ALLOCATING THE MINERAL AND PARK RESOURCES

ON THE

EAST SIDE OF LAKE WINNIPEG

A Practicum
Submitted to the Natural Resource Institute
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In Partial Fulfillment
of the
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Master of Natural Resources Management

by

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DEFINITION OF THE PROBLEM

The east side of Lake Winnipeg, bounded on the north by the Poplar River, the south by the Bloodvein River, and the east by the Manitoba-Ontario border, has a resource base including mineral and park resources. These resources have potential social value because of their utilization in the production of metal and outdoor recreational days.

The Provincial Government of Manitoba has several alternative courses of action that can be followed in allocating these resources which coexist at particular sites in the area. Essentially, the government has the options of:

(1) developing the sites entirely for the harvesting of mineral resources;

(2) developing the sites entirely for park purposes;

(3) various combinations of the above alternatives.

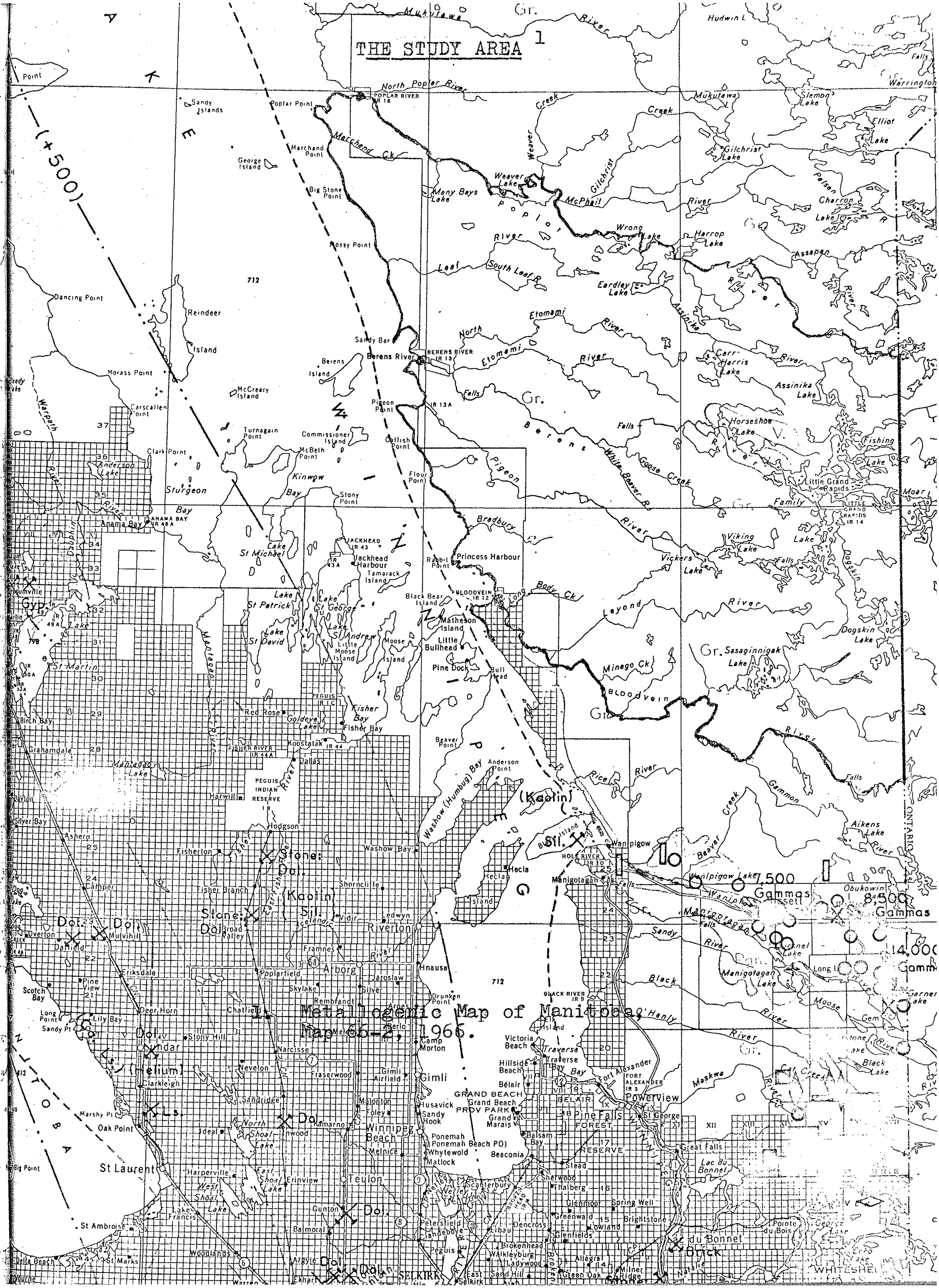
The nature of the problem faced by the government is that the outcomes of each alternative course of action are different.

