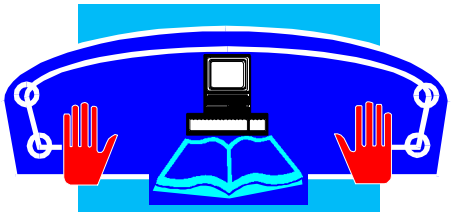

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A REVIEW OF ROAD RELATED WILDLIFE PROBLEMS AND THE ENVIRONMENTAL MANAGEMENT PROCESS IN THE NORTH

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ABSTRACT

Road development potentially can cause significant direct and indirect impacts on wildlife and wildlife habitat. To avoid or minimize detrimental effects associated with road development, wildlife resource concerns must be incorporated during the initial planning stages of development. Three classes of impact reduction measures exist. Spatial measures seek to avoid areas of environmental importance, while timing measures eliminate disturbance during critical periods of the life-cycle. Operational measures embrace codes of good practice that serve to reduce the overall effects during each development phase. Ignoring or failing to undertake comprehensive environmental programs can result in expensive delays and design changes.

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INTRODUCTION

The history of road building in the Northwest Territories is short. Considering the vast area of the N.W.T., the area accessible by road is very limited and is restricted to the Mackenzie District.

The first road in the N.W.T., now known as the Mackenzie Highway, was built from Grimshaw, Alberta, to Hay River, N.W.T., in 1938-39 for military purposes. During the 1950's the "Roads to Resources" policy resulted in substantial extensions of the Mackenzie Highway. In 1972 construction was initiated to extend the Mackenzie Highway north to Tuktoyaktuk. However, this work was halted in 1977 due to changing developmental priorities in the Mackenzie Valley.

All-weather roads in the N.W.T. include the Mackenzie Highway (#l), Hay River Highway (#2), Yellowknife Highway (#3), Ingraham Trail (#4), Fort Smith Highway (#S) , Pine Point Highway (#6), and the Liard Highway (completion expected 1982) (Fig. 1). The Dempster Highway which originates in Dawson City, Yukon, and runs to Inuvik, N.W.T., was opened in 1980. Winter access roads are frequently constructed to support exploration and mining activities. The Gordon Lake winter road, for example, has been used extensively since 1975. The Rae Lakes winter road and the Discovery winter road have provided access to Echo Bay Mine and Discovery Mine, respectively.

The construction, operation and maintenance of those roads spans several decades, but only since the 1970's have environmental reviews of major highway developments been required.

Figure 1. Road access in the Northwest Territories, winter 1980-81.

The Federal Cabinet directive instituting the Environmental Assessment and Review Panel (E.A.R.P) was issued in 1973. Consequently, the major highway projects completed or near completion in the Northwest Territories, with the exception of the environmental assessment for the Mackenzie Highway, were never subjected to a thorough and systematic E.A.R.P. review. Studies of some environmental problems resulting from these roads have been conducted in an effort to identify mitigation measures to rectify the problems, or to facilitate improved future planning of roads.

Almost all studies on the effects of roads on wildlife suffer from a lack of pre-development information on population abundance and distribution. Comparisons with information during and after construction are therefore impossible. Documentation, especially quantitative, of long-term effects from linear facilities on wildlife in northern Canada is virtually non-existent.

This paper is based on a literature review and on the experience of the Northwest Territories Wildlife Service (NWT-WS) with road development projects in the N.W.T. It is intended to provide:

1. a brief review of the literature on road-related wildlife problems and concerns;
2. a discussion of impact reduction strategies, an indication of how they fit into the engineering design process, and a review of some case histories; and
3. recommendations for an approach to solving the problems identified above.

IMPACT OF ROAD DEVELOPMENT

Habitat Loss

Freddy and Erickson (1975), and Bloomfield (1979) found that mountain caribou (Rangifer tarandus caribou) populations in British Columbia consisted of small bands of animals occupying discontinuous habitats. Each band was therefore vulnerable to increased development. Damage to, or destruction of, limited wintering habitat would have jeopardized the existence of any one band of caribou.

Fyfe and Kemper (1975) reported that a primary concern with pipeline development (in most cases accompanied by road construction) is the loss of traditional raptor nest sites and available nesting habitat through modification of bluffs and rock cliffs by rock-cuts. Macleod (1979) alluded to this problem when discussing the potential impacts from construction of the Dempster Highway through sections of the Ogilvie and Richardson Mountains in the Yukon and N.W.T.

