Most of this 3,263-acre estate consists of 12 mixed farms which are let and produce £10,504 a year, but vacant possession is offered of the Hall, two modern houses, seven cottages and a lodge, together with 352 acres of land, including 165 acres of woodland, though possession of the shooting rights will be deferred.

APPENDIX D

EXPLANATION OF ADMINISTRATIVE PRICES AND THEIR USE

Source: "Putting a Value on Wildlife", remarks by James T. McBroom, Assistant Director - Technical Services Bureau of Sports, Fisheries and Wildlife, Louisiana, November 16, 1964. (See especially pp. 77 & 78)

> You can't put a dollar value on wildlife.
> Any attempt to do so only plays into the hands of the enemy and leads to the destruction of wildlife and related natural resources.
> Wildlife and fish resources have values mainly in the mind and spirit of mankind. You can't measure the satisfactions of an outdoor experience in dollars. It's like putting a price tag on your wife and offering her at an auction sale.

These are the precepts that many dedicated conservationists earnestly espouse. They have a point. To the extent that an outdoors experience related to wildlife equates with the experience of visiting the Lincoln Memorial, or viewing the beauties of Yellowstone Park, they are dead right. Who would be gross enough, and lacking in grace enough, to call for a dollar evaluation of what it is worth to stand before the inspiring statue of the Great Emancipator or to experience the thrill of seeing Old Faithful erupt in a cloud of steam?

Not very many.

But the problem is -- fish and wildlife values -- even though they are principally values for the soul of man -- are almost everywhere. They are caught up in the march of progress toward a better life, in dollars, for all of us.

Drain a swamp -- a wildlife paradise -- so that the land under it and around it can be free of mosquitoes and available for human habitation and profit taking.

Why not?

This is how America got to be great. When we cut the forests of the North and plowed the Great Plains, we displaced the wildlife, including one of the real symbols of the West, the buffalo.

The thing is -- wildlife and fish -- if they are to survive -- must survive in the world as it is -- not in a nostalgic world of yesterday. It is futile and self-defeating to apply standards of another day, when today's decisions on the use of land and water resources are made -- must be made -- by the hard, cold criteria of the dollar.

So -- if fish and wildlife interests and agencies are to get into the game of resource development, they've got to play by the rules of the game. Those rules are based on the dollar.

A whole school of economic theory has now been erected on how to decide whether to undertake -- or not to undertake -- a project to alter the face of Nature -- to build a dam or not -- to drain a swamp or not.

This economic theory clusters around a thing called a benefit-cost ratio. If you measure the dollar benefits and find them greater than the dollar costs, you've got a good thing and you authorize and build a project. If it can't measure up, you reject it. You feel good about this because you've got a good reason -- you're not operating blind.

Putting a value on wildlife is difficult and complex, but it is futile not to try if wildlife is to be an equal partner in the councils of planning for natural resources development.

The evaluation of commercial fishery benefits at water resource development projects does not present as difficult a problem as the evaluation of benefits associated with recreational fishing and hunting. Since commercial fishing products are sold in the marketplace, information is available on the evaluation of such production at the fisherman and subsequent processing and distribution levels. The May 1958 Report of the Subcommittee on Evaluation Standards of the Inter-Agency Committee on Water Resources recommended that the value of increased commercial fishery production be obtained by applying expected market prices for these products. It recommended further that all costs incurred by fishermen in harvesting and marketing these products be considered as associated costs and deducted from gross benefits to obtain the net benefits attributable to a water development project or program. Senate Document No. 97, 98th Congress, provides that net commercial fishery benefits of a water development project or program should represent the increase in the market value of commercial fish less the associated cost.

The Bureau of Sport Fisheries and Wildlife works closely with its sister agency, the Bureau of Commercial Fisheries, in evaluating commercial fishery benefits of water development projects under its River Basin Studies program. We rely on that Bureau to provide us with advice regarding the economic aspects of commercial fishery production. That Bureau has determined that benefits properly attributable to a given project may occur at the processing level as well as at the point where the fishermen market their catch. The Bureau of Commercial Fisheries believes that wage payments to fishermen may also represent benefits properly attributable to a project. We agree with the Bureau of Commercial Fisheries in this regard and believe that benefits to a commercial fishery should represent gross revenue received at both the fisherman and processing levels less appropriate associated costs and should also include wage payments to fishermen in certain cases. At our request the Bureau of Commercial Fisheries is developing an evaluation procedure along these lines for use in our River Basin Studies program.

Until such time as the new evaluation procedure has been developed, we are evaluating net commercial fishery benefits in terms of gross revenue at

the fisherman level. We are doing this with the understanding that the summation of net income at the fisherman and processing level together with certain wage payments would approximate the present gross revenue at the fisherman level. We expect to begin using the new evaluation procedure in the near future.

It may be interesting to note that the Corps of Engineers often makes its own evaluation of commercial fishery benefits at harbor improvement projects. In this connection the Corps of Engineers has assigned 40% of the gross revenue to fishermen as a net commercial fishery benefit.

Although such evaluations have proved adequate for the justification of many harbor improvement projects, we believe that an estimate of the true net benefits which will arise to the commercial fishery as a result of these improvements would be substantially larger.

Sport fishing and wildlife values, though they do not lend themselves readily to expression in dollars, are very real indeed to the 50 million Americans who hunt and fish and to millions more who find relaxation and respite in watching and photographing wildlife. In this respect, such values fall into that class of pleasures described by the song "the best things in life are free". The difficulty of placing tangible values on these experiences is due to the fact that they are essentially intangible satisfactions and are based largely on aesthetic considerations. In short, these are the experiences you "wouldn't take a million for" although you may pay very little to enjoy them.

The conclusion that fishing has a great value is buttressed by a statement made by the American Medical Association this summer that "Fishing is highly recommended by your Doctor as a healthy, relaxing sport that will get you out-of-doors into fresh air and sunshine and clear those mental cobwebs left over from home and office worries." This can be interpreted to re-inforce our contention that wildlife conservation equates very closely with the conservation of human resources, the most important of all.

Despite the obvious difficulties of valuing wildlife, we are faced with the necessity of doing just that and have been doing so over much of the past two decades. This action was made necessary in order to meet the demands of an economic apparatus developed over the years by the Federal Government at the behest of Congress. This apparatus provides the simplest means by which C ngress and others can quickly assess the relative merits of proposed water resource projects. The end-result is the benefit-cost ratio. The ratio indicates at a glance whether the dollar benefits created by the project equal or exceed its dollar costs. It remains the best single index of a project's merit.