The government should choose the alternative which "best" achieves the objectives of the province. The evaluation process, however, leading to an ultimate decision is complicated by the uncertain estimates of the relevant ecological, economic and social variables associated with mineral and park resources and their development. The uncertainty in the evaluation process leads to conflict among the resource developers and may result in inefficient and inequitable

allocations that could be otherwise avoided by effective planning. By placing this problem within an appropriate framework, a solution to the problem can be discovered.

The complexity of the allocation problem in this area would increase if other alternative uses of the resources at particular sites were considered. For purposes of simplicity, such alternatives as forestry, hydroelectricity and moose farming will not be discussed.

THE STUDY AREA



THE STUDY AREA

In order to formulate the problem effectively, an analysis of the present social, economic, and ecological conditions in the area is necessary.

At the present time, there is no comprehensive inventory of the resource base in this area. An outline of the resource base can be compiled, however, from the numerous investigations undertaken in the area by various agencies.

The area in question consists of approximately 8,000 square miles of land and water, populated primarily by native people living on reservations. Communities in the area are situated at the mouths of the Berens, Poplar, and Bloodvein Rivers, and an inland settlement is situated at Little Grand Rapids on Family Lake. The population of these communities is approximately 2,000 people. The area is remote, with poor transportation facilities. Provincial Trunk Highway # 304 extends only to within 50 miles of the Bloodvein River, but an extension of this road northward is now under consideration. Other transportation facilities available are commercial aircraft, winter freight roads, and water transport on Lake Winnipeg. [1] The area lies within a 250 - 300 mile radius of the major population centres in the province.

Employment of the available labour force is seasonal, and there exists a high rate of unemployment, due to the

1. Province of Manitoba, Report of Royal Commission Inquiry into Northern Transportation, Winnipeg, Queen's Printer, 1969.

declining emphasis on hunting and trapping, and a lack of available jobs suited to the native people's attitudes and behaviour patterns. [1] Some employment is generated in the Little Grand Rapids area by the fly-in commercial hunting and fishing lodges in the area. The commercial fisheries on Lake Winnipeg and the inland lakes are closed at the present time, due to mercury pollution. Exploitation of the forest resources in the area is carried out by small community cooperatives run by the native people to supply the mill at Pine Falls. Wild rice harvesting by the Cree and Saulteaux Indians for export markets is receiving increased attention as a job supplier and income generator for the residents of the area. Correspondingly, forest and wildlife management is becoming well established since the location of several forestry towers in the area.[2]

Objectives of the People

Some form of regional development, utilizing the park and mineral resources in this area, could serve the purpose of reaching the goals of people living in the area.

In this regard, the goals of the citizens of the area are year-round employment, a better living standard, and a desire to be self-sufficient. [3] Any future regional

1. Manitoba, Commissioner of Northern Affairs, Community Fact Sheets, 1967.
2. Geological Survey of Canada, Department of Energy, Mines and Resources, Paper 69-42 I. F. Eromanovics, p. 3,1969.
3. Manitoba, Commissioner of Northern Affairs, Community Fact Sheets, 1967.

development strategy must view its effectiveness in terms of how well these goals are achieved.

