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Inventory of Recreation Sites

After two months experience, the total inventory task of air-photo interpretation and field checking of selected sites was being completed at the rates of 30 to 50 square miles per man-day.

Introduction

Pressures exerted by an increasing population on a fixed resource base can be relieved through orderly resource planning. Part of that planning must focus on the escalating demands for recreational experiences being levied on the resource base by an expanding population having more and more leisure time. The problem is complicated by the increasing concentration of our population in a relatively few metropolitan complexes. These people own cars, are mobile, and will drive many miles to obtain what they consider outdoor recreation experiences.

In this age of freeways and interstate highways, time, more than distance, is the factor determining how far people will travel to get away from the city and into the outdoors. Because of this, recreational planning must adopt a wider horizon; state, regional, and national planning are needed. Such planning requires knowledge of both existing and potential opportunities for outdoor recreation within the planning unit. Existing facilities are usually known, but the recreational potential of other areas must usually be determined.

Abstract: *The usefulness of existing USDA aerial photography in the inventory of potential outdoor recreation sites was determined for four test areas in Michigan. Based on standards developed for use during the study, potential recreation sites could be located and correctly identified with sufficient accuracy to make coordinated air-photo/ground inventory methods more economical than ground methods alone. Three major types of error in the air-photo work are identified.*

Resources needed to provide outdoor recreational experiences are not absolute and fixed, for with proper planning and sufficient money any land area can be developed for some kind of outdoor recreation. Nevertheless, some resource complexes are more suitable than others for activities such as picnicking, camping, swimming, and boating. Identification and location of such areas must be accomplished before their orderly development and use can be integrated into an overall program. As land-use can change quickly, and conventional ground survey methods are slow and costly, several attempts have been made to employ aerial photographic interpretation techniques in such inventories. This report describes the results of one such study conducted during the winter and spring of 1964. The primary purpose of the study was to demonstrate that potential outdoor recreation sites can be identified from aerial photographs with sufficient accuracy to reduce the cost of recreation site surveys.

Developing Site Standards

No inventory of large land areas can be completed by a single person in a realistic time, nor are all areas equally useful for recreation development. Site standards which can be uniformly applied to a diversity of land forms by all interpreters are essential to recreation inventories. In actual practice, standards vary from one managing agency,

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and from one region, to another and tend to be design-oriented rather than inventory-oriented. To overcome these difficulties the authors developed a set of inventory standards based on the recreation resource classes recommended by the Outdoor Recreation Resources Review Commission (ORRRC, 1962).

The ORRRC report groups recreation areas into six recreation resource classes:

Class I. High density recreation areas, intensively developed and managed for mass use.
Class II. General outdoor recreation areas subject to substantial development for a wide variety of specific recreation uses.
Class III. Natural environment areas suitable for recreation in a natural environment and usually in combination with other uses.
Class IV. Unique natural areas of outstanding scenic splendor, natural wonder, or scientific importance.
Class V. Primitive areas, without roads, characterized by natural wild conditions, including "wilderness areas."
Class VI. Historic and cultural sites of major historic or cultural significance, either local, regional, or national.

Class IV areas are rare and identification of Class VI areas requires historical or cultural knowledge of the area which is seldom obtainable from aerial photographs. For these reasons, we elected to concentrate our attention on the remaining classes. As the study progressed, it became evident that some of the primary factors differentiating ORRRC Classes I, II, III, and V were (1) the size of the recreation area; (2) the intensity of human use; and (3) the nature of the vegetative cover, or wildness of the recreation area. The first of these factors is partly a function of land ownership and the second is a function of transportation, proximity to population centers, and the variety of recreational opportunities available. In trying to determine the location of potential, but undeveloped, recreation sites, aerial photographs offer little information concerning land ownership, transportation, or proximity to population centers not readily available in more useable form from other sources. However, the variety of recreational opportunities available is a direct function of the variety of cover and terrain present in the area. Such information, and the wildness of the recreation area, can be determined from aerial photographs.