To find this ratio for water development projects, the benefits of increased net income from irrigated agriculture, savings from improved transportation and flood damage protection, value of increased hydroelectric power generation and, more recently, values of recreation and fish and wildlife enhancement are racked up by the construction agency on the benefit side of the ledger. These benefits are summed and their total is then compared with the total of construction and operating costs computed on equivalent bases. If the benefits are greater than project costs or, in other words, if the ratio

of benefits to costs is greater than 1, the project will be recommended for and will likely be blessed, in due course, with Congressional authorization for construction.

In the water resource game, Congress has designated the players and the cards, and ordered that it be played according to the rules of Hoyle. No one is permitted to play this game without informing himself of the rules and following them. Fish and wildlife conservation and development was admitted fully to this "select" circle of players by the amendments to the Fish and Wildlife Co-Ordination Act, enacted in 1958. In this Act, Congress decreed that fish and wildlife conservation and development shall be equally considered with other features of water resource development. This means that from that time forward this purpose is to be considered on a par with flood control, irrigation, navigation, and other players of the game who were dealt in earlier.

The Congress also indicated that fish and wildlife would be expected to follow the customary rules of evaluating benefical project effects in dollars. Note that we evaluate only the plus, or beneficial, effect, and not losses. We hold that the resource is worth at least as much as the cost of making whole any losses that are sustained as a result of the project. The only constraints on proposed restoration measures are that they be engineeringly feasible and that their cost be reasonable in relation to the results expected. In short, we do not evaluate the value of wildlife habitat destroyed by a reservoir in order to develop a "reverse benefit-cost ratio" which might be used by the construction agency or others in determining whether the value of lost habitat is sufficient justification for its replacement. In this respect, we consider fish and wildlife to be comparable to a railroad which is replaced by the project without formal analysis to establish justification. If either resource is destroyed, it is a project responsibility to replace it.

When we first evaluated project effects on fish and wildlife prior to the 1958 Act, we used sportsmen's expenditures as a dollar measure of project effects. These consisted of the total amount of money spent by fishermen and hunters for a wide variety of goods and services used in connection with their pursuit. A primary mark of the economic value of a resource, of course, is the actual or potential human use or need it will satisfy. For example, we knew from our 1955 National Survey of Fishing and Hunting that fishermen, on an average, spent $5 per day of fishing use for gasoline, boats, food, equipment, bait, etcetera. We considered these user-expenditures to be valid contributions to the economy, and there is no question that they are.

The problem was that our use of these daily values multiplied by estimated days or hunting or fishing was not on "all fours" with the rules of Hoyle as applied to water resources development. The rules of the game require that benefits be expressed in terms of <u>net</u> income or profits to some primary beneficiary. Expenditures represent <u>gross</u> income to a number of businesses. In applying the user-expenditure approach to evaluation we were forced, in justification, to the argument that these expenditures did, in fact, generate amounts of net income equal in total at least to the sportsman's expenditure as that money flowed through the economy. Another point in this argument -- and the one most frequently advanced -- was that the recreationist himself,

the most important beneficiary, was reaping satisfactions whose total value was at least double the amount of his expenditure. That is, in addition to his expenditures or costs, it was assumed that he was realizing an equal net return as a benefit.

These were inexact and weak arguments in the eyes of the other players, who insisted on something better if we were to remain a player. We were anxious to remain in the game in order to insure the truly important benefits to fish and wildlife that were possible in connection with the 2½ billion dollar annual water resources program. Accordingly, we set about developing better methods, in concert with the other players.

The Inter-Agency Water Resources Committee, a Federal interdepartmental group, directed its Subcommittee on Evaluation Standards in December 1958 to study the evaluation of fish and wildlife benefits and furnish its recommendations for improvement. The Subcommittee sponsored two reports. On July 21, 1959, it stated that, "Unless a fisherman or hunter actually could be expected to pay for the privilege of hunting or fishing, an additional amount equal to his expenditures for associated services (sportsmen's expenditures) or unless some other direct relationship between the two could be established, the economic significance of the user-expenditure approach would appear to be limited." Since benefits from other project functions such as agricultural production are derived from market prices at which the products are sold in the primary market, the Subcommittee believed that it would be comparable to evaluate hunting and fishing benefits in a project area in terms of prices at which hunting and fishing privileges might be sold, a difficult proposition since hunting and fishing traditionally have been free and fish and wildlife considered common property in this country.

The Subcommittee indicated that the user-charge approach showed the most promise for early development into an evaluation procedure comparable to those used in evaluating other project functions. We believe that this conclusion is still valid. Under such a procedure, fishing and hunting benefits would be based on estimated charges which sportsmen could be expected to pay for fishing and hunting privileges in project areas. However, sufficient information was not then available on charges actually being made for such privileges to develop a final procedure and the Subcommittee recommended that an interim procedure be adopted. Accordingly, a Panel on Recreational Values was established to develop an administrative schedule of daily unit values from a review of available sources of applicable information, experience, and expert judgement.

The panel was drawn from the Office of the Secretary of the Interior, the Bureau of Sport Fisheries and Wildlife, the National Park Service, the Bureau of Reclamation, the Corps of Engineers, the Soil Conservation Service, the Forest Service and the Department of Health, Education and Welfare.

The result was a schedule of values for the various types of fishing and hunting which was believed to represent a fair approximation of the net amounts which a hypothetical private operator could realize from providing several classes of fishing and hunting on Federal water development projects.

For example, it was believed that an operator of a reservoir could net from 50¢ to $1.50 for each man-day of fishing provided. Also, it was believed that the private operator could net from $1.50 to $6.00 a day for each man-day of hunting which he could provide on a project area. Since these values were based on the user-charge concept and were intended to represent revenues which could be realized from selling fishing and hunting privileges, they were smaller than previous values which had been obtained under the sportsmen's expenditure procedure. The values in the schedule were presented in the form of ranges to permit variations because of quality or other factors. For example, a mediocre but heavily utilized reservoir might be assigned a value of only 50¢ per fisherman per day, whereas a very high quality but lightly used reservoir might be assigned a value of $1.50 per fisherman day.