Thengovernment, however, is faced with the situation of allocating resourees to reach the multiple objectives of the whole province, [1] as well as this region, and conflicts may be created as a result. To facilitate effective development strategies, the multiple objectives sought should be given a priority ranking. Assuming that the government intervenes in the allocation of the resources in this area to redistribute income and increase employment, the problem confronted is which allocation of resources to a mine or a park maximizes the value of a site to the achievement of the management objectives.

Mineral Resources

The area in question is contained withinathe Superior Province of the Precambrian Shield, and the rocks in this region are estimated to be 2600 million years old. Broad evaluations of the mineral resources in this area have been carried out by the Geological Survey of Canada in the 1930's and in 1968 and 1969. [2] These evaluations dealt solely with the structure and chemistry of the exposed rock surfaces in the area. From these data, Table 1 in the Appendix was compiled, showing the mineral associations possible in the area. Evaluations of the economic mineral potential of the area have largely been subjective judgements. For some time,

1. No attempt is made to formulate and present a list of the Manitoba provincial objectives.
2. Geological Survey of Canada, Department of Energy, Mines and Resources, Paper 69-42, I. F. Eromanovics, p. 3, 1969.

the area was considered as a gold district, not suitable for the occurrence of base metals. From comparison with the geologic parameters of known mineral occurrences, it is judged that the most promising areas for ore deposits seem to be around areas underlain by granodioritic rocks adjacent to metasedimentary or volcanic rocks, occurring in structures called greenstone belts. The only known occurrence of volcanic rocks occurs in a 300 square mile block near Horseshoe Lake.

Other greenstone belts may be related to the numerous fault structures and shear zones in the area whose existence is postulated from ground reconnaissance and aeromagnetic surveys, conducted by the government, which evaluate the magnetic properties of the rocks.

No economic deposits have been developed in the area, to the present time. Claim staking has been undertaken inseveral sites, and geophysical permits issued [1] but no discoveries have been reported. Economic deposits associated with these greenstone belts have been found to the south of the study area, near Bissett, and in the Oiseau River region. The low intensity of exploration activity in the area is a result of other regions having a comparative advantage in financial incentives and favourable geology, thus diverting exploration funds to these more competitive regions.

Park Resources

The suitability os specific land area to be used as parks has no strict code. However, the natural resources

1. Claim staking has taken place at Sasaginnigak, Bradburn, Fishing and Family Lakes as well as geophysical exploration activity by Selco Exploration Company in the area of Horseshoe Lake.

in the study area appear suitable for some of the typical aspects of the North American pattern of outdoor recreation, as well as having qualities suitable for preservation. These resources have not been evaluated by the Canada Land Inventory, but a federal park study of the park potential of the area, as well as biological investigations, have been undertaken. There is a problem in the classification and terminology of uses for particular sites in this area, but undoubtedly some areas could be classified as wilderness.[1]

Physiographically, the land surface has low relief, with plentiful rock outcrop and intervening swamps. The land is drained by three substantial rivers originating in the numerous lakes in the eastern portion of the area. The water

1. A definition of "wilderness" can be found in the U. S. Public Law in the Wilderness Act. This definition is reprinted in Hart, W. I., A Systems Approach to Park Planning, IUCN Publication, Supp. Paper # 4, 1966:

> "A wilderness in contrast with those areas where man and his own works dominate the landscape, is hereby recognized as an area where the earth and its community of life are untrammeled by man, where man himself is a visitor who does not remain. An area of wilderness is further defined as an area of undeveloped land retaining its primeval character and influence, without permanent improvements or human habitation, which is protected and managed so as to preserve its natural conditions and which (1) generally appears to have been affected primarily by the forces of nature, with the imprint of man's work substantially unnoticed, (2) has outstanding opportunities for solitude or a primitive and unconfined type of recreation, (3) has at least 5,000 acres of land or is of sufficient size as to make practical its preservation and use in an unimpaired condition and (4) may also contain ecological, geological, or other features of scientific, educational, scenic, or historic value."

quality of these rivers would be reasonably high, since no industrial activity takes place in the area. Natural pollution or degradation of the environment is possible, however. Some of these rivers have suitable enough c.f.s. flows to be considered as potential white-water canoe routes.[1] The climatic conditions in the area are continental, with average levels of precipitation for such conditions, and no permafrost. The forest resources in the area occur in many environments, but are apparently most abundant along the waterways. These forest resources are considered to have future economic value, but at the present time are non-economic due to their inaccessibility. The wildlife in the area is characteristic of northern coniferous forests. One of the dominating terrestrial species in the area, from a tourist viewpoint, is the Woodland Caribou, but from an ecological viewpoint, the dominating species is the moose. Fish populations in the area are substantial enough to sustain a commercial fishery.

