2 DECISION FRAMEWORK
Section 2.A - Guide to the Vegetation Mapping Process

This section describes the entire framework of the vegetation mapping process. The project manager should gain an appreciation for the decisions that must be made during each step of the process. This guide contains recommendations for questions to ask or actions to take at each step and is appropriate whether the work is done in-house or by contract.

Overview of the Vegetation Mapping Process

The overall vegetation mapping process consists of six major steps, as shown in Figure 2.A-1. Note the solid, dark line in this figure representing a decision point for the Project Manager (PM). This is highlighted because it is at this point that the PM must decide whether to conduct the project in-house or contract out certain activities and/or steps. It is important to note that, regardless of whether the vegetation mapping project is done in-house or contracted, Steps 1 and 2 must be done in-house by Federal employees to ensure that adequate information is available for making an informed decision about the rest of the study.

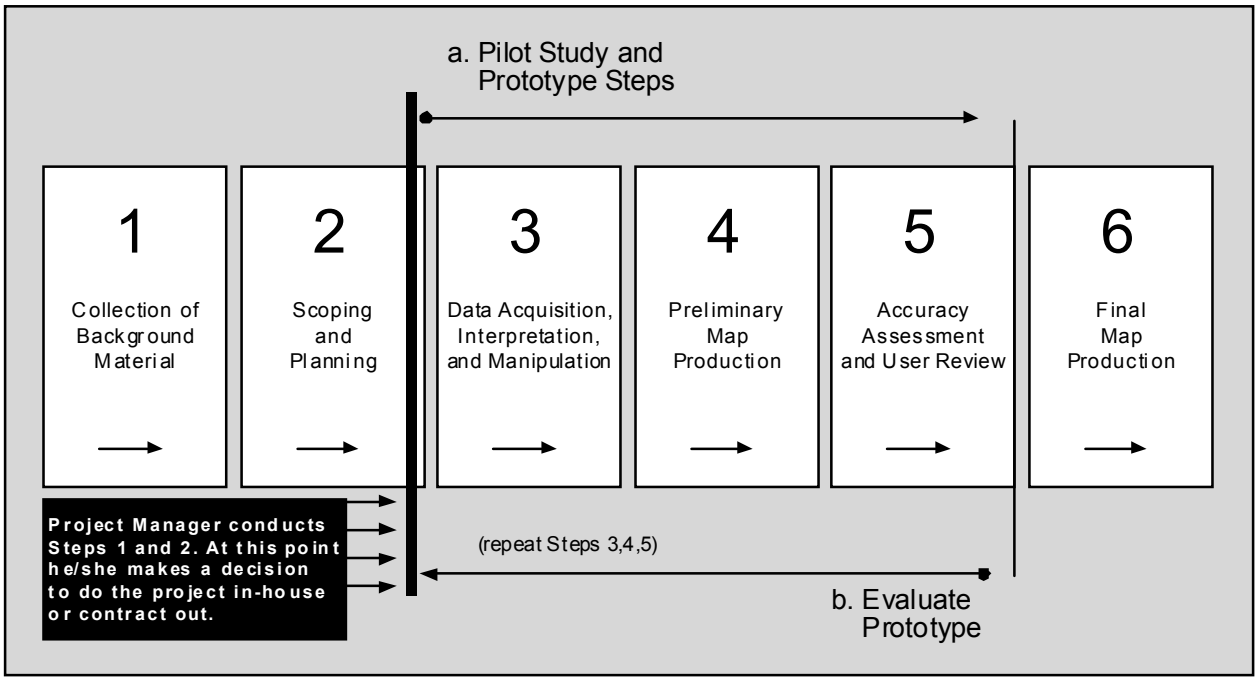

Figure 2.A-1. Overview of the vegetation mapping process

This section describes the general framework of the vegetation mapping process, but does not include everything needed for procedural decision-making. Instead, the reader will be directed to other chapters and sections in this guide for help in making the necessary decisions.

The PM may collapse some of the activities in each step. Activities are presented in their entirety, as if at the start of a new mapping project. The authors acknowledge that there are instances in which a map may already exist or the map objectives might be very narrow, so not all activities must be completed for every mapping project.

Details of the Vegetation Mapping Process

This section will lead the reader through the details of each of the six steps of the vegetation mapping process as presented in Figure 2.A-1. Details will be presented on the following:

- Activities necessary to complete the step.
- Procedural flow and the step's relationship to the other steps in the process.
- Questions that should be asked during the step.
- Decisions that must be made before completing the step.