The Report of the Panel on Recreational Values was approved by the Inter-Agency Committee on Water Resources by unanimous vote at a meeting on October 18, 1960, and was subsequently adopted by all Federal Departments.

The schedule of values has now been superseded by a similar schedule of values having application not only to fishing and hunting but also to all forms of outdoor recreation. The schedule is included in a report, "Evaluation Standards for Primary Outdoor Recreation Benefits", which has been issued as Supplement No. 1 to Senate Document No. 97, 87th Congress, entitled, "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources". This document contains the operating rules followed by the Federal agencies in analyzing water development projects and programs. The unit values set forth in the report are on a man-day basis and again range from a low of 50¢ per day to a high of $6.00 per day. Generally speaking, the lower quality, more abundant types of recreational opportunities are still evaluated at the lower end of the range, while the higher quality, more abundant types of opportunities are evaluated at the upper end of the range.

Additional intangible values are also to be considered fully in planning water development projects. Senate Document 97 states that these intangible values can be decisive in some instances and can tip the balance in favor of or against choices of alternative projects. This will be an important provision, we believe, in future water development projects.

How has the system of administrative values worked in actual practice? On balance, we believe it has worked very well. This conclusion, unfortunately, is not always shared by all our counterparts in the State fish and game agencies. Some have viewed these values as a "sell-out" of fish and wildlife to the rapacity of the construction agencies. Their conclusion is based on the fact that the new values are substantially lower than the old expenditure values.

We believe that the Interim Schedule of Values for recreational aspects of fish and wildlife, adopted by the Inter-Agency group, has provided the most reasonable procedure yet developed for fish and wildlife evaluation. The problem is <u>not</u> to assign <u>large</u> values, which serve principally to increase allocations of costs to fish and wildlife and frequently require re-imbursement of some of these costs by local interests. The real problem is to find and apply values which will faithfully represent the actual benefits of the project

in terms of values which are comparable to values used for other project purposes. If fish and wildlife values are not found by the construction agencies to be comparable, these agencies will provide their own independent evaluations, by-passing the conservation agencies which should have the most 'know-how" in the field.

The water development agencies participated in developing the Interim Schedule and its successor, Supplement No. 1 to Senate Document 97, and therefore accept them.

Water serves a host of divergent interests which must be harmonized by the planner. This process of compromising varying interests means that each interest will not be served to the same degree of efficiency as though the project were developed for that one purpose alone. It may be, and usually is, necessary to forego or modify the ideal development for each purpose, considered singly, in order to achieve an optimum combination of benefits. This is the essence of multiple-purpose planning. The principle is broadly applicable to any planning for future water use, whether you consider how best to distribute a limited supply of water or how best to utilize an overabundance, as in Louisiana.

In this context, mosquito control takes its rightful place in the lineup of the interests to be harmonized in the water planning process. The important thing is that proper planning can insure each interest a proper share of benefits without doing irreparable damage to the rightful interests of other purposes. There is no question that mosquito control can be fully compatible with the maintenance of wildlife values and present research is moving rapidly to insure this compatibility.

So this is how you put a value on wildlife. Right off the bat we must admit that the basis is highly subjective and theoretical. Our defense is that the system is no more weak in these respects than the practices used to put values on flood control, irrigation or navigation.

The important thing is that the simulated market value that we have attached to sport fish and wildlife has acceptance in the kind of economic analysis that is approved by the Federal Government as a whole and by the Committees of Congress. Without this acceptance, putting a value on wildlife would be an exercise in futility. Wildlife interests are supposed to be an equal partner in the game of water resources development. One of the reasons we have achieved that status is that we can and do validly put a value on wildlife.

APPENDIX E

NOTES ON ADMINISTRATIVE PRICES IN CANADA

Several points are made about evaluation of benefits from recreation in the unofficial "Guide to Benefit-Cost Analysis" (Sewell, Davis, Scott, Ross, Montreal, 1961). The ways that benefits may be achieved or calculated for replacement cost if destroyed by the construction of projects, are reviewed. There are four in all. It is important to realize that these are recommended means of estimation, not "values". They are means of calculation that are valid if accepted, and not if unacceptable, to the project"sponsor" or "customer". The cautionary notes on use of these methods are self-explanatory and are underlined in the following copy. The limitations of each individual method are also examined and caution expressed. The important point is that these are recommendations but are not operable until accepted by government authorities for evaluation of projects.

RECREATION 1/

The demand for outdoor recreation facilities is growing rapidly, due particularly to increasing population and leisure time.2/ As this demand grows, recreation will become an increasingly important competitor for the use of water resources. Techniques must be developed, therefore, to weigh these competing claims, and to determine the most efficient ways of providing the services required.

1/ Guide to Benefit-Cost Analysis, by W.R.D. Sewell, John Davis, A.D. Scott, and D.W. Ross. A systematic approach to evaluating and selecting resource development projects, with particular reference to the Canadian scene, which was reviewed by a specially convened workshop at the Resources for Tomorrow Conference held in Montreal, October 23-28, 1961. P. 28.

2/ Lloyd Brooks, The Forces Shaping Demand for Recreation Space in Canada, "Resources for Tomorrow" Conference Background Papers, Vol. 2, Queen's Printer, Ottawa, pp. 957-66.

The evaluation of recreation projects is difficult, particularly because the services provided are "intangible" in nature. The value of such services may sometimes be underestimated because the services are not sold. Nevertheless, care must be taken to present a rational analysis of recreation aspects of projects. As in other project evaluations, all relevant alternative means of providing recreation benefits must be considered.

Costs of construction may be estimated in the same manner as for other types of projects. In addition, damages (compensated and non-compensated) and benefits foregone, should be taken into account.

The evaluation of recreation benefits has been a subject of much controversy.[1/] Recreation benefits may be derived from lands and waters;

(a) Suitable for hunting and fishing;
(b) Suitable for sightseeing, camping, boating, swimming, etc. A particular area may often provide more than one of these services;
(c) Reserved for the preservation of fish and animals.

Benefit-cost analysis may be applied to these types of recreational areas in several different ways:

(i) A project may threaten to destroy the recreational facilities. In the analysis of such projects the possible recreational benefits sacrificed should be counted as project costs;
(ii) Some, and probably most, projects create new recreational benefits. These new benefits should be added quantitatively or qualitatively to whatever other benefits are credited to the project;
(iii) Some special projects are proposed solely for the preservation of recreation facilities, the recreation benefits then providing the only benefits of the project.