In terms of the ecology of the area, much more work is required to inventory the resources and understand the interrelationships of the component parts of the particular ecosystems existing there. This would aid in reducing harmful effects caused by the utilization of the resources for outdoor recreation primarily in the summer months.

A Park Proposal

To utilize the park resources in the area, the National Parks Branch of the Federal Government has proposed the

1. Manitoba, Northern Task Force, Draft Report, Vol. 1, "Summary of Bloodvein River Public Hearing", 1970.

allocation of the resources at particular sites in the study area to a National Park. Apparently, the resources in these area can be utilized to attain the objectives of the National Parks Branch. These objectives are to provide recreational areas and to preserve unique features of the Canadian landscape for the benefit, education, and enjoyment of present and future generations.

Allocating this presently provincial land to a National Park would involve transferring the jurisdictional responsibility over the natural resources in the area from provincial to federal authorities. This would result in the resources of the area being administered from a national viewpoint, and in terms of the present federal park policy, commercial exploitation of the resources is prohibited within park boundaries.

By excluding the possibilities of exploration and development of mineral resources ih a park area, this policy does not account for the possible future values of mineral development that would accrue to the province.

The provincial government, charged with the responsibility for administering and allocating the mineral and park resources at these proposed park sites, at the present time must make a decision for the acceptance or rejection of these proposals based on the present single-use policy.

A decision must be arrived at only after evaluating potential mineral utilization at these sites, and then selecting the combination of park and mineral development which maximizes the gain to the province and the region.

RELEVANT CONCEPTS AND ISSUES

In order to provide a conceptual framework that can serve as a basis for formulating this resource allocation and development problem, a system analysis is helpful. A resource development system flowchart is shown in Figure 1.