Step 1. Collection of Background Material

The PM should study reference material and existing information to find out as much as possible about the study area and find out whether there are any relevant efforts, past or present, that could support the current vegetation mapping effort. Figure 2.A-2 outlines the process and types of information that should be reviewed and collected. This review is conducted to help the investigator understand and appreciate the character of the vegetation, reveal general relationships, disclose affinities to disturbance, appreciate potential interpretational problems, and understand the dominant environmental features (Kuchler and Zonneveld 1988). Reviewing existing information on the area of interest can help the investigator become familiar with previous maps to build on, constraints on access, training use of vegetation, and other concerns specific to the installation.

1.A. Reference material. A literature search (Step 1.A in Figure 2.A-2) should be conducted to support the vegetation mapping program/project. This manual is an excellent starting place to learn about literature that can help support the decision-making process. This section and Chapter 3, "Reference Library," provide many practical references. Reference material should, however, be supplemented with recent literature on regional and local studies.

1.B. Collections. Collections might include literature, maps, databases, imagery, and lessons learned from other nearby vegetation mapping efforts. For additional information on available mapping resources, see Section 2.C. Figure 2.A-2 lists recommended collection materials to have on hand for ready reference and/or to guide the contractor.

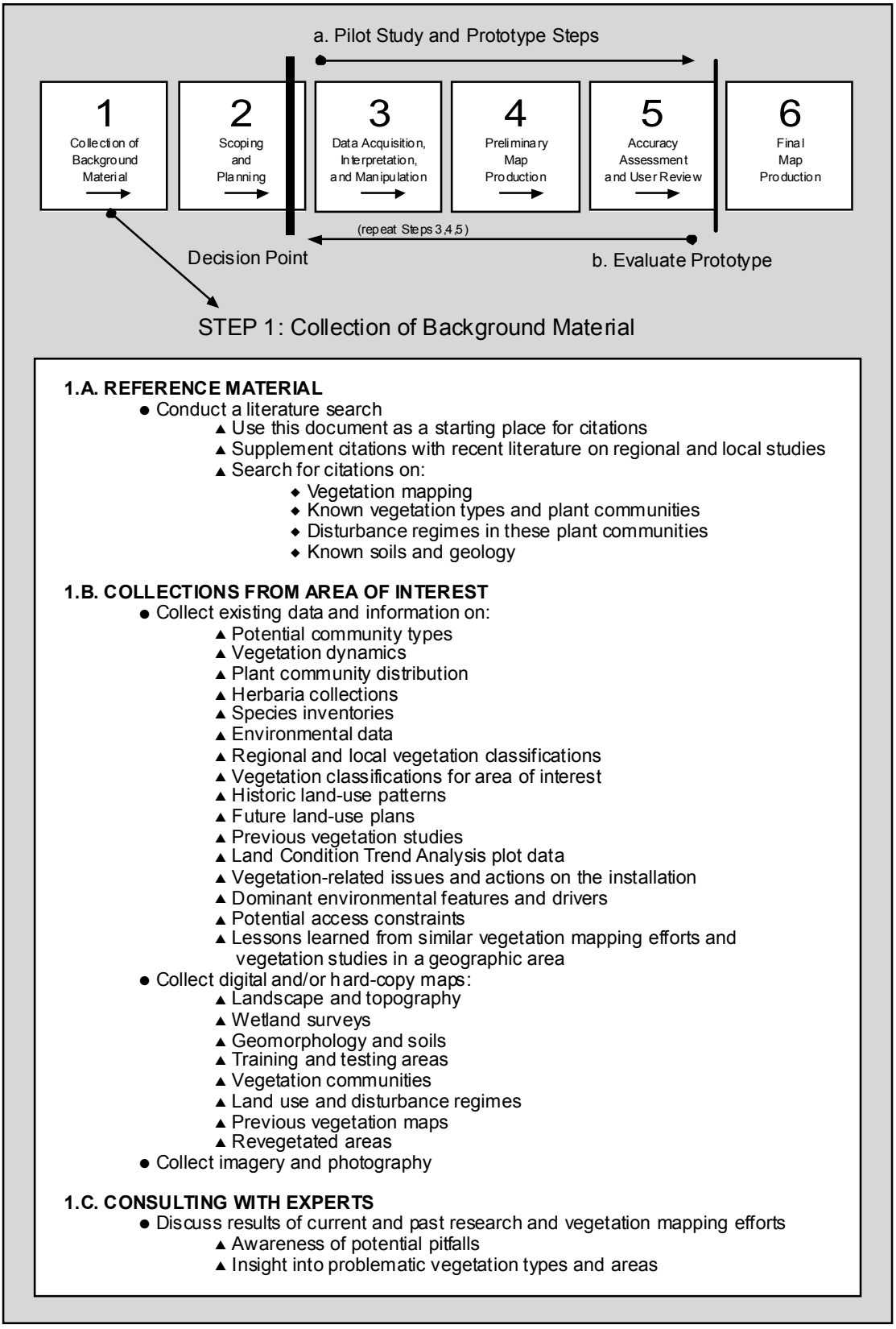

Figure 2.A-2. Expansion of Step 1, collection of background material

1.C. Consulting with experts. Consultations (1.C in Figure 2.A-2) with regional offices, experiment stations, technical centers, universities, research units, and other agencies can be very beneficial. See Section 2.C, "Determine Available Resources," for recommendations of experts to contact for help in completing this task. These consultations can help the investigator do the following:

- Gain familiarity with the geographical area.
- Gain insight into techniques that worked well.
- Line up potential reviewers for their mapping products.
- Find out whether there are current mapping efforts under way.
- Identify potential contributors that might support the project in some way.
- Gain insight into potential pitfalls and which vegetation types and areas may be problematic.