Recreation benefits can sometimes be evaluated as direct benefits, e.g. the revenue obtained from the sale of hunting rights and earnings of tourist guides, and so on. In most instances, however, the benefits being "intangible" are not so easy to measure. The ideal measure of benefits to the user is that sum he would be willing to pay (in license fees, etc.) solely in order to enjoy a recreational opportunity. Although such optimum fees are usually purely hypothetical and will never be charged, a benefit-cost analysis must attempt to estimate the amount that could be collected from the users of recreation areas if it were possible to price their services and amenities.

The following paragraphs summarize four of the techniques which have been employed for estimating recreation benefits.[2/]

1/ See for example, Marion Clawson, Methods of Measuring the Demand for the Value of Outdoor Recreation. Resources for the Future Publication, Washington, D.C., 1959 and R.S. Hammond, op. cit. pp 29-36.

2/ For a more detailed discussion of these techniques see Albert M. Trice and Samuel H. Wood, Measurement of Recreation Benefits, August, 1958, pp. 195-207 and discussion thereof in the succeeding issue of that journal.

(1) The commonly-used expenditure method imputes to the recreational service the whole or part of the amount that hunters, tourists and campers spend while enjoying an area's amenities. There are two main objections to this method being used as a measure of benefit. First, it leads to an understatement of the expenditures since it does not take into account all the outlays made on supplies and transportation, before the recreation area is reached. Secondly, and more important, this method measures only the expenditure which people make to enjoy the benefit. It cannot really measure the benefit itself. Its usefulness is, therefore, limited to making calculations of local secondary benefits in the form of increases in the incomes of the suppliers of food and accomodation, etc. In a benefit-cost analysis conducted from a local point of view, these local increases in tourist income may properly be counted as secondary benefits, but from a national viewpoint many of these secondary benefits are likely to accrue somewhere in the economy even if a particular recreation project is not carried out. Hence, they should be omitted from most project analyses carried out from the national point of view since they would arise both 'with' and 'without' the project.

(2) The cost methods impute to the recreational area a total benefit equal to the cost of providing it. This assumption is sometimes found in financial analysis where the problem is one of assessing a sufficient benefit to cover the cost of a particular recreational facility. It has no place, however, in benefit-cost analyses where the problem may be to decide whether or not to create the recreation amenity, to what scale, and in what location. This method merely begs the question and does not lead to results which are helpful in decision-making.

A minimum value for some benefits, however, may sometimes be estimated by a variant of this approach. For instance, the benefit from sport fishing may be said to be at least the retail value of fish caught, since they do in fact have this value for a city consumer. This type of estimation method may also be useful for measuring the benefit of a hunting area, but it establishes only minimum values.

In many situations, alternative costs can be used to set upper limits to recreational values. For example, consider the estimation of recreational benefits for a multi-purpose project. It is obvious here that the recreational benefits attributed must not exceed the costs of providing the same amenities by some other means (in another project). In computing the costs of the alternative, account must be taken of any additional costs of transportation, etc., involved in reaching the area.

(3) The Hotelling method imputes to the area a benefit equal to the amount the average user saves over the travelling costs of the user coming from the longest distance. The travellers who come the furthest are assumed to just break even on the trip, the recreational benefit to them being exactly balanced by the travelling costs. Then the benefit to the rest of the users is calculated as their savings on travelling costs over the costs included by the furthest travellers.

This approach involves some unusual assumptions that must be treated

carefully before being employed in any actual measurement. It is likely to produce an underestimate rather than an exaggeration of the amount which users are willing to pay to retain the recreation area or amenity. It has the advantage that it lends itself to forecasts of recreational values. It obviously applies best where recreational facilities in various regions are more or less uniform, e.g. picnic areas or sports fields, so that travel distances are an important consideration in establishing a new project. It applies least well to unique wildlife or scenic facilities. Also the value of the method appears to be damaged if far-travelling visitors have come to the recreation site in the course of a trip elsewhere, rather than on a deliberate trip to the project itself.

(4) The non-monetary method confines itself to a descriptive, quantitative account of the number of visitors, the length of stay, the amount they spend, the size of their catch, etc.

It must be remembered that the analyst is usually trying to make an estimate of the value of an 'intangible' benefit. The estimate, therefore, has a double element of risk, in that not only is the estimator likely to be wrong but also that those he interviews may have no clear idea themselves of their valuations, since they are never asked to pay for the services. For this reason, it is strongly recommended that all benefit-cost analyses of recreation projects be accompanied by a careful measure of the number of users, the frequency and intensity of their use, and the alternatives that are open to them in other projects. This procedure will usually be sufficient where the recreation benefit is not crucial to the overall decision (i.e. the contending projects have roughly the same recreational values). When it is necessary to attempt a monetary assessment, there should also be an account in non-monetary terms to accompany the benefit-cost analysis.

APPENDIX F

OVERCOMING THE BENEFIT-COST DRAGON

(Proposing maco programmes or amelioration programmes on their own merits at a stated cost (not value) instead of attributing economic value in the benefit-cost game.)

Source: "Comprehensive Planning and the Dragon to Slay"--
Luna B. Leopold

The following two articles were originally given as speeches at the Ninth Biennial Wilderness Conference, which was held in April of this year.

Luna B. Leopold is Chief Hydrologist of the United States Geological Survey, Department of the Interior. His experience in the engineering field covers many aspects of water resources development, particularly in hydrology. He has been on the Survey staff since 1950 and has been Chief Hydrologist since 1957.

Several years ago I was in India as consultant to that government concerning a flood-control project on the Kosi River in the State of Bihar. The Kosi originates near Mount Everest and emerges from the Himalayas to flow southward for nearly a hundred miles across the Ganges plain. It is a braided river with an ill-defined channel consisting of many distributaries wandering around myriad islands in an unsystematic way. Owing to the fact that the Kosi has moved laterally across its low-angle fan about 75 miles in a hundred years it has progressively devasted by flooding large areas of agricultural land.

The Indian government had chosen as the most practical way to alleviate the flood damage, the construction of levees separated by a distance of about nine miles and confining the river through most of its course across the plain.

