Development of a formalized information needs assessment of multisource inventories and landscape analysis

Renee Rene' Lundberg
The University of Montana

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DEVELOPMENT OF A FORMALIZED
INFORMATION NEEDS ASSESSMENT FOR MULTIRESOURCE
INVENTORIES AND LANDSCAPE ANALYSIS

by

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B.S. Montana State University, 1974
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Date
Development of a Formalized Information Needs Assessment for Multiresource Inventories and Landscape Analysis ((pp 148)

Director: Kelsey Milner

ABSTRACT

Multiresource inventory methodologies are needed for Ecosystem Management. Developing a multiresource inventory requires several steps. This study addresses three steps of the multiresource inventory project by providing a process and tools for resource managers and specialists to understand, identify and evaluate information needs and data sources. Once common information elements are identified, then effective data collection methods can be determined and designed.

Results from this study include: (1) a formalized information needs assessment (INA) process, (2) an Oracle relational database and reports on the IBM computer system, (3) guidance for interdisciplinary teams in using the INA process and database. The INA database facilitates identification of common data needs and evaluation of alternative information and data sources. The primary users are interdisciplinary teams at the Ranger District level. These tools and processes provide key information to improve efficiency both in data collection and analysis and can be used to develop an integrated multiresource inventory.

Results from this developmental, applied research problem analysis include resource specialists opinions on specific information elements needed to conduct Ecosystem Management assessments at the landscape scale. A synthesis of information from surveys, interviews, literature, Forest Service manuals and references was used in developing the processes and tools presented in this study.

An information needs assessment should be conducted whenever management objectives, priorities, social issues or regulations change. The INA database easily facilitates updating, sorting and reprioritizing needs when changes occur.
ACKNOWLEDGMENTS

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IF IT WERE EASY, IT WOULD HAVE BEEN DONE BEFORE!
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Chapter 1
INTRODUCTION

A. Why and How

With the implementation Ecosystem Management (EM) by the Forest Service, resource managers and specialists are asking: How will EM change the way we do business? What new planning and management activities are required? How have our information and data needs changed?

The Forest Service is developing methods and tools to manage vegetation at broader scales. These broader scale analyses, often called landscape assessments, require integrated and consistent information (USDA, 1992). The Kootenai National Forest's Ecosystem Management Core Group identified a number of projects to help resource managers and specialists conduct quality, defensible, cost efficient ecosystem assessments.

One of these projects was to develop a multiresource inventory methodology for landscape scale assessments (Kootenai National Forest, 1994). The underlying assumption was that some efficiency in data collection and analysis can be gained by conducting integrated multiresource inventories. Efficiency is defined as producing the desired results with a minimum of effort, expense or waste. A key objective of an integrated inventory approach is to reduce overlap and redundancy in data collection (Collins, Cottingham, 1992). Kootenai forest managers felt that efficiencies could be achieved by developing new tools and practices.

Why do resource managers and specialists want and need an integrated inventory methodology?

- Ecosystem Management requires a broad and integrated look at the environment at multi-hierarchical scales (Hann et al, 1993). Identifying and maintaining ecosystem function and processes, such as disturbance, succession and evolution, necessitates having information from large river basin or subregional scales to small land units such as timber stands.
- Current inventories are primarily single purposed (resource area specific) and conducted at a variety of scales. For example: silviculturist conduct timber inventories, wildlife biologists conduct wildlife habitat inventories, and botanists
conduct sensitive plant inventories. They all survey vegetation but use different land units and different sampling frequencies.

• When single purpose inventories are conducted at different scales, it is difficult if not impossible to combine data into meaningful information (Lund, 1986).
• This single purpose inventory data is often incompatible, redundant, incomplete or even contradictory when assembled for landscape assessments. For example, the stand exam information the silviculturist collects on the size and number of large or oldgrowth trees may not agree with the biologist's oldgrowth survey data, even though they both surveyed the same area.
• Efficiency may be gained by an integrated, multiscaled approach to inventory (Barry Bollenbacher, Regional Silviculturist). With reduced budgets in the future, it will be increasingly important to design integrated inventories to answer questions pertinent to the scale of analysis.
• There is no integrated or standardized inventory and analysis methodology for hierarchical assessments (Leven, 1992).

