

Oil under the Tundra in the Mackenzie Delta Region

There is justifiable concern about the effects of industrial man's activities on the tundra. For over 20 years the oil industry has explored the western arctic mainland, but only recently has exploration been in earnest. Oil-seeps along the Alaska north slope became known to white-men in 1917, and Naval Petroleum Reserve No. 4 was established there in 1923. It was not until 1943-44 that exploration started with heavy military vehicles initiating the sort of tundra damage which has caused present alarm and awareness. Yet, in summer 1965, Imperial Oil bulldozed away the active layer (thawed in summer) of soil along miles of seismic exploration lines on the Tuktoyaktuk Peninsula. Public outcry, scientific concern, and industrial sensitivity has since gone far to stem the 'boomer' scorched earth attitude. Exploration has succeeded: in 1968 the Prudhoe Bay field was discovered, in 1970 and 1971 pools were found on the Tuktoyaktuk Peninsula, and a recent discovery, on Richards Island is just across a channel from a bird sanctuary in the Mackenzie River Delta.

The use of tracked vehicles is the cause of real concern. Driving over ice-rich permafrost often seriously alters or displaces insulating vegetation and initiates thermokarst which may lead to chronic erosion as water flows in the subsided tracks. The process may be initiated by one track, or even by a foot-path. Most areas seem more resistant but disruption may be subtle. For example, on gently sloping wet meadows vehicles may merely press the vegetation into shallow troughs, which then direct water that would normally percolate over a wide area, thus draining all or part of the meadow and reducing its biotic productivity over many years. All cross-tundra driving should be prohibited on unfrozen tundra and when air temperatures at the ground exceed freezing.

Seismic exploration is now restricted to winter, but continues should a chinook melt the first snows. Nevertheless, at the present intensity, exploration seems to have only minor localized effects. In marshy areas of low-centered polygonal ground cotton grass is lush along seismic lines: presumably the tussocks are spread apart, allowing more new growth. The 1965 lines through similar terrain support almost no vegetation and are often shallow canals and intermittent black pools for long distances. Over drier high-centered, heath and shrub-covered polygons disruption is

greater. The lugs of the bulldozer tracks cut the aerial part of the vegetation into sections and separate them from the roots so that small mats lie loose along the lines. Little is known about regeneration on healthy tundra. The 1965 lines in that terrain support lush stands of native grasses on the exposed mineral soil. In the Mackenzie Delta seismic lines leave a swath of broken willows and spruce. No doubt the willows will regenerate: spruce will have to recolonize, and then will take several hundred years to grow to the same size. The repercussions of widespread disruption on the natural vegetation are almost impossible to predict as it is hard to assess what has already happened. Nevertheless, it is safer to act in future on pessimistic projections.

Revegetation of different types of tundra with native and exotic plants with and without fertilizer is being studied. The value of exotics is in emergencies, and emphasis should be directed as to how to encourage rapid colonization of disturbed sites with native adventives.

Exploration also entails wild-cat drilling, and with it the problems of oil rigs. Each rig blasts two sumps out of the permafrost, one about 15 to 20 feet square is for camp wastes, the other about 75 feet square and 8 to 10 feet deep is for the rig and used drilling mud. The latter is lined with polyethylene in summer to protect the frozen ground. Problems may arise when rig sumps overflow and drilling mud freezes on the tundra; otherwise drilling muds, complete with additives are probably innocuous except in water where the gel may clog fishes' gills. Once wells have been completed the frozen sumps are covered with ground hopefully deep enough to prevent thawing in summer. Revegetation is vital on these artificial pingoes and the surrounding three acres of badly disrupted ground of the rig site. In high winds half-cooked and burned garbage blows for miles, and snow buries equipment and materials. In digging out after blizzards, fuel drums are punctured, and bags of cement and mud additives such as caustic soda and salt are burst. Clearly more care is needed to reduce pollution and litter at these sites.

Access roads for rigs and equipment depots share problems with seismic lines, but seem more disruptive as vegetation along them on all types of tundra tends to be completely destroyed. Rhizomes under roads over low-centered polygons may regenerate given time. Roads are built in winter,

supposedly from packed and wetted snow. Sparse snow in early winter, then extreme cold render that method of construction ineffective in some places. Standard heavy trucks rumble along, pot holes develop, and graders may cut the road surface down to the ground. New concepts in vehicle design show promise for minimizing disruption, but there is resistance to innovations.