Conversion of a potential site into a recreation area is a management, not an inventory, function. During inventory any site can be evaluated in terms of its existing characteristics or in terms of its characteristics after development, for the nature of the development largely determines whether a recreation area will be operated as a Class I, II, III, or possibly wilderness, area.

Each of the recreation resource classes identified in the ORRRC report can provide opportunities for several different kinds of recreation activities. Inventories of potential recreation areas should provide data which indicate what activities a site could support. In developing minimum standards for potential sites, three outdoor recreation activities were considered: boating, swimming, and camping. Picnicking was not recognized as a separate activity because the resource requirements for picnicking and camping are essentially the same. The decision to develop a given site for picnicking or camping, or for a combination of both, is a management function which should be kept separate from the inventory process. Hiking is more often limited by the size of the area available than by resource characteristics. As such, no truly definitive combination of resource characteristics is required in support of hiking activities.

In deriving standards for each resource class it seemed desirable to concentrate on those factors that could be determined from the aerial photographs. The standards finally adopted were organized as a dichotomous key which directed attention from the larger and more general categories to smaller and more specific sites. This approach proved unnecessarily cumbersome, and it was soon evident that the interpretation process was much more efficient if the interpreters began by identifying specific sites and site characteristics before turning their attention to the more general categories.

Site Standards and Their Use

Site standards developed for this study reflected resource requirements for specific activity types. These requirements considered both the character of the resource and its areal extent. Throughout the study we assumed that we were looking for, and trying to identify, potential sites of regional significance. Because of the general availability of lakes and streams in Michigan and the North Central States, no site was considered significant which did not provide water access across dry ground. Minimum sizes for water and dry land areas were also adopted in a deliberate attempt to eliminate the large number of locations which can be developed for local use but contribute little to regional recreation opportunities. The standards used during the study are described below to indi-

cate the nature of the decisions required of the photo interpreters. Neither the specific site requirements nor the dichotomous key used by the interpreters has sufficient applicability to justify publication in full.

Boating

The primary factor affecting the capability of a water area to support boating is the size of the unobstructed water surface. For the purposes for this study, bridges, snags protruding above the water, shoals, or any other obstacle restricting the free use of power boats were considered disqualifying. Within these restrictions, the capacity of a given water body was rated in terms of its total unobstructed surface area. A high-capacity boating site must have at least 1,000 acres of unobstructed water surface. Boating potentials were not considered regionally significant unless at least 40 acres of unobstructed water surface were available. Development of a regionally significant boating site also requires that space be provided for parking and installation of other permanent facilities. This requires dry ground; but the area of dry ground needed varies with the intensity of the intended use. More parking facilities and space for sanitary facilities are required in an ORRRC Class I area than in a Class III area.

Swimming

No swimming potential was considered regionally significant unless located on a water body providing at least 40 acres of unobstructed water surface. Beyond this, the length of useable beach was considered the primary factor limiting beach capacity. Slope conditions both in and out of the water are also significant but, unfortunately, aerial photography seldom permits an accurate assessment of underwater contours in the glacial terrain of the Lake States. Sufficient dry ground adjacent to the beach to provide for parking, bath houses, and lounging is necessary, but is not usually limiting unless the dry ground drops steeply down to the level of the beach. If a significant beach is available, a small amount of work with a bulldozer, and some sod placed upon the earth-fill or reshaped land area, will frequently permit establishment of excellent beach facilities. The nature of the bottom within the water body was not given major importance, because this is difficult to determine from the photographs and a beach of regional significance would justify creation of a sandbottom in many cases. Based on these considerations the primary factors affecting swimming potential and identifiable from air photographs are the size of the water body, and the length of the useable portion of the beach.

Camping

The primary requirement for camping is sufficient dry ground of suitable slope to permit preparation of camping sites, roads, and sanitation facilities. During the study we assumed that individual campsites should be located within one-quarter mile of a qualifying water access point. This one-quarter mile distance had to be a dry land access route, and could not include any cross-swamp travel. Thus, the standards for campgrounds asked the interpreters to determine the campable area within one-quarter mile of the qualifying water access point. In those areas where terrain conditions were such that only part of the gross campable area within one-quarter mile of the water was actually suitable for the erection of campsites, the interpreter was expected to reduce the *campable area* accordingly. Although neither boating nor swimming capabilities were considered regionally significant unless including access to at least 40 acres of unobstructed water surface, camping potentials were considered significant if the site provided dry land access to 20 acres of surface water, or was adjacent to a perennial stream at least ten feet wide.