- Discover the results of mapping efforts from the surrounding areas and other projects.

Step 2. Scoping and Planning

The outcome of Step 2 will be a decision on whether the work will be contracted out, conducted in-house, or accomplished through a combination of these. The purpose of Step 2 is to pull together background information collected in Step 1, then to establish mapping objectives by identifying potential users and the project's parameters. This important step determines what kind of vegetation map will be developed, what it will be used for, and who will use it. Figure 2.A-3 depicts scoping and planning phase activities.

It is important that this planning effort be incorporated into the installation's overall planning and management strategies, and that it be tied to specific management and policy requirements (e.g., preparing the Integrated Natural Resource Management Plans (INRMP). See Section 2.B for details on determining user communities and establishing objectives. Once the objectives are set and the available resources understood (Section 2.C), the PM can receive assistance in determining specifications and costs in Section 2.D. It should be emphasized that establishing user needs (Step 2.B), evaluating resources (Step 2.C), and determining specifications and costs (Step 2.D) can be conducted in reverse order. Chapter 4, "Management," provides further assistance on contractual and project management issues related to these topics.

2.A. Search Literature and Background Material. In Step 1, the PM collected background material to support the project. In this step, the PM should continue building on Step 1 by searching the installation library and files for completed reports and vegetation documentation. Useful items include completed INRMPs, Environmental Impact Statements, and funding requests from previous years (e.g., the Environmental Program Requirements Reports). By the end of this step, the PM should have a collection of relevant literature and materials.

2.B. Establish Objectives. Analyzing user needs is critical to establishing objectives and locating support for the project. The PM should identify the various user communities, users, and others with interest in vegetation on the installation. An efficient way of setting objectives is to hold a structured meeting in which potential users are encouraged to provide their opinions on the project's purpose and its conduct. If interested parties are engaged early in the planning process, their logistical support and expertise can be leveraged throughout the life of the project. Section 2.B provides some tools for establishing objectives.