We were invited to the office of the Commissioner (comparable to a State governor) who wished to dicuss with us the philosphy of this flood control plan. He said, "As you can imagine, with levees so far apart, a situation made necessary by the large width taken up by the many channels of the Kosi, there are many local residents whose homes and fields are being included within the area confined between the levees. Do you think that this Government has incurred an obligation to these people to resettle them from their present location at government expense to some other land outside of the confines of the levees?" My immediate answer was in the affirmative. I argued that before the levees were built the people had lived on the land at considerable risk of damage by the river in flood, but once the levees were built their exposure to flood was assured.

I said I thought the obligation was of such a nature that the people ought to be moved even before the levee system was completed. "I fear you cannot appreciate the problem," he said. "Not only do we have no other lands to which these people can be moved, but also there are many people confined within the levees." How many, I asked. His answer was "More than a quarter of a million."

In the United States the professionals concerned with water-development planning have grown accustomed to believe there is no problem for which a technical solution cannot be found. This being the case, one can approach every planning problem in terms of finding an engineering solution that has the highest ratio of benefit to cost. The human or social aspects involved, that is the non-monetary aspects, are usually either turned into monetary values or mentioned in a few paragraphs and thenceforth disregarded.

Because most of our basic legislation governing the expenditure of Federal money does not explicitly define what is meant by a benefit and what is meant by a cost, it has been necessary to evolve through actual experience ways of evaluating benefits that lend themselves to a final computation of a benefit-cost ratio. There is a philosophic assumption underlying such practice, that the indirect or the non-monetary benefits and costs, though important, are unusable in making the final determination of whether a development scheme is or is not justified.

There has grown up, therefore, the practice of computing by different means price-tags that purport to measure the value even of those gains and losses that do not lend themselves well to this type of description. Seldom are we faced with social costs on such a massive scale as the Kosi example. Such costs or gains are generally either too obscure or too far removed in time to be determining factors in whether a given development plan is to be considered or discarded.

In the early days of water development in the United States the possible alternatives in any development were relatively wide. The demand for water relative to its availability was not so great that competition was very intense. There were available alternative dam sites and alternative land suitable for development. The total encroachment of water-development works was not yet severe. With time the alternatives have become fewer. The best projects have already been built and the economic as well as the social justification is far less clear than it has been in previous decades.

It was then that the dragon's teeth were sown. It was the promotion of water projects that led to the introduction of the benefit-cost economics in public affairs. Benefit-cost ratios are traditional in other aspects of public works. None considered it necessary to so evaluate schools, roads, post offices, police, and other facilities and services. These things are argued in terms of the satisfaction they yield to the public -- not what they return only in the way of dollars. We have reaped the dragon's teeth by extension of benefit-cost economics into esthetics.

There developed, simultaneously, a concept of multiple-use based on the idea that where two uses could be served by a development rather than one, the resource would be more efficiently utilized and more benefits could be obtained for each unit of cost. This concept was re-inforced by the practical-engineer truism that the unit cost of a large project is lower than the unit cost of a small one. Multi-purpose use, therefore, became not only a supporting argument but tended to be looked upon as the measure of efficiency of resource utilization.

The concept of multiple-use can be handled at the planning level only by the involvement of a variety of disciplines because specialists in each type of use are required in the planning and in the process of evaluation. This interdisciplinary approach has forced the managers of esthetic and non-monetary social values to place a dollar cost on these values. Interdisciplinary water-development plans are transmitted for comment to all interested agencies. Disagreement with any aspect to a proposed development is then usually handled within the bureaus involved, and the final product is often advertised as a point plan involving many, if not all, of the concerned government agencies. In reality, such a joint plan does not necessarily indicate what the several bureaus concerned would actually recommend individually. The portions dealing with scenic and non-economic resources usually represent merely a proposal concerning how best to accept or live with the proposed engineering works.

Such co-operative planning requires that evaluations of all aspects be set forth in terms that would be mutually compatible. In practical terms this means that various interests are expressed in monetary terms or they would in fact have no appreciable impact on the proposed program.

For example, it became necessary to evaluate the benefits and costs to fish and wildlife in the same terms that are used to describe the benefits and costs of flood control or of irrigation. The difficult technical problem posed is an assessment of how a given development would adversely or beneficially affect not only the hunting possibilities for migratory waterfowl but also the breeding, and resting habitats of non-migratory and therefore immovable species. It may necessitate an evaluation of the difference in worth between trout and bluegills, or between salmon and non-salmon. The results of these evaluations are known to all. The benefit to fish and wildlife is expressed in terms of the tonnage of fish taken, or the commercial value of the visitor day. The esthetic value of having trout in a reach of river, whether or not it adds tonnage to the creel, becomes a non-monetary cost. And because it is non-monetary, it is essentially discarded.

The net result was that a value was placed on an individual duck in terms of its worth in a game bag. Interestingly, a mallard by this process became worth $2.00, and a goose worth $6.00. The more difficult problem of evaluating other kinds of recreation that do not have a take or bag was relegated to the formula of the visitor day.

Clearly, there is an economic value to the society from the expenditure of time and money by individuals engaged in recreation. The recreationist spends money for gasoline, food, lodging, boat rental, camera equipment, skis,

and the like. Though it is desirable to recognize the economic worth of the activities of the recreationist, there is practical as well as philosophic cause for alarm at the implication that the value of recreation lies in the expenditure for equipment rather than on the quality of the recreational experience.

The evaluation of recreation in terms of the visitor day is the assertion that two recreationists are twice as valuable as one, and therefore, a hundred recreationists are a hundred times more valuable. Social values deny this type of reasoning.

It is generally supposed that a development plan is necessarily better if it is multi-purpose and comprehensive than if it is single-purpose and of local application. Multi-purpose planning means in practice that individual portions of a development scheme need not necessarily satisfy the requirements that the individual benefits exceed the individual costs. The whole may be justified as long as the complex of development yields a new monetary benefit exceeding the net cost.

Costs and benefits in this context mean economic and therefore tangible benefits and costs. The comprehensive plan tends to incorporate even a wider variety of affected uses than individual multi-purpose projects, for when a whole region is encompassed in a comprehensive plan then a still wider diversity of people and situations is encompassed than would be in a single multi-purpose project.

The fact that such a variety of aspects may in reality introduce competition rather than symbiosis has not tarnished the value of the word comprehensive. The comprehensive plan can be potentially even more erosive to the esthetic and non-monetary values than a single multi-purpose project, owing to its much larger effect on the landscape and environment.

