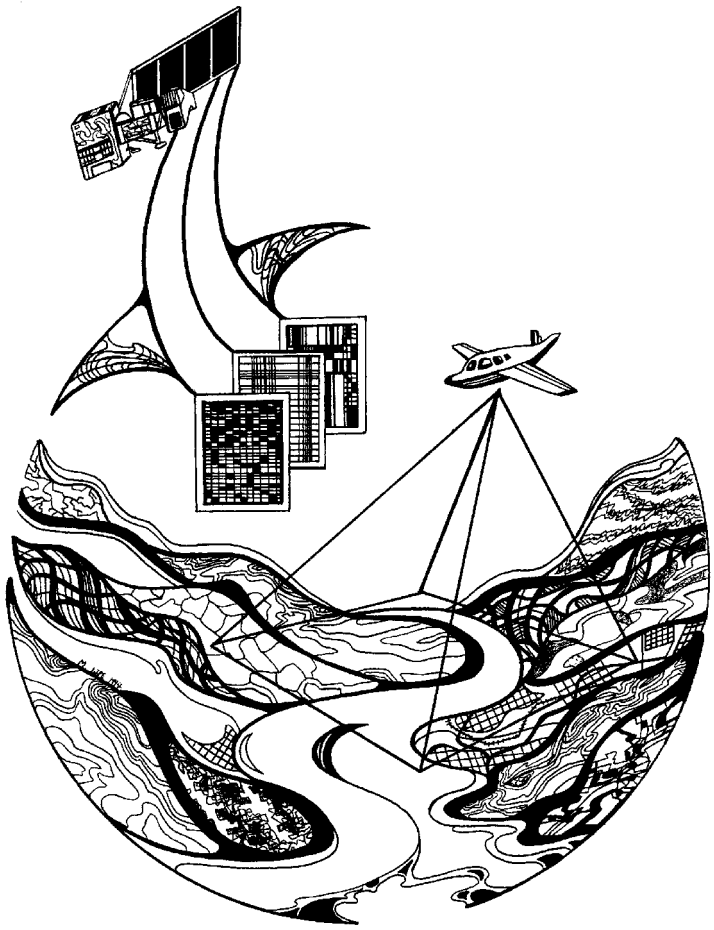
Long Term Resource Monitoring Program

Program Report

95-P008-1

Long Term Resource Monitoring Program
Standard Operating Procedures:

Photointerpretation



July 1995

Long Term Resource Monitoring Program Standard Operating Procedures: Photointerpretation

by

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The Environmental Management Technical Center issues LTRMP Program Reports to provide Long Term Resource Monitoring Program partners with programmatic documentation, procedures manuals, training manuals, and geospatial applications.

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The National Biological Service . . . gathering, analyzing, and sharing the biological information necessary to support the wise stewardship of the Nation's natural resources.

Preface

The Long Term Resource Monitoring Program (LTRMP) was authorized under the Water Resources Development Act of 1986 (Public Law 99-662) as an element of the U.S. Army Corps of Engineers' Environmental Management Program. The LTRMP is being implemented by the Environmental Management Technical Center, an office of the National Biological Service, in cooperation with the five Upper Mississippi River System (UMRS) States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin, with guidance and Program responsibility provided by the U.S. Army Corps of Engineers. The UMRS encompasses the commercially navigable reaches of the Upper Mississippi River, as well as the Illinois River and navigable portions of the Kaskaskia, Black, St. Croix, and Minnesota Rivers.

The mission of the LTRMP is to provide decision makers with information to maintain the UMRS as a sustainable large river ecosystem given its multiple-use character. The long-term goals of the Program are to understand the system, determine resource trends and impacts, develop management alternatives, manage information, and develop useful products.

The strategy to develop and adopt standard operating procedures is included in the LTRMP Operating Plan as Strategy 4.1.1, *Develop and Update Information Management Guidance Documents* under Objective 4.1, *Provide Direction for Automation Activities*. This report was developed with funding provided by the Long Term Resource Monitoring Program.