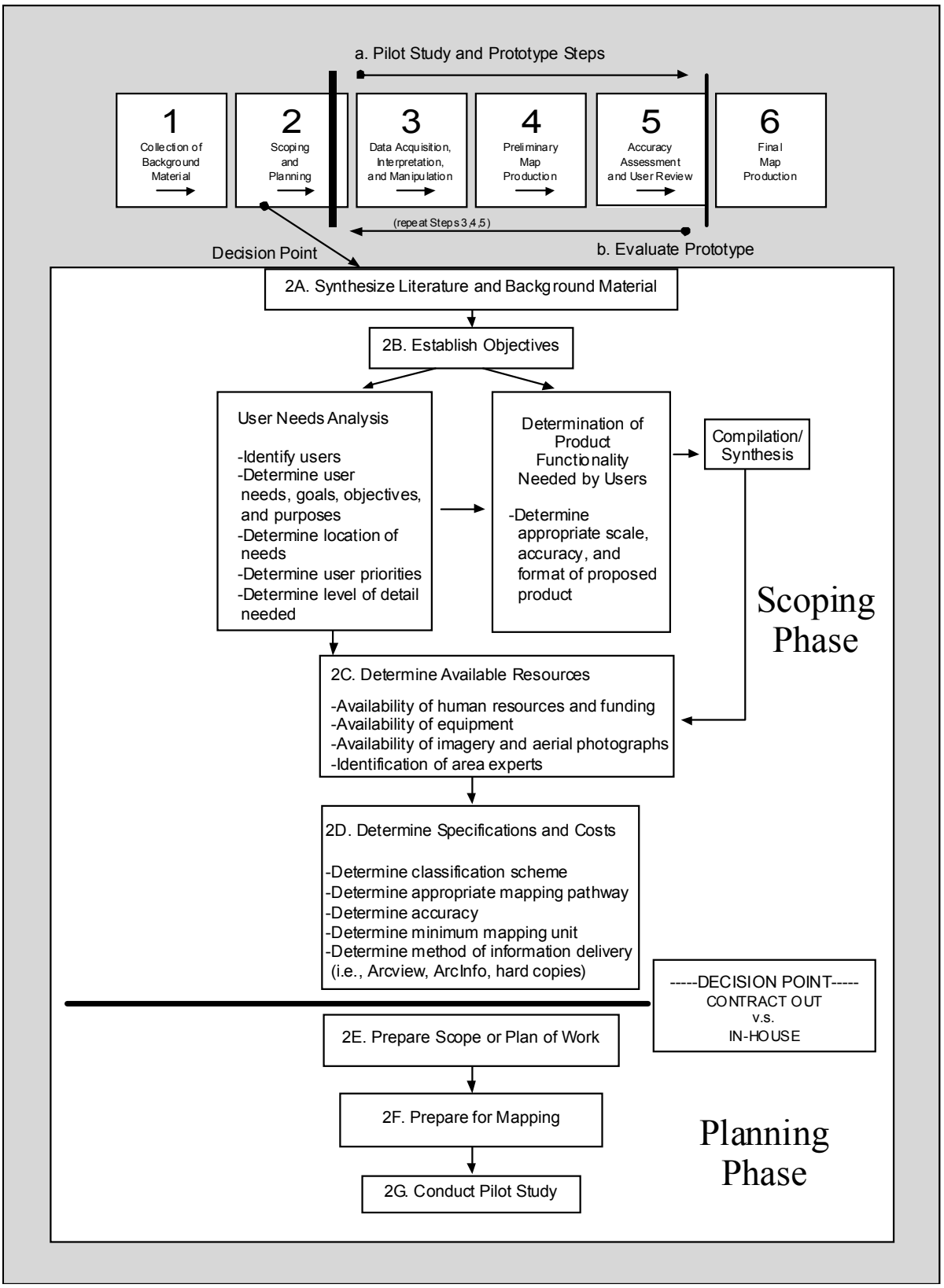

Figure 2.A-3. Expansion of Step 2, scoping and planning

2.C. Determine Available Resources. This step helps the PM evaluate existing resources to determine what parts of the vegetation mapping project, if any, can be conducted in-house. Section 2.C expands this step and provides details on the tasks, questions, and output expected from this step.

2.D. Determine Specifications and Costs. This step helps balance user expectations (Section 2.B) with project resources (Section 2.C) and the constraints and limitations of the imagery and/or technology. Section 2.D provides additional details on the tasks, questions, and output expected from this step.

2.E. Prepare Plan of Work and/or Statement of work. The PM should have enough information at this point to be able to develop a draft plan of work (POW), based on information acquired during the scoping activity. A POW is a tool for the PM and is useful for portraying a sequenced plan of action. At a minimum, the POW should include the following:

- Project goals and objectives.
- Detailed descriptions and specifications of major tasks and end products.
- A flow diagram of the process.
- A proposed schedule and flow diagram of major tasks and critical milestones.
- Resourcing and cost estimates for the various steps and activities.

The PM will also need to develop a statement of work (SOW) detailing contractual obligations if the mapping project will be contracted out. See Section 4.A for guidelines on an SOW.

Information gathered in the scoping and POW activities can best be reviewed in a meeting with all interested parties. Such a meeting can provide valuable insight and suggest refinements. This meeting can help investigators ensure that the stated goals are realistic, the scope is within reason, and that resources are available for the effort. It might also be a forum for planning the next two activities.