A real life story:

You are the manager of the Enchanted Forest and your boss says, "I want you to start implementing ecosystem management by conducting an EM assessment of the Elf Creek landscape area. You need to decide what management activities will help maintain ecosystem function and processes." So you assemble an interdisciplinary team (IDT) of resource specialists to determine, collect and analyze the information that will be required. You remind the team of the limited time and resources for this work.

The team informally discusses what information and data will be needed. Some members actively participate in the meeting and list numerous needs, others do not contribute much. Unfortunately the fuel specialist is on a fire assignment, and his "stand in" is new to the agency and unfamiliar with the assessment process and EM objectives. The silviculturist is not sure if ecosystem management requires stand level data on the entire landscape but does not bring the matter up for decision. The wildlife biologist has done dozens of assessments and assumes her information needs are the same as before EM. So, some of the information and data requirements get identified, and the team goes on their merry way, separately collecting and analyzing the information that they believe you will need to decide how to manage the Elf Creek area.
Six months later, after the data has been collected, maps have been made, and analysis has been completed, you have a team meeting to decide how to implement EM in Elf Creek. The silviculturist says, "Based on my detailed stand exams 50,286 acres (86 percent of the area) are in the oldest age class, stand densities are much higher than historical conditions, and 50% of the stands have on-going mountain pine beetle mortality. These conditions are not desirable and I recommend extensive salvage and regeneration harvesting in Elf Creek." The wildlife biologist says, "Based on my walk through surveys, there is a shortage of hiding and thermal cover. Forest plan standards require 30 percent of the area to be maintained as cover and only 25 percent meets the cover definition. We should defer harvesting for at least 20 years." You wonder if they are talking about the same Elf Creek, and ask the fuel specialist, "What are the fuel conditions in Elf Creek and in the adjacent drainages?" He responds, "Based on my fire scar analysis of 35 trees, the historic fire interval for this area is 30 to 50 years. I did not have time or funding to do fuel inventories, but since there has been little harvesting and no major fires, I’d assume fuel loadings are greater and ladder fuels more continuous than they were historically. The adjacent drainages are on the Emerald Forest and I do not have any information about them." The silviculturist says, "Didn’t you know the stand exam crew collected fuel data in Elf Creek? You’ll need to decide if it is adequate and current enough considering the recent beetle mortality." Since there are many new homes in the Elf Creek drainage, fire risk is an important social issue. You decide better fuels information is necessary before determining what activities should be considered for this area.

What happened?
You, the decision-maker had to reject the assessment because the right information was not available. Costly delays occurred. The process and expectations were not well understood by the team. Instead of looking first to what information was needed to make resource management decisions, the team jumped forward, collected and analyzed the data they assumed was required based on intuition and past experience. No sideboards were placed on where and how to spend the limited time and resources. The functional approach lead to "sloppy" data collection. Both data collection and analysis were not integrated or coordinated, so duplication and overlap occurred. Three different surveys were conducted on the same landscape. With a multiresource inventory fuels, tree cover/density and insect activity could probably have been collected in one survey. Information on tree cover, stand density and thermal cover, conflicted
because different criteria, methods and sampling intensities were used. Not all of the detailed tree data that was collected and analyzed was useful. The wrong kind of fuel data was collected by the exam crew, and needed data was lacking or incomplete. Social factors were not identified.

"Few, if any activities have more comprehensive implications for the successful implementation of EM than information management: the inventory, acquisition, storage, maintenance, use and dissemination of data and information. The degree of success with which resource managers develop and evaluate options has significant implications for the quality and cost-effectiveness of the work they perform." (USDA, USDI, 1996)

Information management includes an information needs assessment (INA) which provides the framework for deciding how to carry out an assessment efficiently. A formal information needs assessment fixes sloppy data collection by clearly defining needs before time and money are expended. A formal INA process includes documenting the needs so they can be used on subsequent assessments and is flexible enough to easily incorporate changes as new information needs and political issues arise. Information management also means identifying opportunities minimize duplication and overlapping inventories.