Often the destruction of habitat is not limited to the area encompassed by the right-of-way. Ancillary developments such as quarries, camps, and staging areas can precipitate reductions in wildlife habitat as well. For example, Donaldson and Fleck (1979) commented on the importance of gravel-rich alluvial flats along the Liard River. These areas are excellent moose (Alces alces andersoni) wintering habitat in a region where moose population levels are not naturally high. The destruction of these flats through road construction-related quarrying activities could have

resulted in the loss of valuable long-term habitat. Harding and Naggy (1980) documented cases where grizzly bear (Ursus arctos) dens on Richards Island, N.W.T., were partially destroyed by vehicular activity or totally destroyed by quarry operations.

In some cases, the effects of road development on habitat may not be judged to be significant. For example, only a small fraction of barren-ground caribou (Rangifer tarandus groenlandicus) habitat that is many thousand square kilometres in size is removed from production by a .70 m right-of-way. However, not all species have large areas of suitable habitat available to them. Road development in habitats that are critical to a species' survival, or small in size, and biogeographically isolated, could result in local and/or regional extirpation of that population. Not all of a species' range is necessarily comprised of critical habitat; some portions of a habitat may be expendable. But every effort should be made to identify and avoid critical habitats during road planning.

Road-Related Disturbance of Wildlife

The effects of disturbance on wildlife are perhaps sane of the least understood and the most difficult to quantify of all the impacts associated with road development. Disturbance begins with the initial intrusion into wildlife habitat by survey crews and continues throughout the life of the development and beyond. Potential effects of disturbance have been extensively reviewed by Geist (1975), Klein (1971, 1980), Mackenzie (1976), Environment Canada (1979), Miller and Gunn (1979), Shank (1979), Sopuck et al.

(1979), and Jakimchuk (1980), and it seems that this research has identified more questions than answers at the present time.

Avoidance of habitat along the right-of-way by wildlife and abandonment resulting from the synergistic effects of ancillary developments is acommonly identified effect of road construction disturbance.

Roby (1978) and Cameron et al. (1979) indicate that during the summer some sex/age classes (eg., cows with calves) of caribou are more sensitive to the vehicular traffic on the Trans-Alaska Pipeline road than to the road itself during post-calving periods.

In the absence of human disturbance most ungulates do not appear to showstrong avoidance to well designed roads that permit easy crossing (Sopuck et al. 197 S). Habitat abandonment may result because of a species' inability to tolerate or habituate to adverse stimuli or disturbance associated with the use of the road. On the other hand, Skoog (1968) reported that hunting pressure and vehicular traffic along the Richardson Highway in Alaska frustrated, but did not deter, migrating caribou (Rangifer tarandus granti) from crossing the corridor. It therefore appears that the sex, age, timing and type of caribou activity affect the response by caribou to roads and associated disturbance.

Increased tolerance of wildlife to roadside corridors is not always desirable. Such habituation could increase the number of vehicle/ animal collisions.

Jackman (1973) and Hinman (1974) stated that a major problem resulting from transportation systems in the north will be the increase in all kinds of associated developments. Klein (1980)

documented cases where reindeer (Rangifer tarandus tarandus) in the U.S.S.R. were prevented from using former habitat because of the construction of a road, a pipeline, and ancillary facilities.

Habituation by ungulates to a single right-of-way, given suitable design, may be possible but a cumulative effect of uncoordinated development could be a series of roads running at various angles, compounding the barrier effects and reducing habitat to unuseable chunks. Research on this problem is presently underway in the Prudhoe Bay area, Alaska (K. Jingfors, pers. comm.).

Generally, we have little quantitative evidence about how roads affect wildlife behaviour and whether the effects are manifested at the population as well as the individual level. The majority of studies to date suffer from a lack of pre-development information on wildlife population distribute on and abundance. Little is known about the long-term impacts of transportation corridors on movements, and size and structure changes in populations. Most importantly, we lack the techniques that would enable biologists to conduct such studies.

The NWT-WS, with the support of the Department of Indian Affairs and Northern Development (DIAND), is now undertaking design research to develop techniques that will enable biologists to study the effects of roads or other linear developments on caribou distribution (Jingfors and Gunn 1981) .

Access and Hunting

Improved hunter access is undoubtedly the most serious and the best documented effect of new roads on wildlife. Klein (1979)

reported that an indirect effect of the Alaska oil pipeline project will be that a large tract of wilderness north of the Yukon River will be accessible by an all-weather road. Harding and Naggy (1978) stated that a ma j or problem on Richards Island, N .W. T. , wil l be that new all-weather roads w il l render gr iz zly bears more vulner able to hunters who l ive in Inuvik and Tuktoyak tuk . In nor them Alberta, 80% of the hunter effort and 23% of the total moose harvest occurs within 1.6 km of access roads (Lynch lg73) .