Rarely is there a perfect fit between the level of detail desired and the available resources and technology. If a mismatch occurs between the desired and actual levels, re-examining and refining the project boundaries and/or re-prioritizing may be necessary. Discrepancies in timing or priorities should be dealt with at this meeting. The group should acknowledge and agree on the timing of critical milestones and appreciate the importance of the classification and timing of the accuracy assessment fieldwork. This is a good opportunity to answer any questions the stakeholders have and any questions the PM has that may have arisen while developing the POW.

2.F. Prepare for Mapping. This activity focuses on the logistical considerations for fieldwork, both in the pilot study and in the full-scale field effort. The PM must coordinate to gain access to the training areas, assure communications are in place, and have a backup plan in case of inclement weather.

2.G. Conduct Pilot Study. The pilot study is a scaled-down version of the larger vegetation mapping effort. This small-scale effort can help the PM determine whether the scope is right, refine the cost estimate, design the database, and identify and solve problems before the full-scale effort is begun. The pilot study can also help determine whether the existing classification scheme is appropriate for the project. If it is not, it must be redefined. Even though the pilot study takes time, it is usually well worth it. A pilot study can encompass as little as a day's activity on the most critical tasks or full mapping of a small site.

Pilot study results should be presented to all interested parties so that any problems discovered in the pilot study can be rectified before moving on to the larger effort. Some adjustments may be necessary

before the full-scale effort can begin. If the pilot study was successful and the methods deemed appropriate, they can be expanded across the entire mapping area and the full-scale effort can begin.

Step 3. Data Acquisition, Interpretation, and Manipulation

The goal of the third step is data acquisition, interpretation, and manipulation. In this step, two decisions must be made: 1) which data sources are the most suitable, and 2) which pathway, or combination of pathways, is most appropriate for the vegetation mapping project. Section 3.D describes several possible mapping pathways. Not all activities presented below are found in each pathway. The discussion in this section will be limited, and the reader will be directed to the applicable section(s) of this guide for more detailed information on these activities.

3.A. Acquisition of Imagery. Acquiring imagery may not be necessary if suitable imagery was obtained in Step 1 or 2. Section 2.C will help direct the PM to imagery sources. Consult Section 3.G for further information on remote sensing data.

3.B. Field Sampling. This activity involves collecting data on vegetation and possibly landforms from the field. Section 3.I, "Field Methods," expands the discussion of this activity. Section 3.J provides details for assessing the data's accuracy, and Section 4.E contains information on data ownership and access.

3.C. Interpretation. All the vegetation mapping pathways involve some level of interpretation. Interpretation, whether of field data, imagery, or aerial photographs, is the core of the vegetation mapping process. It involves some form of pattern recognition and analysis. Generally, this interpretation means the investigator must distinguish each of the major vegetation types to find out whether they can be differentiated in the field and on the imagery. Section 3.H, "Image Interpretation and Digital Processing," presents this topic.

3.D. Field Check and Field Verification. The PM should conduct a field check and field verification. A field check should have been conducted with the pilot study, but if it was not, it should be during this step. A field check or inspection is done to determine whether the initial interpretation and delineations are accurate. This generally involves a brief check, with the PM participating, if possible. If preliminary interpretations are correct, the investigator moves forward. If not, interpretational problems should be rectified before moving forward. The second field verification should be conducted near the end of the fieldwork to determine whether the interpretations and fieldwork are accurate. This field checking should be expanded over the entire area and cover most or all of the vegetation types. This verification process is a more in-depth field check, with the PM and other interested parties participating, if possible.

3.E. Review of Interpretations. Interpretation results should be evaluated for their suitability. At a minimum, this should be done with the PM, but other interested parties may be involved in this review. Interpretational problems might include: 1) vegetation types not distinguishable from the chosen data source, or 2) the classification hierarchical level may not be attainable from the chosen imagery or photograph. For example, the overstory dominants may be easily distinguishable from the photography, but the understory association may not be. This can be problematic if the contract stipulates the desired hierarchical level as the association level (see Section 3.E, "Classification Systems").

By this point in the project, any interpretation questions and problems with the data source(s) or particular vegetation types should be evident. If interpretational problems are discovered, re-interpretations, compromise, or alternative plans may be appropriate. The guidance in Section 3.I can

help the PM minimize interpretational problems in the field; the information in Section 3.J can help the PM to determine whether interpretational problems exist.