Additional copies of this report may be obtained from the National Technical Information Service, 5285 Port Royal Road, Springfield, Virginia 22161 (800/553-6847).

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Owens, T., and K. D. Hop. 1995. Long Term Resource Monitoring Program standard operating procedures: Photointerpretation. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, July 1995. LTRMP 95-P008-1. 7 pp + Appendixes A and B.

Contents

Introduction

The following general procedures are provided for photointerpretation projects initiated under the Long Term Resource Monitoring Program (LTRMP). Guidance is provided for acquisition of materials, classification, photo preparation and interpretation, field work, and quality control. Environmental Management Technical Center staff should follow these guidelines when planning a photointerpretation project. LTRMP Field Station staff should follow the procedures specified in the Standard Operating Procedures for Field Station Photointerpretation (Owens and Hop 1995).

Initial Project Scoping

First, client requirements must be determined. Are needs well defined? Does the client require assistance in determining the best remote sensing/mapping approach? Some of the following questions may be relevant: What is the client's objective? What information does the client want? What type of imagery does the client need—satellite or photography? What type of photography is needed (color, color-infrared, black-and-white, scale, vintage)? What minimum mapping unit (MMU) does the client require?

1. Determine the best method to meet the client's requirements.

2. Define the study area boundary.

3. Determine data themes to be mapped.

4. Determine project time and make material estimates.

Project Planning

Specify Imagery to be Used for Project

1. Existing imagery: Determine if existing imagery will meet project goals according to scale, date, film type, etc.

2. New imagery: If existing imagery is not appropriate, develop specifications for obtaining new imagery (scale, film/filter type, date of imagery, stereo coverage, etc.).

Acquire Imagery

1. Order new or existing imagery.

2. Thoroughly check incoming imagery for the following factors: Color quality, crab or tilt, cloud cover, scale, overlap, and sufficient coverage.

Obtain Collateral Data

1. Obtain topographic base maps from the U.S. Geological Survey at the appropriate scale (1:24,000, 1:62,500, 1:100,000, or 1:250,000). One clean, unfolded set of maps is needed for cartography; another set may be required for field use.

2. Determine whether data are necessary and obtain these materials (e.g., field guides to vegetation, soil surveys, existing maps, etc.).

Design and Develop the Classification System

1. Use a classification system developed by the user, or a standard or national classification system (e.g., Anderson 1976; Cowardin et al. 1979).

2. If existing classification systems are not suitable, develop a new classification system based on user needs.

3. Determine the MMU required.

Prepare a Flightline Index

1. If a flightline index does not exist, prepare an index that shows frame numbers and flightlines in relation to study area and base maps.

2. Organize photographs into folders based on flightlines and project areas. Store maps and other collateral data neatly in map racks or drawers so that they are easily accessible.

Prepare Photos for Interpretation

1. Place clear acetate overlay, cut to size, on photo and secure with tape on each corner.

2. Mark fiducials and photo numbers on overlay with drafting pen. If the overlay is shifted or removed, it then can be accurately replaced.

3. Place one photo over an adjacent photo in the flight strip, find the halfway point of the overlap, and draw a line marking this overlap on the first photo.

4. Using a stereoscope, find matching points along the line drawn on the photos, then connect these lines with a straight edge.

5. Repeat this process on all sides of each photo with adjacent photos.

6. Trace the study area boundary on all photos that cover the outer edge of the study area. Continue this process until the entire study area encompassed by the photo overlays is a closed polygon.

Field Verification

1. A field trip is an expensive and complex endeavor and must be carefully planned. Before leaving on a field trip, be sure that all materials are in hand (photos, maps, collateral data), local guides and experts are available (if necessary), and all logistical and transportation problems have been solved.

2. Scan photographs and locate areas that present questions and are easily accessible by car, boat, or foot. Also locate all easily accessible major photograph signatures and cover types.

3. Mark potential field sites on a good topographic map. Note pertinent questions and comments about the sites in the map border.

