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AN EVALUATION OF SPACE ACQUIRED DATA AS A TOOL FOR MANAGEMENT OF WILDLIFE HABITAT IN ALASKA

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It would be difficult to find, in the United States, a region which could benefit more than Alaska from improved techniques for acquisition of natural resources data.

The size of its land mass and the remoteness of large areas of the State make conventional methods of data collection difficult, expensive, very hazardous, and often inaccurate. For these reasons, information on the vegetation, hydrology, soils, and wildlife of the State is inadequate for proper management and conservation of the State's great natural resources.

The Bureau of Sport Fisheries and Wildlife, through its EROS funded Alaska ERTS-1 experiment, hopes to improve its current data collection techniques for its own internal functions, i.e. predictions of waterfowl populations in the fall migration. It also hopes to assist the State in providing certain baseline data which are essential to the State in many aspects of their land use planning functions.

The Bureau of Sport Fisheries and Wildlife ERTS experiment in Alaska attempts to yield information useful for three primary functions in the State. They are:

1. To test the feasibility of using ERTS data, in conjunction with aircraft acquired multispectral photography, to develop effective stratified sampling techniques for achieving the objectives of items 1 and 2.

2. To provide near real time assessment and evaluation of the quantity, quality, and distribution of waterfowl breeding habitat through frequent ERTS measurements of hydrologic, phenological and vegetational parameters.

3. To provide basic mapping of vegetation and terrain in certain remote areas of the State for which little or no biological data now exist.

The Bureau of Sport Fisheries and Wildlife is responsible for promulgating new waterfowl hunting laws each year because the populations of waterfowl change annually, largely as a result of habitat conditions in the Canadian and Alaskan breeding grounds.

Unlike most resident game species, waterfowl populations are influenced greatly by hunting regulations. Efficient management of this renewable resource, depends on annual adjustment of hunting regulations to insure that a sufficient number of birds remain after the hunting season to provide for production the following year.

An estimate of the size of the fall flight must be available at the time hunting regulations are set. The estimate must be reasonably accurate since, for some species, hunting is the largest cause of mortality. Regulations based on faulty estimates of current numbers of waterfowl could result in reduction of the breeding population to undesirably low levels. A need exists, therefore, to predict accurately the magnitude of the annual fall flight from the Alaska breeding grounds.

To meet this need the U.S. Bureau of Sport Fisheries and Wildlife, the Canadian Wildlife Service, and the various States have developed systematic procedures for predicting fall waterfowl populations. Aerial surveys in May and July are used to provide indices for breeding populations, habitat conditions and waterfowl production. Ground surveys made in May provide correction factors for the aerial data. However, the aerial surveys are not completed until late July, and the laws must be set in mid-August. Administrators, therefore, are hard pressed to evaluate the data and act on recommendations in time to meet this deadline.

The importance of correlating habitat conditions to waterfowl production then becomes obvious. If it can be done quickly, and with reasonable accuracy, it could be a valuable adjunctive index to determining annual waterfowl production.

The Bureau of Sport Fisheries and Wildlife ERTS-1 experiment on waterfowl habitat is based on the accepted theory that a reliable correlation exists between the "degree of wetness" (number of ponds and wetlands) existing in July and annual production of birds.

More precisely, the degree of wetness involves the dynamics of the wetlands which includes pond size, miles of edge or shoreline, water depth, related emergent and submerged aquatic vegetation and associated upland vegetation which may be used as waterfowl habitat.

The Alaska ERTS experiment attempts to test:

1. the degree to which verified (through ground or aerial surv) ERTS vegetation data may be extrapolated to yield information sites some distance from the points of verification

2. the utility of ERTS data in developing vegetation maps of sufficient accuracy to be useful in biological investigations and resource management

3. reliability of ERTS data in measurements of hydrologic parameters, i.e. water surface, areas, depths, miles of edge, and distribution and numbers of water bodies. These data will provide the "degree of wetness" index necessary for near real time evaluation of waterfowl habitat.