3.F. Data Manipulation. The degree of data cleaning and data manipulation needed will depend on the pathway chosen and what is needed for the map production step. This may involve entering code data, further development or production of digital data and files, data conversions and testing, and merging and transforming files.

Step 4. Preliminary Map Production

The goal of the fourth step is to produce a preliminary map. This step involves five activities, as follows (Figure 2.A-4): (a) producing a preliminary digital map or Geographic Information System (GIS) layer, (b) producing a hard copy of the map, (c) preparing a legend, (d) writing the draft metadata, and (e) developing vegetation type descriptions. Several sections provide support for these steps, including 3.F for GIS and Appendix P for sample products.

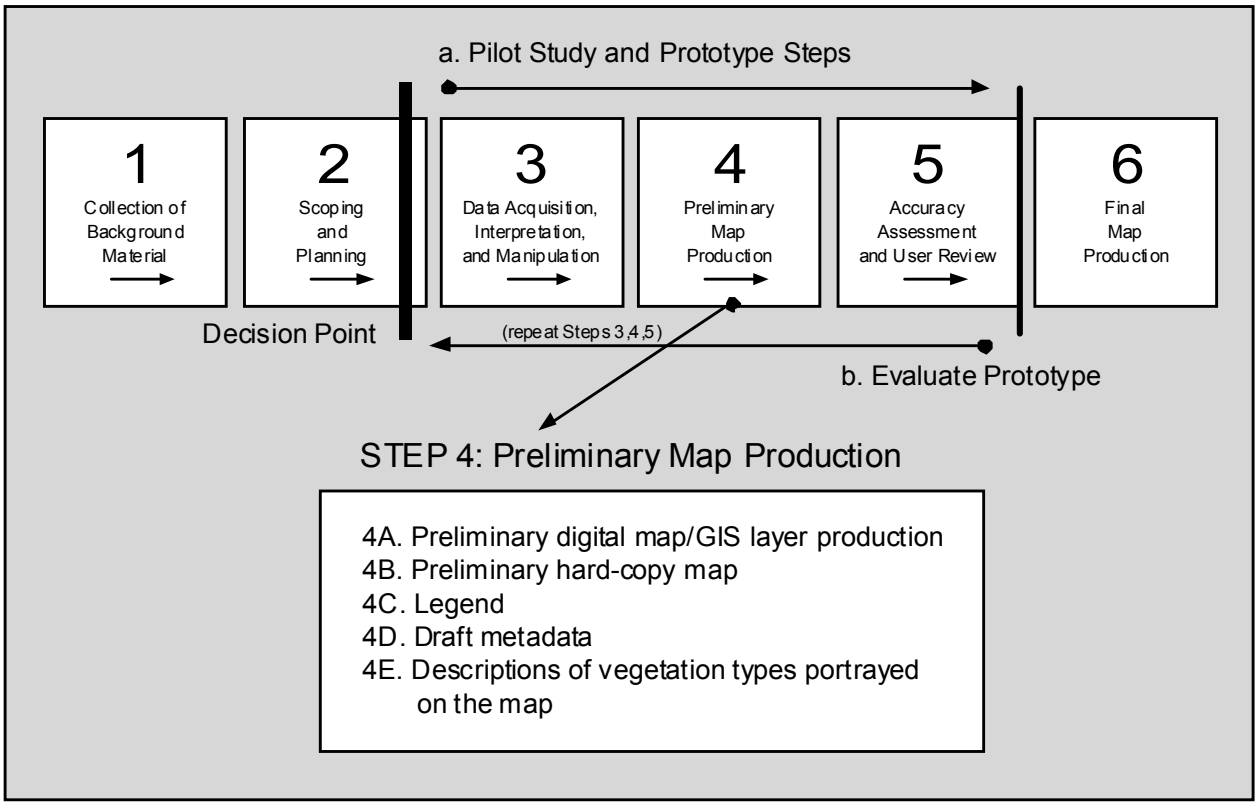

Figure 2.A-4. Expansion of Step 4, preliminary map production

Step 5. Accuracy Assessment and User Review

The goal of the fifth step is to ensure data accuracy and utility. It consists of two main activities: (a) planning, and (b) implementing an accuracy assessment (Figure 2.A-5). Two sections of this guide provide a more thorough discussion: Section 3.J details the accuracy assessment process, and Section 4.A

includes guidance on contracting for assessing accuracy. Needs of the various users identified in Step 2 (see Section 2.B) should be checked.