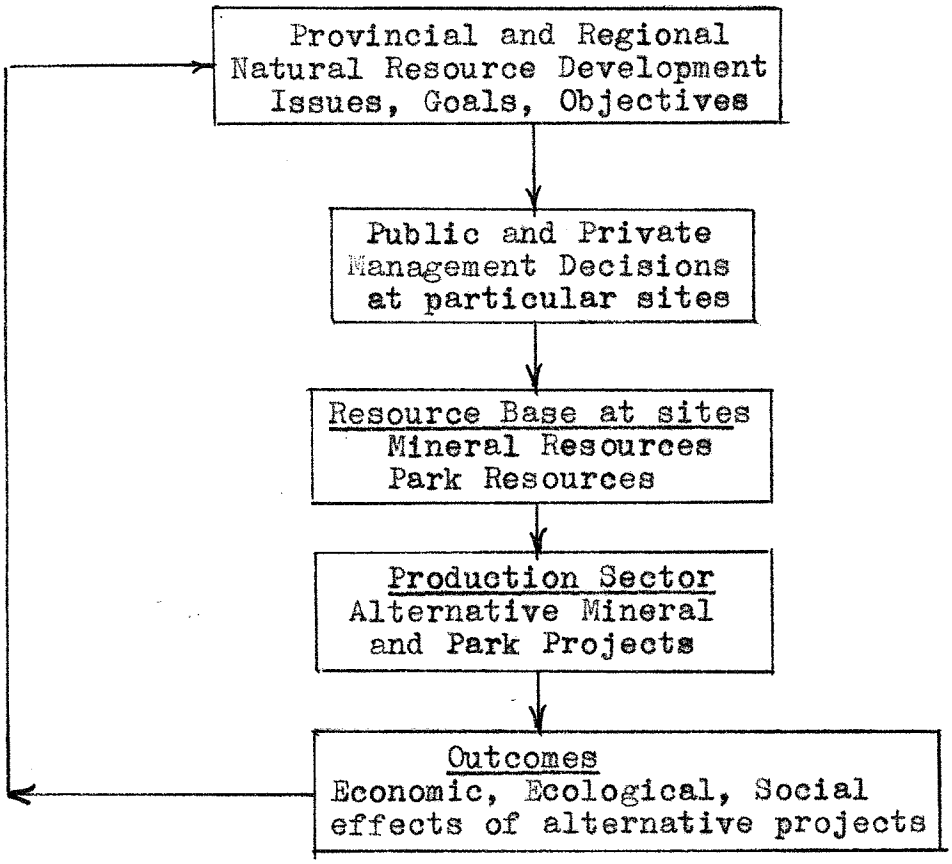


FIGURE 1

Each alternative combination of a mine and a park has different social, economic, and ecological impacts om the area.

Allocation of the mineral and park resources to alternative uses becomes a critical problem when the resources mutually coexist at the same site. Individually, mineral and park developers would favour the allocation of both resources to

their single-use projects, and the production of only one good. Frequently, however, the interdependencies in society make single-use inefficient from a social viewpoint.

Park developers could utilize the park resources at a site efficiently, if the park resources were allocated to a project designed as a wildlife or scenic nature preserve, where the human manipulation of the natural environment is minimal. Such a project would effectively prohibit a mine project in combination, if the objective were maximum efficiency for the park project alone. This situation would arise since private mineral deveopers could achieve their greatest technological efficiencies in the production process if they did not have to account for the externalities involved in the process, such as pollution. Frequently, the achievement of technological efficiency increases the human manipulation of the natural environment, and may destroy it.

Potential conflict situations exist on the east side of Lake Winnipeg at sites which have no substantial initial allocation of the mineral and park resources. Park and mineral developers conflict on the basis of incompatible efficiency objectives. However, resolution of such conflicts can often be found in the multiple-use of mineral and park resources.

In order to evaluate the alternative courses of action available, the variables of park and mine development should be understood. With this information, the ecological, economic and social consequences of each alternative can be visualized.

Parks

The characteristics of outdoor recreational resources can be compared to those of mineral resources. Outdoor recreational land and water resources are regarded as having elements of a public or collective good. Any development of these resources is rightfully undertaken by public agencies who would seek to maximize the benefits to society from the utilization of the resources. Recreational resources exhibit common property characteristics which indicate that these resources can be used simultaneously by more than one person, and no one person can appropriate exclusive use rights to the resource and prevent others from sharing its benefits. In effect, the price to consumers of using the resource, irrespective of travel costs and living expenses, would be zero, assuming there is no congestion.

The provision of wilderness and recreational land resources to be used for outdoor recreation is justifiably undertaken by public agencies, because of two aspects of outdoor recreation. The decision to allocate resources to outdoor recreation and preservation involves the interests of future generations which are accounted for in the marketplace, but possibly incorrectly, due to the dynamics in society. A park project, therefore, usually has a physically unlimited project life. The public supply of outdoor recreation has been justified also on the grounds that an availability of an opportunity to enjoy the outdoors provides external benefits to the public in a more productive, happy, and healthier citizenry.[1] Public authority over outdoor recreational facilities also helps to alleviate the common consequences of exploitation of such resources, such as

1. Harvey E. Brazer, "Outdoor Recreation as a Public Good and Some Problems of Financing." (Mimeographed)

depletion, caused by overutilization, inefficient exploitation and congestion caused by interference among the users of the resource.

A park project can range from a strict nature preserve to a multiple-use management area, occupying an area of acres to hundreds of square miles. In the present National Park system, the constraints imposed on the human manipulation of the natural environment are substantial. Multiple-use of an area for a mine and a park is prohibited on the grounds that the mining or harvesting of mineral resources for the primary purpose of commercial gain is detrimental to the natural history values of a park. [1] However, in a recreational area where the obligation to preserve the natural state is secondary, multiple-use of resources appears to be a reasonable alternative to single-use.