An ERTS scene dated August 30, covering the Yukon/Kuskokwim Delta was analyzed to determine the degree to which it could satisfy the needs of the experiment.

The scene was selected because it is an important waterfowl production area, it contains diverse vegetation and terrain types, has many lakes of varying size and adequate, ground surveyed, vegetation maps exist for it. Also, it is the site of a proposed navigational canal which could create a considerable biological alteration of the region.

South Dakota State University Remote Sensing Institute's SADE (Signature Analysis Dissemination Equipment) program was selected to perform the necessary analyses. Color coded density renditions of the 70 mm positive transparencies were made using a Datacolor system looking at all four MSS bands.

An area containing large lakes in MSS band 5 and an area containing small lakes in MSS band 6 were digitized using SDSU's SADE. Eight gray levels were displayed, with each level having a range of 32 numbers. What appear to be significant differences in transmission levels were noted when looking at three large lakes. Interpretation of these differences must await ground or aerial surveys to be made this summer. However, from comparison with other, color coded, (Spatial Data) CRT prints and the original GSFC prints it appears that tonal differences are probably a function of a) turbidity, b) organic stain, or c) depth.

Surface area of water bodies depicted as a percentage of the total scene is immediately and directly obtainable. In the case of the Yukon/Kuskokwim frame, approximately 18.4 percent of the total frame is water area.

Measurement of pond and lake perimeters will be accomplished using a system comparable to that of the Environmental Research Institute of Michigan which is conducting another, similar, project for the Bureau of Sport Fisheries and Wildlife. Earlier studies by the BSF&W and Michigan's Willow Run Laboratories have shown this to be a feasible technique. At present the data are being studied to determine proper contracting procedures for their interpretation using a SPARC or equivalent system.

A rather simplistic approach has been adopted, and will continue to be used, for vegetation type mapping where ground verification now exists. Color coded densitometric renditions from Polaroid photography of CRT displays are compared with line, point, or quadrat transect samples traversing the area to be mapped. Areas on the conventional vegetation maps are matched to corresponding areas on the color coded densitometric displays which may or may not have identical boundaries, but agree in general with the area covered. In most cases, the conventional maps or sampled data are, and will be, from years past, therefore, exact boundaries of vegetation zones can not be expected to fit precisely the ERTS derived scenes.

As stated, vegetation maps such as the one available for the Yukon/ Kuskokwim Delta exist only for a very few areas of the State. Consequently, those that do exist will be used to test the limits of extrapolation of ERTS data for application in areas far removed from a known vegetation zone.

To apply the technique in areas for which no ground or aerial data are available, other approaches will be used. These will include aircraft acquired multispectral photography and conventional ground surveys designed to serve as sampling sites in lieu of existing vegetation maps for a given ERTS frame.

Some multispectral photography using the Bureau's I^2S camera in August, 1972, has been acquired and analyzed. Preliminary analyses indicate that it can play a vital role in substituting in part or altogether, for ground surveys in support of ERTS data. Although I^2S data were not acquired for the Yukon/ Kuskokwim Delta, coverage of areas of a similar type were analyzed and found to facilitate greatly the correlation of minimal ground data to space acquired data.

The preliminary conclusion drawn from these tests is that a stratified sampling technique using aircraft multispectral data, verified with minimal ground transect sampling, can provide near real time vegetation maps for Alaska. The maps thus produced will be of species association zones, and not detailed species maps. For the Yukon/Kuskokwim Delta the zonal coding is as follows:

1. Dense Forest
   - 1a. Interior High Forest - White spruce, poplar, and locally birch.
   - 1b. Low Forest - White spruce, poplar, aspen, and birch.
2. Open Forest - High Brush
   - 2a. High Brush - Principally alder, commonly mixed with willow and birch.

3. Low Vegetation

   3a. Tundra - Grass and herbs from a few inches to 3 ft. high.

   3b. Sparse Low Vegetation and Barren Areas - Chiefly sparse lichens and mosses.

4. Wet Vegetation

   4a. Marsh and Bog - Peat moss in bogs, and grasslike aquatic plants.