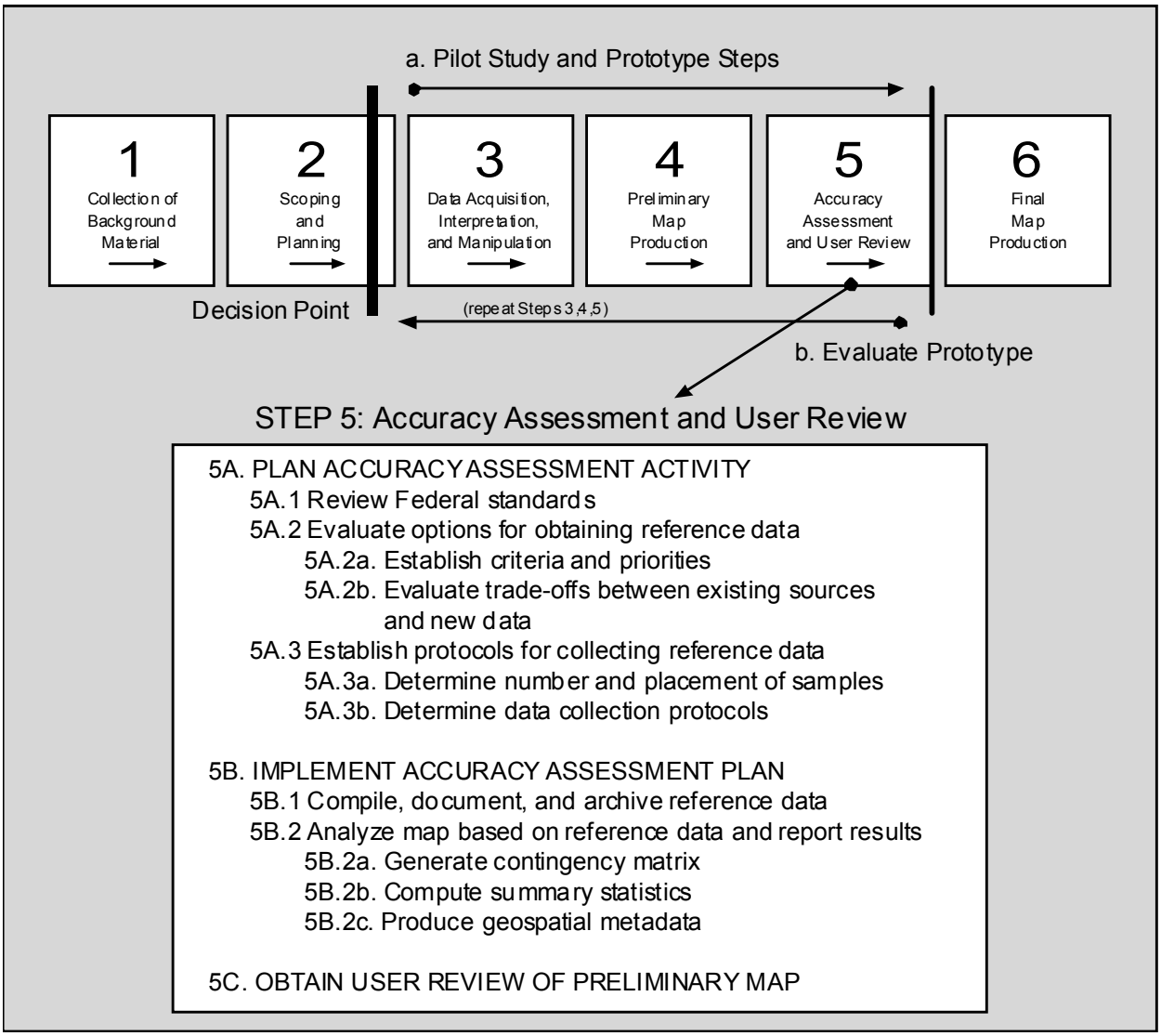

Figure 2.A-5. Expansion of Step 5, accuracy assessment and user review

5.A. Planning Accuracy Assessment Activity. The planning activity consists of three sub-activities: reviewing Federal standards for assessing and reporting accuracy, evaluating options for obtaining reference data, and establishing protocols for collecting reference data. Some of the information obtained in Step 1 (e.g., field data on vegetation) may be useful in this step.