What the long-term effect is on society, for good or bad, of a comprehensive resource plan is difficult to judge because the social benefits and social costs are more dispersed than where a quarter of a million people are enclosed between levees.

There is another danger in the present scheme of monetary evaluation. The benefit-cost type of reasoning carries with it the implicit assertion that society is best served by developing not merely within the present generation, but immediately, all of the resources the monetary benefits of which can be demonstrated to exceed the costs. One may ask what is the cost of the resultant reduction in flexibility of choice left for future generations. Yet the concept of a comprehensive river basin plan is supposed to be our assurance that such a social cost is not significant.

Our knowledge of science outpaces the development of ethical principles. The newer the knowledge, the greener the ethics. Only recently have we learned that bigness is the way to economic efficiency. We have come to believe that bigness in the market place is not only compatible with but necessary for quality.

Long highways are better than side roads. Big universities offer better graduate schools than country colleges.

Markets attest to the merit of the economic scale. The same idea is behind multi-purpose and multi-basin water plans. They began only yesterday, so to speak, at first combining only irrigation and power, as at Hoover Dam, and then becoming basinwide, and now we are soon to consider a scheme that stretches from Alaska to Mexico and puts New York and California on the same pipeline.

These proposals will be argued chiefly in the benefit-cost framework. But the speed with which we improve our econometrics and our construction methods outruns the enlargement of our ethical attitude toward landscape. In the process, bigness can subvert quality. Assigning dollar values to irrigation and power is one matter, assuming that all recreation can be measured in similar terms is another.

The emphasis on least cost as it is presently interpreted does not provide society with an adequate choice. Society may well choose, if given an opportunity, a development scheme that is higher in immediate dollar cost than an alternative, but that would preserve some natural asset.

Let us examine in more detail the nature of the gain in efficiency in multi-purpose over single-purpose structures. The advantage to be gained by combining in a single dam for example, the primary purposes of flood control and irrigation, comes primarily from the fact that per unit of reservoir volume the cost is lower for a large dam than for a small one. This may not be the understanding gained by the public, who probably thinks that the same storage capacity can be used for each of the two purposes. For irrigation or municipal use the storage must be utilized during times of high flow and depleted during times of low flow. For flood control on the other hand, storage must be depleted at all times in order that when a high flow occurs it can be utilized. So a reservoir for water supply should be kept as full as possible and one for flood control as empty as possible. The same storage volume cannot be used simultaneously for both purposes at the same time.

A given amount of water discharge through a penstock develops more power under a high head than under a low one. Therefore, from the standpoint of power production the more depth in a reservoir the better. Also, one of the advantages of hydroelectric power production is that by merely opening or closing the penstocks the rate of power generation can be adjusted rapidly to meet variations in demand. For this reason hydro-power is considered to be especially efficient for peaking purposes.

In contrast to all these uses, reservoir operation for recreation is most efficient when the water level is kept as steady as possible, with minimum fluctuation. It can be seen, therefore, that in principle, preferences for various reservoir uses are completely in conflict.

What is truly meant by the recreational use of a reservoir built for

water supply, flood control, or power generation is that during the time a body of water exists it can sustain fish, or float a boat. Any more sophisticated value of the water for recreation is made subservient to the alternative engineering purposes.

To summarize, then, a so-called multi-purpose reservoir does not mean that the storage can be used for more than one purpose, except collaterally or by chance. Multi-purpose development merely means that the cost of each unit of storage decreases as the height of the dam increases.

Exactly the same kinds of conflict appear, in principle, in other kinds of multi-purpose use. Selective logging may, by opening up the stand, increase the forage production for grazing. Weighed against this is the ever-present possibility that in certain ecological types, an incursion of brush or other less desirable species may negate hope for improvement in total forage capacity. Whereas the expansion of agriculture materially improved game-bird and animal production in certain ecological types over that which had existed in the virgin state, this increased productivity generally resulted from the increase in the linear extent of edges between two vegetative types in juxtaposition. Thus it cannot be said always that either logging or grazing will necessarily improve the production of game-birds and animals.

The relation between logging, grazing, and recreation is somewhat less clear because the criteria governing recreational uses are less clear than those measuring the productivity of lumber, wool, or beef. The only thing that is obvious is that for wilderness recreation any regular utilization is detrimental. There is a big enough problem in learning how to manage wilderness lands in order to keep the biota stable, but a clear distinction should be drawn between the management of lands for long-term stability and the regular utilization of that land for economic production.

In my opinion, then, multiple-use has become a shibboleth tending to obscure the actual benefits to society, because losses and gains to society are both economic and non-monetary. Presumably, before any alternative philosophy can be given serious consideration it is vitally necessary that a larger segment of the public recognize the difference between the true economies to be obtained by multi-purpose development and the unreality that has grown in the public mind that multi-purpose development is a good thing per se. In present planning procedures, non-development is not considered as a real alternative. Immediate development is considered the only valid aim, and one to be recommended as soon as it can be shown that monetary benefit exceeds cost.

I am convinced that the non-monetary and esthetic values of the landscape can never be preserved if their economic significance is pitted against that of engineering works. It seems necessary to divide resource planning into two steps.

In the first stage, there should be presented to the public in equal detail the alternative schemes by which the stated objectives could be achieved. The public deserves to be informed of the various ways development might be approached.

They should be offered for consideration and discussion more than merely what some planner considered to be the "best scheme", and more than what some economist computes to be the "least cost" plan. When given the alternatives, the public increasingly is known to prefer some plan other than that carrying the lowest dollar price tag.

The first stage should illuminate those esthetic and non-monetary values in landscape or in resources that should not be called upon to face a test of monetary significance. Those of greatest social value would, through a process analogous to zoning, be set aside for preservation and non-development.

The second stage would be to weigh in a far more sophisticated manner than is now practiced, the hard-boiled economic realities of all those resources not marked for preservation, in order that the most efficient engineering and technological design for their development be achieved. For the second stage the present simple comparison of so-called benefits and costs should be up-dated and elaborated to a level that would utilize economic knowledge and theory already extant, and that would make the economic design somewhere near the level of sophistication that characterizes the engineering technology.

