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Proposal for the
Terrestrial Biology Section
of the
Regional Environmental Impact Study
Summer - 1976

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A Regional Environmental Impact Study (REIS) is currently being conducted with funds appropriated by the Minnesota legislature. The study is slated to run through 1977 on an area of approximately 600 square miles. This region has been termed the Mine Site Area by the Department of Natural Resources and is the area with the highest potential for developing copper-nickel mining in the future (Figure 1.).

The present study is unique in several ways: 1) This is the first regional EIS to be undertaken in the U.S. and is not a site specific study as most other EIS's have been in the past. 2) This study is charged with gathering baseline data in many categories before potential disturbances caused by mining have occurred. Many EIS's have been conducted after the damage has been done and attempt to reconstruct the degree of ecological change without the benefit of baseline data. 3) The study is of relatively long term, covering two complete field seasons, rather than the customary 6 months of field work.

The baseline data gathered during this study will be instrumental in the future decision-making for uses of the Mine Site Area. If, and when mining occurs, a similar study will be conducted using the same techniques and on generally the same sites. These two studies will form the comparative basis to determine the harmful effects, if any, caused by copper-nickel mining on the various fauna and flora of the region.

The baseline data will be gathered and analysed by professional biologists working with the following major organizations:

- State Planning Agency
- Department of Natural Resources
- Pollution Control Agency
- State Health Department
- U.S. Forest Service
- U.S. Bureau of Mines

U.S. Geological Survey
U.S. Environmental Protection Agency
Minnesota Geological Survey
University of Minnesota, Minneapolis, St. Paul, and Duluth campuses
Environmental Quality Council, Minnesota

Field personal also have experts available to them on a contract basis for taxonomic, statistical and computer purposes.

The form of the final publication has not yet been decided, but copies should be available to interested persons in University, State and Federal agencies.

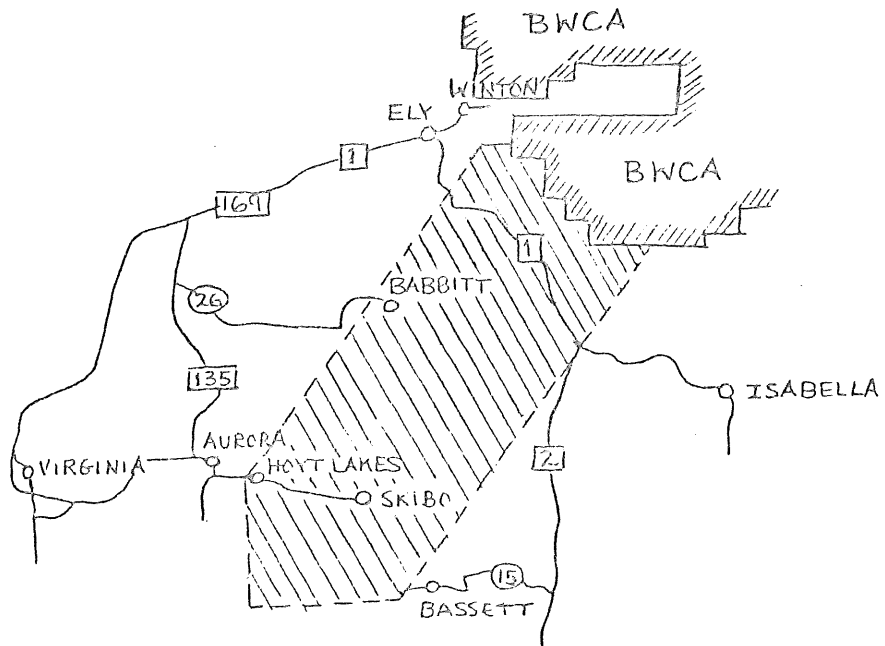


Figure 1. Mine Site Area



PLOT ESTABLISHMENT

Twenty plots will be established during May, 1976 in ten different habitat types on United States Forest Service (USFS) land. The plots will be located in the following types; 1) aspen-paper birch, 2) jack pine, 3) red pine, 4) northern hardwoods, 5) mixed aspen, birch, fir, pine, etc., 6) open grassland, 7) spruce-fir, 8) black spruce, 9) mixed spruce, balsam fir, cedar, etc., 10) ash, elm, soft maple, etc. Several of these types, especially number 4 and 6, may be deleted and replaced by other types.

Two plots will be located in each habitat type, one to the north and one to the south of the Laurentian Divide. Plots will contain 40 acres, a 20 acre core area used for sampling and a 20 acre buffer zone surrounding the core area for added protection against possible future disturbances (mainly logging). The corners and sides of these two areas (core and buffer) will be marked with 5 ft. long aluminum or steel conduit driven into the ground 12-18 in. and properly labeled.

The plots established this year (May 1976) will be located along the only north-south road system on the area that will be open on a year around basis. This system includes the following roads, starting at state highway No. 1 to the north and terminating at Babbitt or Hoyt Lakes to the southwest: 424, 1431, 114, 116, 113, 120, and 569.