Over the years, the Forest Service has attempted to combine selected portions of field inventories. Successful integration has been limited by lack of agreement on inventory objectives, functionalism, lack of communication and organizational parochialism, along with beliefs about data ownership (USDA, 1993b).

The Kootenai Forest and other forests in Region One have been using and adapting current inventory methods (compartment inventories, stand exams, ecodata, strata averaging, regression estimates), but it is uncertain to what extent existing inventories and methods meet the objective and information needs of EM. Incorporating EM principles into current resource management practices means that different and additional information may be needed (Comanor, 1993).
B. Multiresource Inventory Process

Developing a multiresource inventory (MRI) requires several steps. Some general premises to consider:

- Before you can design an inventory, you must know what you want. (Your information needs including why you want it, its quality and importance, the cost and benefits, and the end products desired.)
- Before you can know what to inventory, you must determine what you have and what is lacking. (What are the existing and potential information sources?)
- Before you can decide if you can design a multiresource inventory, you must know the common information needs between resource specialists. (What information does fire, wildlife and silviculture all need?)
- You seldom obtain all the information you want, so you must prioritize your needs, wants and desires. (This is where quality, importance, costs and benefits come into play.)

A critical step to integrating resource information and inventories is to identify what information is essential for the given objectives and decision to be made (USDA, 1995c). One of the most important things learned from the first round of national forest plans is to gather only the information needed for decision making. It is also important to identify existing as well as alternative data and information sources (such as remote sensing). This will help determine what new or updated information is required, as well as the most efficient method of acquiring it.

A six-step process for achieving a MRI is outlined in Figure 1. This study addresses the first three steps of the Kootenai’s MRI project by:

1. Providing background and developing awareness of management direction (step 1 - understand).
2. Providing an information needs assessment (INA) process to identify management objectives, issues and the information needed to conduct landscape assessments (step 2 - identify).
3. Providing tools to summarize, evaluate and prioritize information and data needs and their sources (step 3 - evaluate).
C. **Objective**

This study addresses the first three steps of the multiresource inventory process shown in Figure 1. Specifically, the study objective is to develop a formalized INA process for EM landscape assessments. It is intended to provide information, methods and tools to assist resource managers and specialists in defining, evaluating, and prioritizing the information, data and sources needed to expedite these assessments.
Chapter 2
BACKGROUND

This chapter provides background for determining information needs and integrating both resource data collection and analysis for EM landscape assessments. The information presented here was used in developing a formalized INA process for landscape assessments with the future goal of designing an integrated inventory. Information management is the underlying theme of this chapter and this study.

In my literature review I was unable to find a formalized (or existing) INA. Although the Rocky Mountain Region of the Forest Service recently developed an Integrated Resource Inventory Training Guide (USDA, 1995b), its personnel were unable to provide examples of or information on how they determined inventory data elements. I found some results from INAs, but as far as I could determine the INA process had not been formalized in a way that could be used as a model.

The first section of this chapter defines data and information and discusses integration. The second section provides background on Forest Service resource management direction and practices. The third section addresses INA concepts. The fourth section discusses sources. And the final section briefly addresses the topic of integrating inventories.

A. Definitions

Information and Data

Although the terms information and data are often used interchangeably, the distinction between them is important. Data are facts that result from the observation or measurement of physical phenomena. Technically, data are the raw facts and numbers that are processed into information (Freedman, 1993). Information is knowledge derived from study, experience or instruction. Information is the interpretation of data used in decision making (USFS, USDI, 1996). Depending on the analysis, different information can be obtained from the same data.

For example, one or more resource specialists may need information on land cover. Forest type is one descriptor of land cover. Forest type can be called an information element. Information elements are key characteristics, attributes or components of
information. They can be either directly observed data or derived "information". Forest type is an example of a derived information element. Tree species is the raw data which is used to determine forest type.

Functional resource areas often have overlapping needs. By determining which information elements are common between resources, efforts can be pooled and existing data can be compiled to achieve several goals with minimal duplication of effort.