I believe there exists a social value in maintaining and enhancing the quality of landscape. There is an esthetic uplift to be gained in a deeper concern for the world in which we have to live. But in our path is a dragon that regenerates itself every time it suffers attack. The dragon of misconception concerning the planning process is ever enlarging its radius of use. We must arm ourselves with the moral conviction that the cost to society of present procedures is too large, and that we must attack the dragon on its own ground before there is nothing more left for us to protect.

APPENDIX G

SOME NOTES ON HUNTING RITUAL

The source of the following is "A Guide to Mississippi Flyway Waterfowl Management" by Mississippi Flyway Council -- March, 1958. pp. 353.1 (18) - 353.1 (19) and 353.1 (21) - 353.1 (22).

There is one provision of the German licensing system which might be worth copying. According to Manual No. 28-145 issued by the United States Army, Europe, 1 December 1959, entitled Guide to Hunting in Germany: "The German hunting system requires that a hunter successfully pass an examination before obtaining a hunting license. Normally, the examination is preceded by a series of 10 to 15 two-hour lectures and class work periods which cover all phases of hunting, such as the use of weapons, safety, laws, animals, customs, etc. Upon completion of the instruction course, the applicant is questioned by a board of three to five experienced hunters and officials. If the applicant passes the examination, he is authorized to purchase a hunting license."

Among the lessons included in the course are: German hunting law; German hunting customs; hunting big and small game including methods, proper weapons, and taking proper care of the meat; wildlife management and conservation; hunting dogs; guns and equipment; safety; descriptions and habits of various game species and animals of prey; a glossary of terms and finally the ten commandments of the sportsmanlike hunter. These translated from the German hunting license, include:

> You must consider hunting a recreation and not a source of meat or money.
>
> You must observe the result of your shot and conscientiously search for wounded game.
>
> You must keep a good hunting dog or be sure that one is available for your use.
>
> You must dress the game killed in a sportsmanlike manner, and register it in accordance with the established controls.
>
> Quality, not quantity, of game is the goal.
>
> You must also care for your hunting area during the off-season.

Few will deny that this sort of preliminary training would be good for our hunters, too. It appears that by modifying and expanding the gun-safety training course, in time this could be accomplished. First, legislation would be needed, requiring that anyone applying for a hunting license for the first time must present a certificate showing completion of an approved course of instruction both on gun safety and the other aspects of hunting, which, after

all, are equally important. Second, there would be the problem of organizing the instructional program in an efficient manner.

Making it more difficult to obtain a license would serve the beneficial purpose of culling out those unwilling to learn the rules of the game without eliminating anybody who really cared. At the same time license sales might drop and revenue from them be reduced.

The Code

Every situation is somewhat different in terms of hunting pressure, space, the supply of birds, and what can be done to promote quality but there are several basic principles which should be considered.

1. Wildfowling is essentially a contest between a wary bird and a skillful hunter in an appropriate setting. The sporting element is weakened by so managing the quarry that it has no choice but to become a target for the hunter no matter how unskillful he may be.

2. The hunter exhibits his skill in various ways. He may be able to fashion life-like decoys or so arrange them in the marsh as to deceive even gun-shy birds. He may know the best place for a blind under various wind conditions or he may "talk" duck language so skillfully on a call that he brings birds to him from great distances. The coup is a nifty shot which produces a clean kill. Quality is reduced when a hunter is prevented from exercising these and other traditional skills.

3. The third basic element is the setting. A duck marsh is just that, pure and simple. To the extent that a marsh is defiled by signs or other unnatural objects, the hunter is being shortchanged in his experience.

4. Sportsmanship is an indispensable aspect of waterfowl hunting. Fighting for a place to hunt, sky-busting to beat your neighbor, and arguing over downed birds have no place on a duck marsh. Management has definite ways of encouraging or discouraging sportsmanship.

5. Knowing the birds enhances the sport and provides entertainment for both hunters and non-hunters. It adds quality to the sport and impetus to species management when a hunter has the knowledge and self-control to abstain from shooting a protected species or to kill a drake rather than a hen.

Super-imposed on these basic principles is the fact that the supply of birds is limited by production habitat, which is being progressively reduced at the same time the potential for more hunters is rapidly increasing. At some point this recreation becomes uninviting to all except the most tolerant because of poor success and over-crowding. Management wants to prevent this from happening. To do so will require some method of limiting hunters and the method has to be democratic because the whole tradition of hunting in America is based on democracy at its best. This element must be preserved at all cost.

APPENDIX H

SOCIAL COSTS, LAND PRICES AND DRAINAGE SUBSIDY - A CONTROVERSY

The controversy over agricultural drainage has been severe and prolonged because of the effect on what has been defined as "vital" waterfowl habitat. The following is not an attempt to evaluate the pros and cons of this controversy but to provide a summary of the various points and indicate where more data are needed. It is important to remember, however, that this data and information is based on U.S. experience and conditions and may not be relevant to Canadian needs or conditions.

Drainage and/or the filling of potholes or combinations of potholes used for breeding prairie waterfowl has been pointed to as the critical constraint on production of waterfowl. As a first point it is instructive to speculate as to inclusions under "drainage". Consolidation of small potholes and waterholes into one large area (that is, "internal drainage", not external drainage into an active water body such as a stream or river) also constitutes "drainage". It has reduced waterfowl numbers, especially of the largest population component -- the somewhat Victorian prairie waterfowl which breed one pair to a pothole.

There are a number of elements that influence loss of habitat and not all are "drainage". These are:

(1) Variation in water area distribution that temporarily affect waterfowl production.

(2) Natural forces are constantly reducing the number of water areas, through siltation and deposition. This is accelerated by farming practices.

(3) Land use changes during wars where additional land is quickly brought

into cultivation.

(4) Government aid to private drainage by technical assistance from S.C.S. Subsidy payments from production and marketing administration also stimulate land drainage. The latter is estimated to be frequently 1/2 to 3/4 of the cost of the project. In addition, the farmer gets complete engineering assistance without charge.

(5) The extension service opts for drainage, as do educational institutions.

(6) There are problems of field layout as a result of farm mechanization.

(7) Another factor is the probable effect of drainage on the soils water exhaustion.