In all instances where campsite requirements are met, sufficient dry land exists to permit construction of facilities supporting swimming and/or boating activities. The interpreters soon discovered that their initial search for potential sites should concentrate on camping opportunities, and the interpreters began by inspecting all water bodies for suitable campsites. If a campsite was present, the site was also evaluated for swimming and boating potential, and an individual site might be rated for camping, swimming and boating. If no campsite opportunity was available, the site was still evaluated for swimming and/or boating opportunities which might exist even though the site was not suitable for camping.

Once a site had been identified and its activity potentials established, the area surrounding the site was evaluated to determine the present ORRRC class of the site. This determination was based on the existing area of natural vegetation cover, and the absence, or amount, of man-made construction. The potential ORRRC class, if fully developed to maximum capacity, was also determined for each site recognized. It was possible for a Class V site to be rated for potential develop-

ment into Class I. The eventual level of development is a management decision that should be based on, but not confused with, the inventory data.

Methods

Five areas of at least township size were used as test areas. Each of the test areas was located in a different county in the lower peninsula of Michigan (Figure 1). Existing aerial photographs obtained from the Agricultural Stabilization and Conservation Service of the U. S. Department of Agriculture were used throughout the study. Photo characteristics varied between areas as shown in Table 1.

The photographs of each test area were interpreted independently by two professional foresters. Interpreter *A* had more than ten years experience as a photo-interpreter but virtually no experience in outdoor recreation planning or administration, whereas Interpreter *B* had little experience in photo-interpretation but considerable training and experience in administration and planning of forest recreation areas. Neither interpreter had ever seen the Allegan, Otsego, or Tuscola County test areas. Although Interpreter *A* had worked extensively in a different part of Leelanau County, he had not been in the test area itself in over five years. Washtenaw County was used for preliminary testing of the photointerpretation key, the results of which are not discussed in this paper.

After the photographs of any one test area had been interpreted by both interpreters, each potential outdoor recreation site identified by either of them was examined on the ground by both interpreters. Locations which *almost qualified* in the opinion of either interpreter were also field-checked. Unfortunately, time limitations did not permit complete field checking of each test area to locate sites missed by both interpreters. Even though the number of missed sites is believed very small, or zero, no true index of interpreter accuracy is available, for our analysis of the results has been based only on those sites selected as suitable by one, or both, interpreters.

Fig. 1. Location of the five study areas.

Results

Early in the study it became obvious that both interpreters had memorized major portions of the recreation resources key. This was not surprising, for both had helped prepare the key and similar results have been noted whenever any key is used regularly. The primary usefulness of the PI key was as a training aid and guide to the standards being employed. If used steadily, the interpreter soon masters the information in the key, and the key is laid aside.

As the interpretation and subsequent field-checking progressed, it became apparent that potential outdoor recreation sites (as defined in the key) could be identified by both interpreters. Neither interpreter was completely accurate in any county but, in at least one test area, both interpreters correctly rated more than 90 percent of the sites found in the

Table 1. Characteristics of Air Photos Used in an Inventory of Potential Outdoor Recreation Sites in Five Areas in the Lower Peninsula of Michigan

County	*Photo Date*	*Emulsion Type*	*Filter*	*Scale*
Allegan	June 1960	Panchromatic	Minus-blue	1:20,000
Leelanau	Oct. 1963	Panchromatic	Minus-blue	1:20,000
Otsego	July 1952	Infrared	Minus-blue	1:15,840
Tuscola	June 1963	Panchromatic	Minus-blue	1:20,000
Washtenaw	Sept. 1963	Panchromatic	Minus-blue	1:20,000

test area, and results of the photo interpretations and field-checks were identical. In Tuscola County, neither interpreter was more than 60 percent accurate. This seemed to result from the scarcity of acceptable sites in the Tuscola County test area. Both interpreters tended to bend the standards in an apparent attempt to find a site where one did not exist; and where acceptable sites are rare, a small number of errors sharply reduces accuracy if accuracy is expressed as a percentage of the total number of sites identified correctly.