Mines

Economic ore deposits represent accumulations of concentrated elements in a relatively small area, and are unusual to the crust of the earth, and vary as to location, size, quality, complexity and proximity to the surface. Depending on the economic value of the ore deposit and its characteristics, a mine project can vary from a single vertical shaft or open pit to a vast, integrated complex, involving a concentrator, smelter, and a transport network. Mine developments can vary in space and time also. The area of a mine site is usually measured in acres, but often externalities involved with the production process can have wide-ranging effects extending hundreds of

1. Canada, Department of Indian Affairs and Northern Development, National and Historic Parks Branch, National Park Policy, 1970.

miles. A mine development, due to the stock nature of ore deposits, has a technologically limited life span, ending when the economic ore is completely removed. The project life span of a mine consists of various developmental stages, such as preliminary exploration, intensive exploration of specific targets, pre-production development, production, and reclamation. The gains and losses to society vary as development proceeds.

Development of ore deposits has historically been initiated by private venture capital being invested in the exploration for ore deposits, in order to appropriate the resources in the deposit when it is discovered. Such a system allocates ore deposits within the framework of private enterprise, and a world-wide market system which places a monetary value on the output produced from a mine. Once a mine is discovered, private mineral developers operate on the basis of reaching the goal of maximizing the value of profits. Exploration is maintained in order to maximize profits on a sustained basis. A rational mine manager, adjusting his level of ore recovery and rate of ore recovery, would use the best opportunities available to him first, reducing the amount of fixed capital (minerals) tied up in illiquid form. A mine manager would also tilt his production schedule toward the present, instead of producing at a constant rate, since profits are worth more now than in the future.[1] These means of realizing a profit are acceptable social conduct, provided they take all effects (such as pollution) into account through prices and costs which reflect social values. The imperfections in the market system, not accounting for the social cost, account for the involvement of

1. Gaffney Mason, ed/, Extractive Resources and Taxation, Madison, University of Wisconsin Press, 1967, Chap. 2,3.

government in terms of allocation, utilization efficiency, stabilization and redistribution.[1]

When undertaking single-use or multiple-use of mineral and park resources within a resource management area, consideration must be given to the possible effects associated with irreversible decisions allocating resources within park areas. A decision to allow a mine to operate within a park may be ecologically irreversible. The ecosystem on which the park was based may be distorted to an extent that it may not regain its stability for several generations after a mine has ceased operation, therefore eliminating future utilization of the park resources.

Correspondingly, the decision not to allow a mine in a park may be socially and economically irreversible. If a mineis not allowed in a park now, in the future this decision may be irreversible due to political considerations.

In effect, there may be irreversible consequences in either allowing or not allowing a mine in a park, and these consequences must be given consideration when making a decision based on inadequate and uncertain data.

Clearly, the number of variables in both mineral and park developments is large. However, suitable analysis of these variables may prove that there are only a small number of critical variables upon which the interactions of mineral and park development have an effect. Discovery of these variables and the control that can be exercised over them can lead to the construction of a model representing this problem situation.

1. The Mines Act enacted by the Legislative Assembly of Manitoba sets out the areas of government involvement that would take place if mineral development were undertaken in the study area.

Such a model, the derivation of a solution to the model, the testing and evaluation of the solution and finally, the implementation and maintenance of the solution in the real world can serve to improve the performance of natural resource allocation at particular sites having mineral and park resources.

THE EVALUATION PROCESS

A public sector park project has been proposed for utilizing the mineral and park resources at particular sites in the area. To evaluate this proposal and other proposals for development of the same site, such as for a mine or for a mine-park combination, a benefit-cost study could be implemented. The study would consider each project in terms of a cost for an outlay of resources in return for an anticipated flow of future benefits to the province. Consideration of each of these projects proposed by the public or private sectors would lead to a decision selecting the best project for a particular site.

The criterion used to compare alternative proposals for a site would be a comparison of the net benefits created by the alternatives. The project which has the largest net benefits associated with it would be chosen, since the objective of the study is to maximize the value of the site. The benefit-cost ratio would not be relevant in this case.

