BIOPHYSICAL MAPPING IN THE MACKENZIE VALLEY

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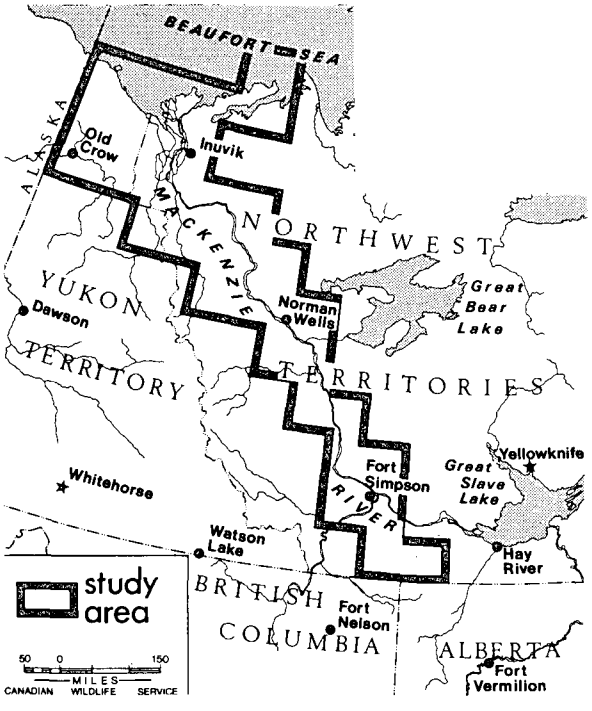
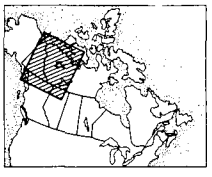
In 1970, the Geological Survey of Canada (GSC) undertook a three-year program of mapping the surficial deposits in the Mackenzie Valley and northern Yukon. As environmental concerns relating to a possible energy transportation corridor became evident, the survey was expanded to include such terrain sensitivity indicators as vegetation and soils. In 1971, the Canadian Forestry Service was invited to provide the vegetation input, and the Soil Research Institute was invited to provide pedological information.

The resulting survey was clearly a surficial geology study, with vegetation and soils added on. Thus, it was never intended nor organized to be a biophysical study. The investigators of the vegetation-soils aspect had two viable choices: 1. to use the mapping units identified by the GSC to characterize the vegetation and soils of the area; and 2. to map biophysical characteristics of the area. The size of the area (120,000 mi^2) and time constraints (two field seasons) were important constraints, as each of the two teams were to cover about 30,000 mi^2 a year.

The northern team chose to use the mapping units prepared by the GSC at a scale of 1:125,000. The mapping units, as conceived by the GSC, were to be based strictly on the genesis of the surface materials. The vegetation-soils team was successful in persuading the surficial geologists to add such features as texture and slope to their mapping criteria. This made the resulting units more suitable to vegetation-soil interpretation and paved the way to a modified biophysical classification. The modification was necessary, as the main thrust of the project was not productivity of the terrain, but sensitivity to disturbance.

The southern team chose to map the area, applying a biophysical classification, as interpreted by the investigator. This study





very rapidly became a nightmarish exercise in mapping and air photo interpretation of the huge area at the detriment of field studies, as both the surficial geology mapping and the biophysical mapping were proceeding concurrently, without effective interchange of ideas or maps. In 1972, the Soil Research Institute became involved with the southern team and produced an integrated report with the Geological Survey (Tarnocai, 1973).

The northern team, free of the burden of duplicating the mapping effort of the GSC, concentrated on studying and understanding the relationships between landforms (identified by the GSC), vegetation, and soil (active layer). Two avenues were taken in the reporting: one presented the findings of the vegetation-soils team only (Zoltai and Pettapiece, 1973), and the second avenue was to integrate the vegetation-soil-active layer results into the legend of the map by GSC. In the legend, the Land Zones (e.g. Land or Site Regions) were established on the basis of vegetation chronosequence and permafrost characteristics. Within each Land Zone (Region), the mapping units were characterized as to vegetation and soils. The stable and fire-originated vegetation were indicated for the major moisture regimes (drainage classes) of each landform. Likewise, the soil texture, depth of active layer and frost-induced microrelief were given for each major drainage class of each mapping unit in the different Land Zones (Regions).

This study and subsequent field work in 1973 (Zoltai and Tarnocai, 1974) enables us to develop a terrain sensitivity classification (Van Eyk and Zoltai, 1975). In this scheme, each drainage class of all mapping units was rated as to the expected reaction to specified surface disturbances. The resulting ratings were generalized and portrayed on a 1:1,000,000 map. This map, while too generalized to be of value at the local level, shows the regional picture and puts southern (boreal forest) features on the same scale as the northern (tundra) features.

The cost of the survey in relation to a biophysical survey cannot be determined. The GSC, being the lead agency, decided the various aspects of the field investigations. Thus, much effort may be spent on an area of complex glacial history, while other areas of simple depositional history may receive little attention, although this may be an area sensitive to disturbances.

The northern team consisted of two or three professional Pleistocene geologists, a geophysicist, a vegetation man and a soils man. With support staff (technicians, pilots, students, labourers and cook) the whole crew numbered about 16 persons. A helicopter and a Beaver aircraft supplied full-time transportation. A biophysical survey, yielding comparable results, could have been completed by about half the crew in the field, with comparable savings.

My estimate is that such a survey could be conducted for \$175,000 to cover 30,000 mi^2, or about \$6/mi^2.

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