S ignif icant decl ines of access i bl e moose populations surrounding communi ties in the southwestern N. W. T. suggest that access created by inc r eased r oad development, if unregulated, could r esul t in mor e widespread dec l ines of wildl if e populations. Donaldson and Fleck (1. 979) suggested that the greatest ef feet of the Liard H ighway on moo se popu lations woul d be the resultant increased hunting pr es sur e. Secondary access roads, eg. winter roads , in the N. W. T. al so create serious problems. The Gordon Lake winter road, for example, which runs from the Ingr aham Trail east of Yell owk nife t o Camla ren Mine on Gordon Lake, h as been used by hunters to harvest bar ren-ground car ibou from the Bathurst herd. In early 1980, an estimated 2,000 ca r ibou we r e l', arvested by hunters who gained access to winter ing areas by this road.

Illegal hunt ing of wildlife by construction cr ews can cent r ibute to the over al l decline of popul a ti ons i f permitted to occur uncheck ed. In nor them Br itish Columbia, for ex ample , illegal harvesting of mountain goats (Oreamnus americanus) by r a ilway cons t r u c t i on w o r k e rs c a used pop ul a t i on d e c l i nes (D.

Hatler, pers. comm. ; cited by Donaldson and Fleck 1979). Bloomfield (1979) reported that illegal hunting by highway construction crews contributed to the decline of mountain caribou in central British Columbia.

Problem Wildlife and Road Kills

Hinman (1974) reported that during the pre-construction stage of the Trans-Alaska pipeline project, human-wildlife confrontations were a serious problem. The improper disposal of combustible garbage and the deliberate feeding of wildlife in construction camps can precipitance problem wildlife situations. Scavenging wolves, bears and foxes will readily habituate to human presence in camps, which often results in situations where the animals must be killed.

It is estimated that fewer than 10 moose are killed on N.W.T. roads annually (Environment Canada 1979), but the greater volume of traffic associated with increased development will result in an increased number of traffic mishaps. In the context of cumulative effects, traffic deaths could potentially further reduce wildlife populations. Donaldson and Fleck (1979) suggest that moose-vehicle mishaps along the Liard Highway could become a problem, especially during the fall and winter months when the days are short and visibility is reduced. Grenier (1973) determined that 14% of a moose (Alces alces americana) population frequenting habitat that was bisected by the Laurentides Highway in Quebec was killed annually by collisions with vehicles.

IMPACT REDUCTION STRATEGIES

Environmental impact reduction should be a goal during all stages of the design, construction, operation and maintenance of a road. The selection of an optimal mix of measures to achieve engineering standards, economic efficiency and environmental protection is a complex planning and design problem requiring interdisciplinary and interagency cooperation.

Several classes of impact reduction measures exist. Spatial measures seek to avoid areas of environmental significance such as critical wildlife habitat or unique landscape features. Identification and avoidance of critical habitat should be a major goal of the corridor identification and selection process. Avoidance of areas such as wintering ranges, nesting areas, and calving and post-calving grounds is the best solution to minimizing or eliminating impacts. Avoidance measures can also be applied during the right-of-way selection to minimize local impacts.

Careful timing of road constucticn activities can reduce impacts by eliminating disturbance related to surveying, clearing, construction and operation during critical periods in the life-cycle of wildlife populations. Such measures will minimize the short-term impacts of project construction.

Operational measures refer to those codes of good practice, general rehabilitation, and to the controls on employees which, if carefully adhered to, can reduce the overall effects of any project at any time.

Impact Reduction and Project Planning

The environmental review process required for major projects in the north has several goals. The identification and mitigation of impacts is one. Mitigative measures should be applied during the planning and design, construction, operation and abandonment phases of a project with the specific objective of avoiding or reducing adverse environmental impacts.

Despite best efforts, all impacts cannot be mitigated; certain residual impacts or costs willalwaysresult from development projects. Within the overall cost-benefit analysis for a project, the wildlife manager must sometimes accept certain residual costs with full knowledge that the overall benefits to society resulting from improved transportation sometimes outweigh effects on natural resources. The essential point in such trade-offs is that the environmental review process must make them explicit and that careful study of environmental resources such as wildlife and fisheries must precede any final decisions on projects which will affect their management.

As we have mentioned, mitigation is an expensive process. It is more so when mitigation efforts are applied late in the design process with the hope that they will alleviate the effects of poorly planned developments.

Loucks et al. (1980) examined the effect of insufficient environmental input during design and early construction phases of projects such as the Trans-Alaska Pipeline, the Garrison Diversion, and the Great Canadian Oil Sands tailings ponds and dykes. Estimated excessive costs resulting from poor

environmental planning in these examples were $800 million, $400 million and $45-90 million. No such analyses are possible for northern highways. Most were completed before the rise of environmental awareness and concern in the mid-1970's. Nevertheless, the consequences of ignoring the need for careful study and analysis of environmental factors can be expensive delays and design changes.