The gains and losses of a public park project are difficult to quantify because of the intangible or non-marketed values of recreational areas and wilderness and scenic preserves. In general, the benefits that would accrue to the province and region from a national park project on the east side of the Lake are:

- the user value of the park to the citizens of the province;
- intangible benefit in preserving a unique feature of Canada for present and future generations;
- educational benefit in providing an area for the study of the interrelationships between living organisms and the environment in the area, and possibly remove

uncertainty about the effects of particular developments in other areas of the Precambrian Shield that may cause social losses;
- indirect social benefit in providing employment opportunities and potential source of earned income for the under-employed labour force in the area;
- indirect benefit in the increased provincial revenues from the tourist trade generated by the park.

The costs borne by the province by a national park project would include:

- the provincial taxpayer's share of the operating, capital and administrative costs of the park, financed from the federal level;
- opportunity costs of utilizing the resources in another manner to produce social gains.

The evaluation of the social gains and losses from a private mine development would include benefits such as:

- the value of the tax payment made by the mines, in proportion to the value of the output of the mine;
- employment opportunities and potential source of earned income for labour force in the area.

Social costs to the province involved with a private mine development include:

- associated costs to the province equal to the cost of infrastructure investment necessary for a mine development;
- administrative cost by the government;
- opportunity costs equal to the benefits possible from utilizing the resources in a different project, such as a park.

The measurement of the gains and losses of a mine, park, or mine-park combination at any particular site involves a large degree of estimation and uncertainty. The items

included as gains and losses are different for both the private and the public project.

The techniques used to measure the gains and losses of projects would measure the incremental costs and benefits of the individual projects. In order to measure the ecological factors, an ecological survey of a site is necessary. Social factors can be measured using the performance measures of the park, such as the visitation rate and capacity, to estimate the employment and income benefits. The economic value of a park to the users can be estimated by direct or indirect methods of assigning a quantitative measure on the user's willingness to pay for the recreation experience. The appropriateness of evaluating outdoor recreation using this concept has been questioned by numerous economists.[1] Placing a value on the intangible educational and preservation benefits is extremely difficult, if not impossible. To incorporate these factors into the analyses, they may be given positive or negative weights to be used to judge the tangible benefits of a project.

In order to measure the gains and losses from a mine, the geological parameters of the ore body must be known. Once these variables are discovered, a mine development can be planned. From these data, the ecological, social, and economic impacts of the mine development can be estimated.

The measurement of the impact of a mine and park developed sequentially involves many difficulties. The time pattern of benefits of a park and a mine would be variable as the production of the mine proceeded through the stages of development.

1. Seckler, David W. "On the Uses and Abuses of Economic Science in Evaluating Public Outdoor Recreation." Land Economics, November 1966, p. 485 - 494.

Neither operation could operate efficiently from its individual viewpoint because of constraints imposed upon it by the existence of the other project.

If a new recreational project were to displace an existing mine, then compensation would have to be paid to the individuals benefitting from the mine, so that there would be no redistributiob of income. This, however, is not the case in this area.

In order to make an objective comparison of the alternative projects proposed for a particular site, the time patterns of net benefits of each project must be discounted to the present, using a uniform price level. For all alternatives, the price level of a base year could be used. For a single-use mine, the project life would be the time required until the economic ore was completely removed. For the multiple-use alternative, the project life would be the period required for the mine site to return to the state where the benefits of the park after the mining operation equal the benefits that would have arisen from the park without the mine.

The problem of choosing a suitable rate of discount is more difficult, however. The gains and losses from both projects would occur over time and in various patterns. At a zero rate of discount, there would be no discromination between present and future generations. To make a decision, these gains and losses must be discounted to present values. The rate of discount varies, however, for public and private projects. Private and public projects are financed through different spurces and each has different opportunity costs for funds. The interest rate is usually higher for private projects than for public projects, indicating the relatively greater risk involved in private projects. There appears some justification because of the imperfections in the capital markets for using different rates to discount values for each project, although it is

generally an unacceptable procedure. More favourable would be analysis of values at different rates to measure the sensitivity of the benefits at different rates. From this, a more objective choice for a discount rate could be chosen.