An analysis of the errors made in the Allegan, Leelanau, Otsego, and Tuscola County test areas indicated that most errors could be grouped into three broad classes.

1. ERRORS DUE TO UNREALISTIC OR AMBIGUOUS STANDARDS OF CLASSIFICATION

Several errors were due to under- or overestimation of the size of lakes or streams. Normal variation in measurements taken from aerial photographs at the scales used were great enough to account for most of the errors in measurement. At a scale of 1:20,000, an error of 0.0001 foot in a photo measurement would produce an error of two feet in ground dimension. A stream considered 11 feet wide from photo-measurements might prove to be only nine feet wide at the time of the field-check. All sites identified along such disqualified portions of a stream were considered errors.

Although it might be argued that treatment of this type of discrepancy as an error is unnecessarily severe, or unrealistic, adherence to rigid numerical standards is a common problem confronting the interpreter wherever standards are imposed from above by persons unfamiliar with the limits in precision obtainable with measuring equipment available to most interpreters. Some supervisory personnel consider photo-interpretation techniques invalid because they do not match the precision obtainable on the ground with a steel tape.

Another error of this type was partially responsible for the poor showing of both interpreters in Tuscola County. At one location both interpreters had identified a site with boating, swimming, and camping potentials. Field examination confirmed that the physical resources were present, but that raw sewage and detergents were flowing past the site from a sewage treatment plant immediately upstream. These pollutants, plus the obnoxious odor, disqualified the site and the site was subsequently considered an error for both interpreters. The sewage treatment plant was visible in the photographs but such features were not allowed for in the key. It would be relatively easy to add the presence of sewage treatment plants to the key, but a key which would include all of the variables in the landscape which might affect recreational use would be extremely difficult to construct and unwieldy to use. It is doubtful, therefore, that any practical key could overcome the dangers associated with too rigid adherence to a

FIG. 2. An otherwise desirable recreation site in Tuscola County, Michigan, disqualified by polluted effluents from the sewage plant at S (USDA photo).

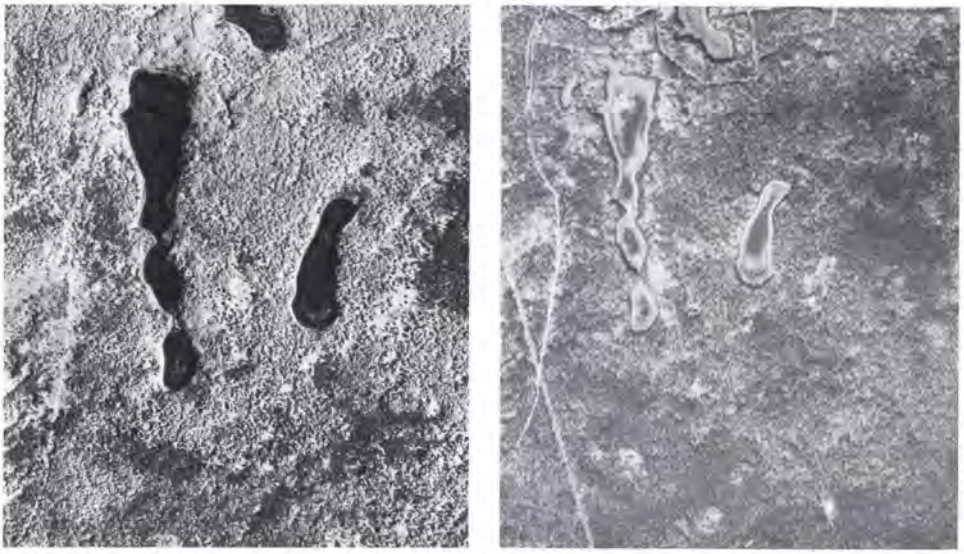

FIG. 3. Modified infrared (left) and panchromatic air-photos of a shallow lake in Otsego County, Michigan. A regional drop in the water table between 1952 (left) and 1964 caused the lake nearly to dry up (USDA photo).