In May 1977, 20 additional plots will be located. Most of these will be on the mine site area, while a few may be placed within the Boundary Waters Canoe Area (BWCA). The distribution of these plots with regard to vegetation type will be made after completion of the current field season.

ANALYSIS OF THE VEGETATION

Species list - qualitative data

Each 20 acre core area on the 20 plots will be visited three times from 1 June to 1 September to establish as complete a species list per plot as possible. The data collected during these visitations will be qualitative. The two persons involved in this part of the study (Debby Shubat and Nancy Sather) will cover the entire 20 acres using a previously prepared species check list from other studies done in this same portion of Minnesota. Species and their relative abundance will be checked off and new species added to the list when necessary. Both of these persons have had field experience in similar northern forest types.

STRUCTURE OF THE VEGETATION

(qualitative and quantitative)

A detailed study using random transects and examining quadrats along these transects will not be conducted during this project. The time required to do a statistically significant study on 20 different plots by two people who will also be assisting other portions of this study is simply out of the question. Any lesser effort in this type of sampling provides data of highly questionable value.

Rather than the above approach, each 20 acre core area will be divided into 1 acre plots. The observer will stand in the center of each plot or move along a transect (not yet decided) and record the following data: tree canopy cover using a forest densiometer, shrub canopy cover (densiometer), the presence or absence of species of the pole-size understory, the relative amount and type of grasses, ferns, or other herbaceous plants in the ground layer, point-quarter measurements of trees at several locations, the growth pattern and distribution of trees and shrubs (continuous, interrupted, park-like, dense savannah, sparse savanna, rare), the presence, absence and relative abundance of dead-fallen or wind-thrown trees,

average tree, sapling and shrub height, number of unusual or uncommon tree or shrub species (for example, a clump of white cedar, spruce or fir on a hardwood site), and other structural measurements not yet decided upon.

This approach in characterizing the vegetation will be helpful when analyzing and comparing the abundance and species diversity of small mammals, birds and insects collected or recorded on similar plots during different portions of the field season. For example, a small clump of conifers on an upland hardwood stand alone may provide the proper habitat for several species of birds not found on that plot if conifers were absent (personal communication with Gerry Niemi, PhD candidate, University of Minnesota, Duluth). These same findings may be evident during small mammal trapping and insect collecting.

SMALL MAMMALCensus

Small mammals will be trapped three times a year using "museum special" snap traps. The decision to use extinction trapping on small areas (1.44 hectares) rather than live trapping was made because accepted statistical methods allow population estimates to be made from the former, as well as the latter methods. As a result, field efficiency is greatly increased and more plots can be run simultaneously by using snap traps.

The entire 20 plots will be trapped during the same period. Trapping will be conducted during June, August, and October. Traps will be placed 15 m apart (rows and columns) in an 8mX8m trapping grid (64 traps per plot). This is a total of 1280 traps run on the 20 plots.

All trapping grids will be measured and laid out in the same corner of each plot. Traps will be removed after a trapping period is completed and future plots will be established in different corners of the 20 acre core area. The same plot will not be trapped in the same season. The reason for this is that if trapping is successful at significantly reducing the mammal population as is expected, reproduction and dispersal may not be adequate to fully repopulate the site before the next trapping period.

After all grids are established, traps will be pre-baited for three days. At the end of this period, traps will be set and run for three days. Prebaiting is an accepted and necessary function of snap trapping and is used to familiarize resident animals with bait sites to maximize trapping success.

All traps will be staked to the ground, the wire stake also acting as a marker. Traps will be numbered from 1 to 64. Mammals will be removed from the trap once a day, during the daylight hours, placed in individual plastic whirl-top plastic bags, labeled as to plot and trap number, kept on ice during the collecting day, and frozen that evening. Positive identification by species,

sex and age will be made by Dr. Elmer C. Birney, Bell Museum of Natural History, University of Minnesota. Dr. Birney will also determine reproductive condition of these animals for his own work.

Specimens will be saved periodically for analysis of heavy metals. A larger number will also be preserved (preserving methods may include freeze-drying) for analysis in the future. These and other biological specimens from the terrestrial sampling programs (insects, vegetation and birds) and from other field studies will be preserved in a permanent biological archives. The location of and jurisdiction over this archives has not yet been determined.

A reference collection of small mammal skins may be prepared, but is not a working part of the terrestrial plan at this time. The time required to prepare and to check traps twice a day, rather than once, to prevent specimens from deterioration and attack by insects, would be great. Since specimens will be saved for heavy metals analysis, the value of museum skins for this project is questionable.

MEDIUM AND LARGE MAMMAL CENSUS

Information on distribution and relative abundance of moose, deer, wolves, black bear and other medium to large mammal species occurring on the area, will be obtained from the DNR, USFS, United States Fish and Wildlife Service, thesis of graduate students who have worked in the area, and any other available sources. Observations and location of these animals will be recorded when encountered in the field during the current study, but no intensive studies are planned. The relatively low density of these species compared to small mammals, the difficulty and cost of trapping (several full time trappers would be required), and the interpretation of data based on small and scattered sample sizes further complicate data collected from this group of animals. However, their presence on the area, especially uncommon species such as the wolf and lynx, is important to document and will be recorded during the current program.