5.B. Implementing Accuracy Assessment Plan. The implementation activity consists of two sub-activities: (a) compiling, documenting, and archiving reference data based on the established protocols, and (b) analyzing the map based on the reference data and reporting the results.

Step 6. Final Map Production

The goal of this step is to complete the final map and produce the accompanying documentation (Figure 2.A-6). This involves the same five activities as in Step 4, except in final form. It also includes one additional activity, the final report. These reports can be scientific in nature and document the methods and results. They can also be contractual in nature; if so, they might describe the application or concentrate on the project's life cycle. Section 4.C provides details on cartographic and presentation considerations, and Section 4.E discusses ownership and access to data.

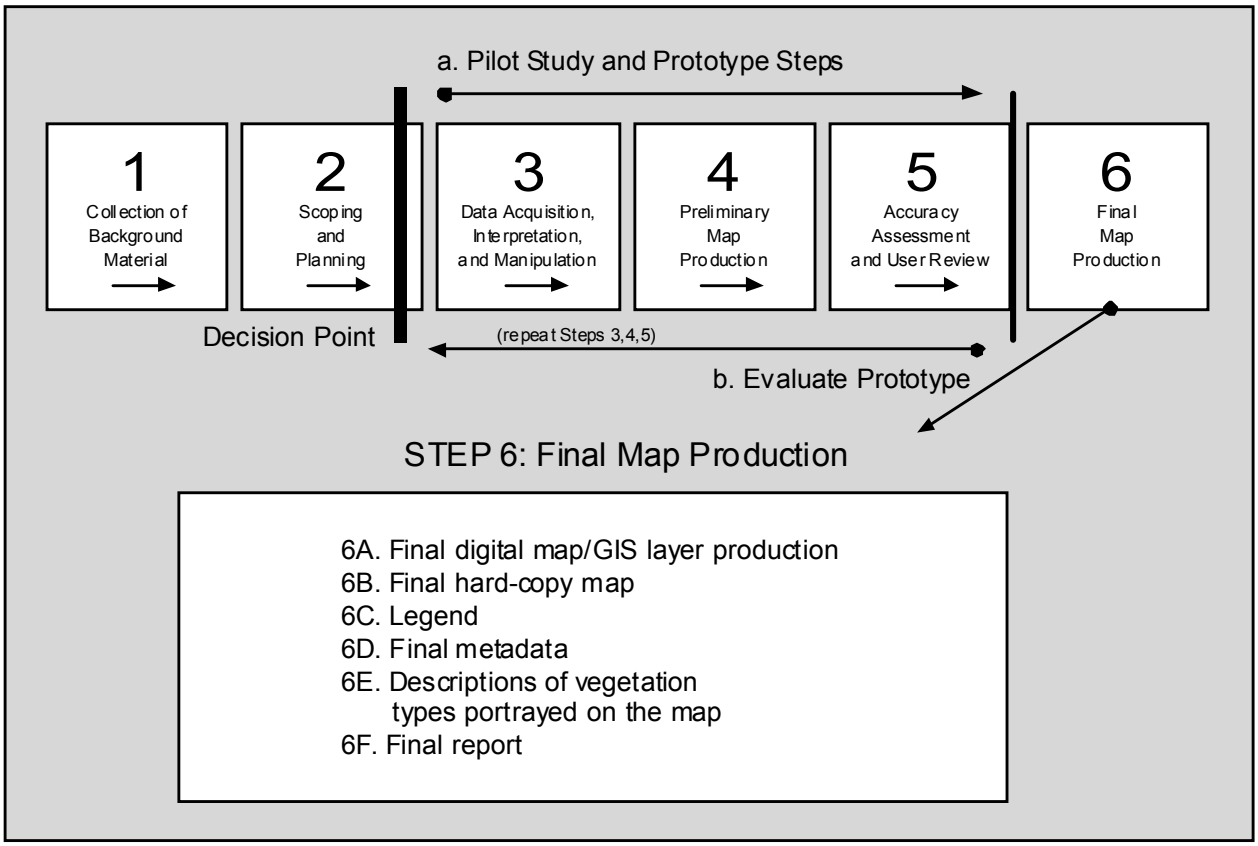

Figure 2.A-6. Expansion of Step 6, final map and GIS layer production

Literature Cited

Kuchler, A.W. and Zonneveld, I.S., ed. (1988). "The Nature of Vegetation." *Handbook of Vegetation Science*. Vol. 10, Kluwer Academic Publishers, Dordrecht, Netherlands, 13-23.