With a suitable framework of analysis constructed, the gains and losses of each alternative project can be evaluated within an accounting framework. The alternative which maximizes the value of the specified objectives of development will be selected. The implications of setting different objectives may result in the selection of different alternatives. The range of objectives can include high preferences for ecological balance, regional economic development, and social development of native peoples. The evaluation of the gains and losses from an efficiency viewpoint can be supplemented through the political process by weighting these variables according to the way they are distributed throughout the provincial population.

STATEMENT OF CONCLUSIONS

The allocation of the mineral and park resources on the east side of the Lake is receiving increased attention from private and public development agencies because of the under-developed economic status of the area.

The provincial government has the responsibility of considering two aspects of the natural resource allocation problem in the area. First, the government must decide on the acceptance or rejection of the National Park proposals for single-use park development at particular sites. Second, the government must develop some framework within which to consider all alternative multiple-use or single-use park and mineral proposals.

A benefit-cost study can be used to evaluate a National Park proposal for the area, once the park proposal is formulated. In order to make a decision, evaluation of the mineral resources is necessary also. However, the knowledge about the mineral potential in this area is limited. Realistically, perhaps the best decision would be to leave as many options open as possible, by rejecting single-use park proposals, and leaving the situation open to annual review, and instituting a program to increase the knowledge about the economic mineral resources in the area.

Traditionally, this information is gathered by private mining firms in their process of exploring for and developing mines for exploitation. The areas and time of exploration are variables dependent on world-wide market conditions, however, and reliance on this system may delay an ultimate decision on a park proposal indefinitely.

Furthermore, it is unrealistic to expect private mining firms to make investments in an exploration program within a proposed

park area in order to define the geological parameters of the ore bodies existing there, without some assurance of resource tenure such that they will be able to exploit the ore when they discover it.

Therefore, it appears that the government must take some initiative in defining the economic mineral potential of proposed park areas. Attempts have been made, using statistical data, to estimate the geological parameters of ore bodies in specific areas. The procedure followed in analyzing the mineral potential of a park area would involve analyzing the surficial geology of grid locations in the area. The parameters discovered would be compared with the geological parameters of known economic ore deposits. From such an analysis, probability distributions could be drawn for the size, location, grade and tonnage of possible ore deposits in the area. Such an analysis would be costly, however, and may not be suitable for discovering high grade localized ore deposits which are expected to be located in the study area. To minimize the cost of such an investigation, linear programming techniques could be used to improve the performance of this statistical system. If the parameters of the ore bodies are constants, then the variables that could be controlled would be the time and money spent in more intensive investigation of specific anomalies outlined by the statistical data. Optimum areas for investigation would then be intensely explored and the cost minimized. Costs should include possible degradation of the environment due to the search process itself.

Such an exploration program would be undertaken either by a government agency, or through an agreement with private exploration companies. The results of such a program would give a more objective basis on which to judge the single-use park projects of the Federal Government.

In order to provide a framework for considering all alternative

utilizations of mineral and park resources at specific sites in the area, the government, in the long run, should adopt an interdisciplinary research approach. A simple model of the present natural resource allocation system distributing the mineral and park resources in the area should be constructed by an interdisciplinary team, and used to find the best combination of resource use at sites under variable conditions. Such a program will assist natural resource managers in making decisions on the control of the mineral and park resources at particular sites on the east side of the Lake.

APPENDIX

Table 1 [1]

Probability of Rock Type Occurring in Area	Rock Type	Minerals Associated with Rock Type
80 %	Granites, Pegmatites rich in rare earths	Beryllium, Tantalite-Columbite, Lithium, Cesium, Tin, Boron
50 %	Gneisses, Pegmatites, Metasediments	Gold, Silver, Molybdenum, Zinc
10 %	Ultrabasics	Copper, Nickel, Chromium
10 %	Basic Volcanics	Gold, Silver, Tellurides, Copper, Zinc

1. Personal Communication, Mr. Dave MacRitchie, Mines Branch, Department of Mines and Natural Resources.

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