Drilling for oil, like any mechanized operation on tundra, requires gravel pads to prevent equipment and materials from sinking into the ground in summer. Vast quantities of gravel will be needed for the Dempster Highway and the proposed Mackenzie Valley Pipe-line. Gravel is scarce in the Mackenzie Delta. Much is in the river valleys and may be fish spawning grounds. Other gravel is old glacial deposits and is important habitat for foxes and ground-squirrels, the latter a staple food of predators including the rare Barren-ground Grizzly Bear. Gravel should not be simply regarded as a ready made material conveniently deposited by nature for man's roads, air-strips, pads, and berms.

Many problems I have mentioned may be resolved through adequate care and planning or properly directed research efforts or both. The problems associated with wildlife are more thorny. Caribou may or may not cross seismic lines or roads, depending on their temperament which changes throughout the year: what may be a barrier during calving, may be a pathway at the height of migration. It is foolhardy for industrial representatives and others with vested interests to offhandedly claim that caribou are, or will be unaffected. Grizzly bears, in digging for ground-squirrels on man-made berms may remove protective layers on buried pipes, displace supporting gravel, and weaken pipe-lines. Grizzly bears have been known to burst fuel bladders. For bears and foxes, improperly treated garbage is a great attractant. Already grizzly bears have been shot on garbage dumps because they became belligerent when chased. Foxes are tame and attractive, but carry rabies. Bored aircraft pilots illegally harass game, and I have heard of helicopter pilots herding Dall Sheep off cliffs. The drone of aircraft disturbs some nesting birds, and increases nest predation. Some disturbance by aircraft is inevitable, but restriction on flight altitudes over different regions and seasons are needed.

Social problems are developing in the north. White-man's ways have cast scorn on professional trapping. The trend of native people to wage

earning is resulting in the loss of skills and arts pertinent to living from the land, and simultaneously increases the social and economic dependence of native people on white society's patronage. Native people, with opportunity to advance, work for oil operations, but tend to remain at the lowest levels and quit. Sometimes signs of feeling inferior appear. Some natives on oil exploration crews also trap; but this seems unfair to the professional trappers in the area. Other problems correlated with the presence of whites, wages, and alcohol are no more attributable to the oil industry than any other foreign institution. Even if one accepts the thesis that wage earning is best for the people, it must be remembered that oil field development and exploration do not employ many people.

The portents of the future are difficult to decipher. At the present level of activity, if practices improve over the next few years, environmental hazards seem minor. But presumably the discoveries of the last two years are important and we can expect accelerated exploration and greater pressure for building pipe-lines. If that premise is correct several tens of thousands of miles of seismic lines will be run and hundreds of wild-cat wells drilled. The area which will be directly affected is said to be 0.3% of the sedimentary basin of about 470,000 sq. miles. Ecologically such a proportion is meaningless. An oil field may be discovered in a small area critical to the survival of a wide-ranging species, so the elimination of that species would affect the total area of its range. Numerous rigs will be moved onto proven fields, and all the associated problems multiplied accordingly. Once the oil is tapped, a maze of above-ground feeder pipes and pumps would be installed to take the oil to a major pipe-line.

Misleading and ecologically invalid proportions of land use are touted for the proposed Mackenzie Valley Pipe-line (e.g. 0.0002% of the area of the Yukon and N.W.T.). The chance of a pipe-line breaking is small, but exists. Earthquakes occur along the mountains in the Yukon, albeit not as frequently as along the trans-Alaska route. The pipe-line could break anywhere, so the ecologically valid area from this stand-point is the total area of water-sheds, coastal seas, and land which could be affected. The fanfare over the voyages of the Manhattan have ceased abruptly, and just as well. The forces of moving sea-ice are formidable. Off-shore crude oil spills in the arctic would be many times more devastating than in

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the south where we are experiencing their destructiveness. Along the arctic coast huge numbers of shore-birds, swans, geese, ducks would be eliminated, as probably also seals, whales, and polar bears. Oil tankers and offshore drilling in the arctic ocean could only lead to disaster.

With the history of arctic oil exploration riddled with errors, carelessness, and lack of planning, we should take a very critical look at present practices in the light of likely future developments. Greater efforts must be made to determine precisely what sort of disruption has already taken place and to find remedial measures for it. Simultaneously exploration methods should be modified to fully minimize disturbance. If we really think that that can be accomplished, we can discuss similarly the ramifications of exploitation. At the present rate of progress in solving the problems presented here, and the present blind zeal to extract non-renewable resources in the arctic, I regret that I see arctic oil not as a boon but a bane.

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