The charge here is that reduction in breeding and associated habitat in the Plains States (when they were drained for agriculture) has reduced waterfowl numbers. We should be quite sure, however, that this is not being used as a blanket to cover a great many things that reduce waterfowl numbers including the greatest of all -- hunting pressure -- which annually reduces population by 50 per cent. While hunting may have become so acceptable that it is ignored as a cause of reduction we should still specify that the population is affected most severely by this element. Given the cost of hunting controls, versus habitat management and controls, perhaps a new set of priorities for management needs to be established. For example, even habitat formerly used by waterfowl for breeding on occasion is reportedly unused. If this is true, and there is little reason to doubt its accuracy, it is logical to speculate that breeding and nesting habitat are not always governing but that there are also deficiencies in breeding population numbers that also have caused reduction in total waterfowl numbers. This stems from hunting kill.

Obviously a whole complex of factors and constraints are at work here.

It would not do to become so enamoured with a popular, acceptable "conventional" constraint that it was allowed to blur perception of magnitudes involved. It is incomplete to select the constraint that shifts the responsibility for damage where one would like to see it. After reviewing the literature, drainage as a reason for reduction of waterfowl numbers appears to cover a multitude of elements including the drought cycle itself, pollution of environment, and any number of others. Some perspective is needed.

Attempts to structure and analyze drainage as a problem emphasize that the main problem is agricultural drainage subsidy and that this results in more areas being drained than would otherwise occur without the subsidy. This is undoubtedly true, but it may also be true that although as yet unmeasured even where subsidies has been successfully blocked, the drainage merely goes ahead privately.. Moreover, much of the drainage occured before the subsidies. Probably drainage is made feasible by high land prices more than by subsidy. There are also many examples of private drainage occuring, without subsidies, on a basis and at costs that appear quite irrational to outside observers. This, however, is not the point. Drainage will occur on private land as long as farmers think it is an aid to their enterprise and as land costs rise and taxes increase. It is for this reason that the full opportunity cost will undoubtedly have to be paid in order to prevent drainage, whether that is based on a rational or irrational figure or on expectations of future returns.

Another point frequently made is that drainage is occurring at some fixed rate. Thus, if drainage is occuring in some area at say 4 per cent per year it is speculated that in "x" number of years all the habitat will be destroyed there. This does not take into account the resistances to effective drainage. Presumably the easiest and shallowest sloughs are drained first and

so with potholes. As the difficulty increases, the percentage rate of habitat is destroyed in much the same way as the frog always jumps halfway to, but never reaches the wall. On the other hand, there is some indication that there is no longer an irreducable minimum of habitat that cannot be drained. Modern machinery and new, cheap explosives now make it possible to do more drainage than was possible ten years ago. It might also be pointed out, however, that great levelling and drainage operations may work well at the depths of a drought cycle but not so well in a wet cycle. That is, some drainage so defined will be quite effective in increasing the amount of dry land available for some percentage of a base time period say, 7 of 10, instead of 4 of 10, years. It does not guarantee, however, that the land will remain dry and tillable for the entire base period. It is a relative matter. Presumably when the water is there the ducks will breed.

A critical question of drainage and filling as destruction of habitat involves the question of social costs. It is asserted that publically subsidized and privately sponsored drainage results in general costs to society. This could be a fruitful area for research as there is great difficulty in finding relevant data to assess the great body of speculation. Extensive drainage in the Dakotas may have resulted in a great deal of flood damage because of the "flash" run-off that occurs when water is unretarded by small impoundments or perhaps when there is a great amount of drainage. On the other hand, flood damage from lengthy rains may well not be prevented. Large amounts of reservoir storage can contain heavy run-off that may overwhelm the capacity of small undrained natural impoundments and sloughs.

The point might be made that drainage, subsequent drying and agricultural operations may "impact" natural "acquafers" resulting in a decrease in

ground water storage and an accumulation or an increase in run-off.

It might also be noted that a good deal of drainage is "run down the road allowance" and may be instrumental in washing out roads and bridges representing a social cost. Drainage thus actually becomes cumulative as it proceeds by gravity toward ultimate collecting points.

There is a difficulty in establishing the drainage that is "unnecessary" that is caused by "unnecessary" subsidies to agriculture or "unnecessary" engineering services or merely the inflation of land values. Much of this is speculative in nature and there is little data as yet. A cautionary point is that it would be a major error to confuse drainage "subsidies" and effects on habitat as the only major source of reduced waterfowl population. Not a little proportion of drainage is private anyway. This is only one of a series of constraints that operate. It has not been proved that it is the largest in effect either, although destruction of natural habitat has become the most popular production constraint.

What may have happened is that "drainage" has come to mean the effect on reduced population of everything from drought, botulism, and hunting to lead-poisoning. The effect of drainage has probably been significant and it may well be that the social costs (or development costs of agriculture) resulting from it have been severe. It cannot be denied however, that although many drainage projects are politically motivated, are not immediately beneficial or perhaps ever economically significant in their effect, nevertheless the productivity of agriculture has been raised fantastically by a combination of factors that probably include drainage subsidies over the years.

It is also notable that until social damage to such public facilities as roads or bridges can be proven to be the result of "excessive" or "subsidized"

drainage it can be spoken of only conjecturally. External disutility or social diseconomies may be caused by some drainage and that may be caused by unnecessary or subsidized drainage projects. A great deal of definition, analysis and documentation now has to be done to prove the case. Actually, the most destructive of habitat (breeding) may not be large drainage projects at all but small temporary sloughs and potholes denuded of border and fringe by those now spoken of as "marginal farmers". More documentation and research are needed.

It also has not been proved that waterfowl can't adapt to large areas of water surface that result from major dams and reservoirs. This has been experienced in the west coast flyway in Washington for migratory habitat. Finally it is important in defining destruction from drainage to carefully specify just what are critical portions and elements of habitat. What is the minimum of habitat that is controlling and must therefore be retained? Would the critical portion of habitat have been retained anyway?

"First, critical areas which may determine animal abundance are often a small fraction of total range. One deer study on the west slope of the Sierra Neva, for example, showed that important winter range, which could be manipulated to support the deer, constituted less than two per cent of the year-long herd range".

Finally, it might also be recalled that destructive as changing the landscape may be to some portions of natural environment it can also, be mildly beneficial in other ways. For example, in the Garrison reservoir in North Dakota, a large portion of natural waterfowl habitat was flooded. Under re-amelioration procedures, however, it was possible to purchase other habitat and to provide it with a permanent water source for waterfowl production rather than the temporary water that had been available perhaps only seven years

out of ten in natural environment.

It is possible to be overly misanthropic in interpretating the effects of environmental change.