Integration - Requirements and Barriers

For the purpose of this study, integration can be viewed as the process of combining or adapting information and data to achieve a holistic view of an ecosystem. Integrated assessment and inventories are required under current National Forest Management Act (NFMA) regulation and Forest Service manual direction, and they are absolutely essential for ecosystem management.

The most often cited barriers to integration include lack of agreement on objectives, functionalism, lack of communication, and organizational parochialism (USDA, 1993b). When inventory or assessment objectives are unclear, or if there is a lack of consensus on objectives, it is impossible to identify the priority resource questions to be addressed or to design an inventory. Forest Service attitudes, budgets and processes are strongly functional in spite of agency emphasis on interdisciplinary approaches. Functionalism becomes stronger in times of budget stress. Some specialists do not trust each other’s data collection or analysis methods and may not want to relinquish their data collection authority (Lund, 1986). Poor communication and coordination, within organizational units and between organization levels, leads to inefficiency and duplication. The result is reinventing the wheel by ignoring collective Forest Service experience whether it may be "functionally tainted" or not. Perhaps the biggest barrier is agency parochialism, i.e., the "it wasn’t invented here syndrome" that fosters the attitude that if we did not develop it, it can’t be any good; hence we won’t use it.

Lund’s (1986) four principles for integrating inventories are the foundation for obtaining meaningful data and information in an efficient and timely manner. Lund’s inventory principles directly apply to identifying information needs and elements. These principles are: cooperation and coordination, standardization, objectivity, and control and responsibility.
• Cooperation is needed to: a) establish minimum requirements for meeting information needs irrespective of resource area, b) establish information standards and minimum quality requirements, c) eliminate unnecessary duplication of data collection and analysis, and d) increase utility of resulting information.

• Coordination improves cost effectiveness by eliminating duplication of effort and by defining areas of responsibility.

• Standardization adds value to the information, making it useful to more people. It also facilitates making comparisons and combining data and information.

• Objectivity involves minimizing bias. Objectivity is needed so that data from different sources can be compared and aggregated. Measurement, selection and estimation are sources of bias. When selecting information to use in an assessment, objectivity is necessary to assure the information is suitable and adequate (meets quality standards).

• Assigning control and responsibilities insures that information and data are collected according to specifications. Control ranges from choosing standard map units, time frames, through to the collection, compilation and summary processes.

• Without commitment to the cooperation and coordination, the other three principles are useless.

The most critical factor in achieving integration is full participation (close communication and interaction) of the decision-maker and all resource specialists. These principles are essential for achieving the overall goal of improving efficiency in data collection and analysis.

**Types of Integration**

Due to the spatial nature of ecological questions associated with EM, integration, standards, and consistency become necessary aspects of landscape assessments. An underlying assumption of integration is that fragments of knowledge can be structured in a manner that permits many things to be related to each other in a meaningful way (Lund, 1986). Because integration may have a different meaning to people in an organization, it is helpful to recognize four types of integration (Lund, 1986).

• **Multilocation Integration** incorporates information from more than one location. An example is a forest wide data set created by two or more districts for forest planning.
• **Multilevel Integration** provides data sets for higher or lower decision levels, such as forest stand examinations that are used in both stand level silvicultural prescriptions and forest planning growth simulations.

• **Multiresource Integration** creates common data sets used to meet the information requirements of several resource functions at one location. A multiresource inventory attempts to record part or all of the biological and physical conditions of a site regardless of the intended resource uses.

• **Temporal Integration** covers the same survey area at two or more different times to determine changes and predict trends.

All four types of integration are relevant and must be considered in any EM assessment. EM requires establishing historic or reference conditions to identify changes and trends, thus it requires temporal integration. A holistic view of the landscape necessitates multilocalational (spatial) integration. Information must be compiled on Forest Service as well as adjacent lands. The concept of a staged decision making process, discussed in the next section, implies that multilevel integrated information is also needed. The focus of this study, the MRI project and the INA process described in Chapter 4, is multiresource integration of information at the landscape scale and the Ranger District level.