given set of standards, unless operational procedures permit recognition of additional factors by the interpreters. (Figure 2)

2. ERRORS DUE TO INEXPERIENCE OF THE PHOTO-INTERPRETER

Errors of this type influenced the results of both interpreters. Accuracy was greatest in those counties where terrain and cover characteristics were similar to those in areas where an interpreter had worked before, but accuracy increased rapidly during the field checks as the interpreters became familiar with previously unfamiliar terrain and cover types. This is in accord with photographic interpretation experience with other types of inventories and reemphasizes the need for frequent field checks, particularly when the interpreter first begins work in a new locale.

Lack of prior experience with infrared photography reduced the effectiveness of Interpreter *B* in the Otsego County test area, the first area interpreted and field checked. By the end of the study, however, no difference in accuracy was observed between interpreters.

3. ERRORS DUE TO FAILURE TO SEPARATE CLEARLY THE INVENTORY AND MANAGEMENT DECISION-MAKING FUNCTIONS

Errors of this type were more frequent at the end than at the beginning of the study. This could have been due to the fact that both interpreters used the key religiously at the start but relied more and more on memory as time went on. However, an analysis of several sites which were treated differently by the two interpreters suggests a different explanation. In one case, a distinct change in forest cover type occurred within the area and each interpreter identified a site in one but ignored the potential in the other cover type. Each choice was based on the interpreter's personal preferences and each had selected that part of the area which he felt would provide the *highest quality*, or most satisfying outdoor experience. Both interpreters should have included the area in both cover types and failure to do so could easily lead resource planning personnel to underestimate the potential recreational capacity of the site.

The temptation to make quality judgements and eliminate some acceptable sites as less desirable than other nearby sites should be avoided during the inventory process. In many cases the site considered most desirable during inventory proves unavailable or unacceptable for other reasons. Where this happens, failure to identify all potential sites results in opportunities being overlooked or requires that the inventory be repeated. The separation of inventory and management decision-making functions is particularly difficult when a single individual performs both tasks.

PROBLEMS ASSOCIATED WITH AGE OR TYPE OF PHOTOGRAPHS

At the beginning of the study it was believed that the age of some of the photographs would be a limiting factor. This proved true, but not to the extent anticipated. The Otsego County photographs were the oldest used during the study, yet results in Otsego County were better than in Allegan or Tuscola Counties. However, panchromatic photography of Otsego County, taken in 1963, was obtained after the field work had been completed. Comparative interpretation of the 1952 and 1963 photographs suggests that all but one of the errors made in interpreting the older photographs would not have been made had the newer photographs been available. The remaining error was due to recent subdivision and cottage construction at a desirable site.

Reasons for the increased accuracy with the new photos were varied, as two examples will show. In one instance Interpreter *B* identified a potential campground site beside what he thought was a lake. The lake proved to be a bog that had been imaged in dark tones on the infrared photography. In the newer panchromatic photography the bog was distinctly light-toned and differed from the dark-toned lakes shown in the photos. This was considered an error of the second type described above, because Interpreter *A* correctly identified the bog on both sets of pictures.

At another location, Interpreter *A* identified a potential campground site at the edge of a relatively long and narrow lake. Field examination confirmed the desirability of the site but revealed that the lake was too shallow. A general drop in the regional water table between 1952 and 1964 had made the lake unsuitable, thereby disqualifying the site according to the standards used during the study. The lower water level is clearly visible in the 1963 photographs of the area, and the site would not have been selected had these photographs been available at the time of the original interpretation. (Figure 3)

In using these two examples we do not mean to imply that panchromatic photographs are more suitable for recreation resource inventories than modified infrared photography. Each type of photograph has advantages and disadvantages which vary from one situation to another. An experienced interpreter can adjust readily from one type to another, but even the most experienced interpreter will obtain more information if both types of photographs are available, than if he must work from one type alone.