4. Travel to the site and locate the areas on the ground. A field sheet (Appendix A) is helpful in prompting the interpreter to ask and answer all pertinent questions. Take careful notes about each site on the photograph sleeve (using permanent marker) to locate the exact signature and area. Note such things as size, major species composition and mixture, percentage of each species, etc., and make good sketch maps. Ground photographs are very helpful in recalling details about the site once the interpreter is back in the office.

5. Carefully review the field notes and sketch maps to ensure that all initial questions were answered.

6. If time and money permit, subsequent field trips may be necessary to answer questions that arise during interpretation.

Photointerpretation

1. Photointerpretation is usually done under a stereoscope with stereo pairs of photos. First, place the photos under the objective lenses so that the photos are aligned with the flightline, then locate an obvious feature, such as a road intersection. Look through the stereoscope and align the photos so all features are focused in the view and topography becomes apparent.

2. Delineate the features of interest described in the classification system. Features are delineated by identifying signature, the characteristic appearance of an object on a given type of imagery. Vegetation signatures vary greatly according to time of day, time of season, type of photography, and scale, and are affected by the following factors: color/tone, texture, pattern, shape, size, and location. A single factor may not be sufficient to identify an object, but a combination of these factors will often lead to proper identification. For example, two vegetation types found in different locations may have the same color and texture; conversely, two vegetation types found

in the same location may have different colors. It is important to learn the combination of factors that distinguish one type from another.

(a) **Color/Tone:** Color is the combination of hue, chroma, and saturation in color photography, while tone is the shade of gray in black-and-white photography. These two factors usually convey more information to the interpreter than anything else. The human eye can distinguish 100 to 200 shades of gray, while it can distinguish thousands of different colors. For these reasons, color and color-infrared photography are far superior to black-and-white photography in vegetation identification.

(b) **Texture:** Texture is the composition and arrangement of small constituent parts of an object. Texture may be characterized by such terms as smooth, uniform, velvety, or rough. Planted vegetation usually appears smoother than natural vegetation, while differences in height produce rougher textures.

(c) **Pattern:** Pattern or repetition is the characteristic arrangement of objects. Some vegetation types have highly distinctive patterns that are easily recognized and aid in feature identification.

(d) **Shape:** An object's shape may be difficult to recognize from the vertical perspective of aerial photography. The shape or form of objects may be determined by their shadows. For example, tree shadows can be used to determine species.

(e) **Size:** Some objects are easily identified by their size and can be used as guides to determine the size of other objects not so easily identified. Relative size may be critical in identifying objects, such as a shrub versus a tree.

(f) **Location:** Location covers a wide variety of factors such as global location, ecological site, and association with other objects.

3. Work methodically from the general to the specific and from the known to the unknown. Begin interpretation of photographs that have been groundtruthed to get a good grasp of visual clues and photographic signatures.

4. Delineation and labeling must be done in a neat, legible manner. Lines should be of uniform width and should closely follow the ground features on the photo. Polygons must be closed and labels should be placed within the polygon. However, if the polygon is too small, the label should be placed outside the polygon with a lead-line into the polygon. Linears should be used to delineate significant ground features that cannot be delineated with a polygon. A linear must be labeled with an arrow from the label to the linear feature.

5. If a project area is large and requires more than one interpreter, a photointerpretation key may be necessary to organize and synthesize information. Keys can take many forms, including dichotomous keys and descriptive keys. A dichotomous key provides a series of choices for the photointerpreter to work through, as the following example illustrates:

(1) Vegetation is found in wetlands, go to 2; or
(1) Vegetation is found in uplands, go to 10.

The next example is a descriptive key which describes the important cover types:

Sagittaria (arrowhead) has a medium pink color, a velvety texture, and is found in 6 inches to 2 feet of water.

6. After interpreting each photo, match all lines and labels with adjacent photos to ensure that edge ties and labels are accurate and consistent (including side lap).

7. When interpretation is completed, place a clean sheet of white paper between the overlay and the photo to check for completeness of linework and labeling as well as interpretation errors.

8. Use a production log to track and record completed work (Appendix B). Logs are essential to record completed photos, to document problems or concerns, and to track progress.