This message, of course, has not been lost on the road designers of today. Environmental codes of practice, guidelines, terms and conditions abound. Some problems persist at the field level where these guidelines are implemented. The administration of responsibility for enforcement, interpretation of intent, authority to stop construction or to require design changes in the field, become a troublesome consideration when the bulldozers are moving. In this respect, the need for careful integration of government agencies, contractors and developers is a vital component of the environmental planning process.

Road Development: Some Examples From Our Experience

In earlier discussion, we alluded to gaps in information and a lack of techniques for studying long-term impacts of road development on wildlife. Against this background, we have examined the mitigation process, set within the general context of northern road development.

Codes of good practice and many operational measures which serve to mitigate negative environmental impacts can be developed and applied through professional experience and plain common

sense. However, many of the long-term questions about wildlife and roads will require in-depth study.

The information required to facilitate sound corridor planning and road design must be identified early and used to guide design and planning efforts during the pre-construction phases. Experience with roads in the north suggests that to attempt to resolve wildlife problems during the later stages of development often forces biologists to deal with the symptoms rather than the causes of impacts.

Examples of this kind have occurred in the Yukon and N.W.T. Studies are ongoing along the Dempster Highway to quantify behavioral and distributional changes resulting from corridor development. However, pre-construction studies were not comprehensive enough to facilitate comparative analyses.

Winter roads also create problems for management agencies. Even though such reads may be used year after year, little detailed review and study accompanies their planning and development. We mentioned earlier the access problems created by the Gordon Lake winter road. Significant concerns also exist for the Cadillac Mine road being constructed from the Liard River to Prairie Creek, a distance of 160 km through several areas of Dan sheep (Ovis dalli dalli), mountain caribou and moose habitat. This road was approved under a land-use permit with virtually no pre-construction environmental study.

The NWT-WS is attempting to solve wildlife management problems that are generated by increased access through winter road construction. For example, our “Wildlife Ordinance” enables

the NWT-WS to establish special wildlife management areas in order to regulate access and opportunistic hunting. Despite the present lack of highway construction in the N.W.T., road-related problems will continue to crop up for secondary and winter roads.

We have been involved with an example of careful preparation for road development as well. When several major base metal deposits, and a subsequent increase in exploration occurred in the northeastern Mackenzie District in the late 1970's, DIAND and the GNWT-WS collaborated to fund a pre-development survey of wildlife resources (Searing and Alliston 1979). This study was designed to examine alternative routes and methods to transport base metals from this region. In addition, the study described deficiencies in the wildlife information base and suggested necessary research requirements. We are, in this case, prepared to respond with some foreknowledge to the potential problems a road development decision would present.

RECOMMENDATIONS

Our brief review of literature on the road development process and the effects on wildlife has identified two major problems.

Road Planning

The road development process must include environmental information from the beginning. A lead time of up to 2-3 years may be necessary to complete wildlife studies. A coordinated interdisciplinary approach is required to identify information gaps, establish information gathering priorities, and ensure communication among the project specialists.

We must eliminate the concept of environmental assessment as a one-time predictor of impacts. Environmental assessment should be an ongoing and iterative process, eventually merging with management. This concept is a central component of Holling's (1980) call for adaptive environmental assessment and management.

Environmental reviews have not been, for historical reasons, a Part of road planning in the N.W.T. Serious discussion among responsible agencies must occur and careful efforts should be directed at ensuring that new roads are planned to minimize losses of renewable resources.

Status of Wildlife Information and Techniques

The comprehensive reviews referred to earlier identify several common problems with respect to a wildlife manager's

ability to contribute to the environmental assessment of roads. Methods are not comparable between many of the existing studies. Gaps in the data base on wildlife species abundance, distribution, and the location of critical wildlife habitat exist for many areas studied.

There is a need for selective studies to accompany road development from concept to operation, maintenance, and abandonment. We say selective because what we need to learn or to begin to study are the long-term effects of roads on wildlife. The root of this problem then, is the lack of techniques that enable wildlife biologists to develop statistically reliable, quantitative measures of behavioral and physiological reactions to linear disturbance, and the effects of these factors on wildlife populations.

These problems can and must be dealt with as soon as possible. The GNWT-WS, in cooperation with the Canadian Wildlife Service and Alaskan biologists, has begun basic research designed to develop techniques to measure behavioral impacts. These techniques will enable studies of the effects of disturbance due to roads on wildlife populations. When combined with careful environmental assessment, mitigation and regulation of access, we hope to enhance the compatibility of northern road developments with wildlife resources.

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