TIME REQUIRED FOR INTERPRETATION AND FIELD CHECKING

After two months experience either interpreter could complete the photo-inventory of 36 square miles in two to three hours. Field checking was completed at the rate of 40 to 80 square miles a day depending on the problems of access and the number of sites to be examined on the ground. Thus, the total inventory task, as defined for this study, could be completed at the rate of 30 to 50 square miles per man-day if aerial photographs are used in conjunction with ground checks. Inventory techniques relying solely on ground methods take considerably longer.

EFFECT OF SCALE ON ACCURACY AND TIME REQUIRED

No evidence is available that would indicate that photo scale had any real influence on the accuracy achieved by either interpreter; nor did the time required to complete the photo study of any test area vary significantly with photo scale. However, the only photo scales encountered during the study were 1:15,840 and 1:20,000.

SUMMARY

A test of the utility of air-photo interpretation in inventories of potential, outdoor recreation sites was conducted in 1964. Standards were developed by the authors that would lead the photo interpreters to recreational sites having regional significance. These standards were used with existing U. S. Department of Agriculture 1:20,000 and 1:15,840 aerial photographs to inventory potential recreation sites in parts of four widely separated counties in the Lower Peninsula of Michigan. Each test area was subsequently field-checked to determine the accuracy of the interpreters.

Results indicated that relatively unskilled photo-interpreters can successfully locate and classify potential recreation sites with considerable accuracy. Ground-checking was necessary, but the air-photo work increased the efficiency of field parties. After two months experience, the total inventory task of air-photo interpretation and field checking of the selected sites was being completed at the rates of 30 to 50 square miles per man-day; faster than is currently possible with ground techniques alone.

An analysis of the errors made by the

photo-interpreters revealed that most errors fell into one of three categories:

1. Errors due to unrealistic or ambiguous standards of classification.
2. Errors due to inexperience of the photo-interpreter.
3. Errors due to failure to clearly separate the inventory and management decision-making functions.

Of these three types of errors, the last appears to be the hardest to overcome.

Literature Cited

ORRRC, 1962. *Outdoor recreation for America.* A report to the President and to the Congress by the Outdoor Recreation Resources Review Commission, January 1962. (Available from the Superintendent of Documents, Washington, D. C.) 246 pp.

International Society News

THE COMMITTEE FOR the 1972 Congress of the International Society of Photogrammetry recently issued its *News Letter No. 1.* The Committee is composed of:

Mr. S. G. Gamble, Congress Director
Mr. T. J. Blachut, Program Coordination
Mr. R. Moore, Tours
Lt. Col. L. J. O'Brien, Exhibits
Mr. L. Sebert, Secretariat
Mr. A. Stewart, Liaison with the Canadian Institute of Surveying
Mrs. Mary Thompson, Ladies Program
Dr. D. Zarzycki, Finance.

The Ottawa Civic Center has been selected as the location of all technical meetings of the Congress which will run from Sunday July 23, 1972, to Saturday August 4. The Civic Center will also house the exhibition halls for commercial, scientific and national displays.

The National Arts Center in Ottawa is rapidly approaching completion—this fine building will be used for the opening and closing ceremonies. Most of the hotels of Ottawa and Hull have stated that they will set aside a generous portion of their 3,000 rooms for ISP use in 1972. Mrs. Mary Thompson has started to plan a most interesting program for the ladies.

ATTENTION ALL MEMBER SOCIETIES

You are urged to inform the ISP Secretary-General as soon as practicable the names of your country's reporters for each of the seven technical commissions so that relevant correspondence can be directed to them. Several ISP Symposiums and/or Seminars are already being planned for next year (1970) where everybody's contribution will be mutually beneficial. The Secretary-General also needs to know whether you are receiving his correspondence—four circular letters have been mailed to all Members; if you haven't written to him during the past year, please send him a brief note to confirm your correct mailing address. Correspondence to him should be addressed: Mr. G. C. Tewinkel, ISP Secretary-General, ESSA Coast & Geodetic Survey, Rockville, Maryland 20852, U.S.A.