BIRD CENSUS

Raptors

The bird census will be divided into two separate categories. Raptors (hawks, owls, falcons, eagles, etc.) will be observed and recorded from vehicles during travel between sampling sites and when on foot in the field. The date, time of day, map location, behavior (perched, flying, etc.), habitat, and length of potential observation time will be noted. Special attention will be given during fall migration. Additional information on nesting success will be obtained from the USFS during their annual aerial survey of osprey and eagle nests. Forms will also be distributed to members of other teams capable and willing to record raptor observations on the study area.

It is hoped that by plotting these locations, especially of ospreys, goshawks, eagles and other rare or uncommon raptors, that seasonal sitings may help determine these important, high-used areas other than nest locations.

Also, an agreement has been made with Pat Redig at the University of Minnesota, School of Veterinary Medicine, St. Paul Campus, to examine and run necessary laboratory tests to determine cause of death of any raptors found dead and in "reasonably good condition" on the study area. This is a mutual interest project between Pat and myself.

Song Bird Census

Singing males will be censused on their breeding territories from approximately June 1 to July 1. Each of the 20 plots will be visited at least twice, and preferable three times during this period. The weather conditions under which observations will be allowed will be defined to reduce variability between plots and on the same plot over time. These counts are conducted from just before sunrise to about 0730 on days that qualify weather-wise.

Lee Pfannmuller and Gerald Niemi will conduct the singing male census. Both are qualified ornithologist. Gerald is currently completing his PhD thesis

on territory mapping of song bird species on the Little Sioux Burn within the Superior National Forest and should provide a great deal of experience to the project in this respect.

The exact methods used during the song bird census have not been rigidly set. However, the following information and techniques may be used: 1) all songs will be recorded by species as the observer listens for a prescribed length of time at a given point within a one acre plot on the core area; 2) travel time between listening stations will also be fixed and songs recorded; 3) when possible, singing males will be classified as to the species of tree used, the height above the ground, and any other habitat or behavioral features that may be considered important and are practical to record in the allotted time.

We realize that singing male counts have interpretation problems. Counts need to be considered as the number of males or pairs per area and are not reliable population estimates. This census technique does not take into consideration the "free-floating", non-breeding (non-singing) portions of the population. This group may comprise a considerable proportion of the population. However, mist-netting techniques necessary to estimate these free-floaters are not within the budget or man power limits of this project.

Since the emphasis during plot establishment will be to locate stands which are representative of established plant communities, plots on recently logged or burned areas will not be included. Personal field observations indicate that logged areas may be quite extensive and a significant portion of the total area. Song bird species using these habitats will be sampled by using mist nets. These nets will be run periodically during the day after the morning singing male census has been completed. Netting sites will be established within site of roads so they may be checked from vehicles using binoculars or spotting scopes and thus increase nettings efficiency. All song bird species will be banded with Federal

Fish and Wildlife Bands. Age and sex information will be recorded, along with the length of the netting period. The height and dominant species of trees and shrubs will be recorded for each site.

INSECT CENSUS

There are three main groups of insects that can be sampled. These include the flying insects, the ground dwelling species (primarily in leaf litter), and the soil invertebrates. Conversations with professors knowledgeable with the taxonomy and difficulty of sampling insect populations have led me to conclude that ground dwelling species, particularly ground beetles (Carabidae), are the group to study during this project. Since funding and man power will not allow us to sample the entire insect community, ground beetles have been selected for the following reasons: 1) there are 8-15 common species in the habitats we will be trapping, an adequate number to show environmental differences and yet not the taxonomic problem of, for example collembola, with approximately 40 species; 2) although most ground beetles are carnivorous, some are omnivorous and others are primarily vegetarians. As a result, body burdens of heavy metals should reflect different rates of accumulations based on food habit differences between species; 3) most ground beetles are large enough for heavy metal analysis of individuals. Hundreds or thousands of gnats and mites would be required for a similar analysis; 4) ground beetles are sensitive to micro-environmental changes and their abundance and species diversity may be an important criteria for evaluating the effects of contamination in future studies.

Methods Used to Sample Insects

Ten permanent pit-fall traps will be established along a north-south axis extending across the center of the core area for each of the 20 plots. These traps will be located 15-30m apart and will be constructed in the following way: 1) a golf-course hole digger will be used to cut a six inch deep core out of the soil; 2) a four inch diameter tin can is placed in the hole with the top lip of the can flush with the soil surface; 3) a paper cup is fitted snugly into the can and 1½ to 2 inches of antifreeze poured into the cup to kill and preserve insects falling into the traps; 4) a 1/2 x 1/2 inch wire mesh screen is placed

over the top of the paper cup to prevent small mammals from falling into the trap; 5) a 1/4" thick, 12 x 12 inch exterior plywood shield is placed 3-4 inches above the leaf litter and over the can to prevent the dilution of the antifreeze with rain water or contamination with vegetative matter.

Pit-fall traps will be run for one 24-hour period at weekly intervals from June 1 to September 30 each summer. Some trapping will also be done in fall and winter to collect species that may be more active during these seasons.

Terrestrial (Summer) Staff

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