Quality Control

1. Interpretation will be checked by the supervisor or another experienced photointerpreter who is familiar with the project. To promote correctness and consistency of work, the basic guideline is to assume that errors exist and to search for them.

2. Place a sheet of white paper between the overlay and the photo and make sure that lines and labels are neat, clean, and complete. Check edge ties to adjacent photos.

3. Scan each polygon under the stereoscope to check the correctness of final linework and labels and the consistency of classification.

4. Sign your initials on the production log when interpretation is complete.

References

Anderson, J. R., E. E. Hardy, J. T. Roach, and R. E. Witmer. 1976. A land use and land cover classification system for use with remote sensor data. Geological Survey Professional Paper 964, U.S. Geological Survey, Washington, D.C. 28 pp.

Cowardin, L. M., V. Carter, F. C. Golet, and E. T. LaRoe. 1979. Classification of wetlands and deepwater habitats of the United States. U.S. Fish and Wildlife Service, Office of Biological Services, Washington, D.C. 131 pp.

Owens, T., and K. D. Hop. 1995. Long Term Resource Monitoring Program standard operating procedures: Field station photointerpretation. National Biological Service, Environmental Management Technical Center, Onalaska, Wisconsin, August 1995. LTRMP 95-P008-2. 11 pp. + Appendixes A-E.

U.S. Fish and Wildlife Service. 1992. Operating Plan for the Upper Mississippi River System Long Term Resource Monitoring Program. Environmental Management Technical Center, Onalaska, Wisconsin, Revised September 1993. EMTC 91-P002. 179 pp. (NTIS #PB94-160199)

Appendix A

Upper Mississippi River System Field Sheet

Reported By_____ Date_____ Site No._____

Other Field Personnel_____

_____

General Site Data

Aerial Photo: Number_____ Date_____ Type_____ Scale_____

USGS Quad_____ State_____ City_____ Pool_____

Township_____ Range_____ Section_____

Brief description of site relative to identifiable points on top map

_____

_____

_____

Attach photocopy of field site from 7 1/2" quad

_____

Ground Photo Data

Roll	Number	Direction	Description

Upper Mississippi River Sytem Field Sheet

Detailed Site Data

Description of Site_____
_____
_____
_____

Dominant Plants_____
_____

Common Plants_____
_____

Less Common Plants_____
_____

Initial Field Classification (1) Geomorph_____

2) Land Use/Land Cover_____

Discussion of Photo Interpretation_____
_____
_____

Final Photo Classification (1) Geomorph_____

(2) Land Use/Land Cover_____

Soils Data_____
_____

Other Observations (water regime, wildlife, geomorph, etc.) Discussion
_____
_____
_____

Sketch of Field Site

Approximate Scale

North
Arrow

Appendix B

Photointerpretation Production Log

Project: Total Number Photos:

Photo No.	Date	Time	Hours	QC	Comments	Map Name

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13. ABSTRACT (Maximum 200 words)

Guidance is provided for planning a photointerpretation project, including acquisition of materials, classification, photo preparation and interpretation, field work, and quality control. The Environmental Management Technical Center should follow these guidelines. The planning process is divided into several steps: (1) initial project scoping, which includes determining client needs; (2) project planning; (3) acquiring imagery, whether new or existing; (4) obtaining collateral data; (5) adapting a classification system, whether the system is a new one or existing classification; (6) preparing a flightline index; (7) preparing photos for interpretation; (8) field verification; (9) photointerpretation; and (10) quality control. Detailed instructions are given for each section.

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Aerial photography, aerial photointerpretation, vegetation mapping

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The Long Term Resource Monitoring Program (LTRMP) for the Upper Mississippi River System was authorized under the Water Resources Development Act of 1986 as an element of the Environmental Management Program. The mission of the LTRMP is to provide river managers with information to maintain the Upper Mississippi River System as a sustainable large river ecosystem given its multiple-use character. The LTRMP is a cooperative effort by the National Biological Service, the U.S. Army Corps of Engineers, and the States of Illinois, Iowa, Minnesota, Missouri, and Wisconsin.