**B. Forest Service Resource Management Direction and Practices**

This section focuses on the *Understand* step of the MRI process. It provides the basic concepts pertaining to ecosystem management and explains how hierarchical assessments relate to resource decision making. The concept of staged decision making is presented to show how the National Forest Management Act’s direction and the National Environmental Protection Act (NEPA) process relate to landscape assessments. Incorporation of EM principles with forest planning is also addressed. This section concludes with an outline of necessary steps and tasks in an EM assessment.

**Ecosystem Management**

The EM concept provides an ecological foundation for management activities. EM shifts the focus from sustaining production of goods and services (sustained yields) to sustaining the variability of ecological, social and economic systems now and into the future (USDA, 1992, USDA, 1994).
EM Principles

- Understand natural variability
- Management and assessments at appropriate scales (multi-hierarchical)
- Conservation of diversity
- Consideration of ecological functions

Implications to FS Management

- Ecologically based desired future condition
- Coarse filter approach to analysis (with fine filter for special elements)
- Cooperation between administrative units and neighboring lands
- Influences forest planning and implementation
- Requires technology to address a variety of spatial scales
- Integrated ecological inventories are required to support EM
- Accountability emphasizing land conditions

EM objectives are achieved by maintaining and restoring desired vegetative conditions that maintain healthy (functioning) ecosystems. The goal is long term sustainable, productive, and resilient ecosystems.

The "Kootenai Forest Plan Revision Process" (Kootenai National Forest, 1996) illustrates the influence of EM on forest planning and describes the role of hierarchical assessments scales in resource management.

Hierarchical Scales for EM Assessments

The EM concept includes a broad and integrated look at the environment at many scales. Viewing ecosystems as being organized hierarchically with temporal and spatial scales has several implications for management. Assessment should be made at several scales, looking at larger scales to set context and smaller scales to understand processes (USDA, USDI, 1994).

A hierarchical framework of ecological units was developed to promote implementation of EM. These units provide a systematic method for classifying and
mapping areas of the earth (USDA, 1993a) at different geographic scales. Ecological units range from global and regional scales of 10,000 or more square miles to landtype units of less than 10 acres. Within this framework the Region 1 Forests are currently developing protocols for delineating and mapping ecological units for landscape assessments.

Ecological units provide basic information for natural resource planning and management. They are the basis for assessing resource conditions at multiple scales and are used in determining and describing ways to achieve desired conditions. At the forest and ranger district levels, three scales of ecological units are most relevant.

The **physiographic area** (PA) is the KNF’s scale for conducting EM landscape assessments. According to the "Kootenai Forest Plan Revision Process" (Kootenai National Forest, 1996) PAs are equivalent to subunits. PAs are landscape areas based on geologic patterns, hydrologic processes, topography and vegetative communities. PAs conform to watershed boundaries that generally correspond to fifth order hydrologic units. PAs aggregate to the larger **geographic areas** corresponding to the fourth order hydrologic units. These geographic areas are the planning units which will be used for KNF Forest Plan revision. PAs are subdivided into **vegetative response units** (VRUs). VRUs (formerly called ecological land units) are the basic management units for diagnosing ecosystem condition and health. The recently developed "Protocol II - Working Guidelines for Vegetation Response Units" (Northern Region, 1996) provides direction for delineating VRUs and using them to describe and develop landscape level treatments.

The appropriate scale(s) for data collection and analysis can be determined by identifying the issues or strategic questions to be addressed in an assessment. Issues such as protecting rare plant communities, geologic or other significant landscape features often need to be evaluated at more than one scale. Nesting information through use of this hierarchical framework requires integrated and consistent information.

**Staged Resource Decision Making**

The National Forest Management Act required the Forest Service to establish forest plans. The concept of staged decision making in forest planning is central to understanding how landscape assessments fit into this overall resource management direction. Staged decision making means that a final commitment to a specific action
or project is the product of two interrelated decisions. These two decisions are the *programmatic* decisions made in a forest plan and the *site specific* decision made for an individual action or project (USDA, 1990). Site specific decisions are based on an analysis process required by the National Environmental Protection Act.

Forest plan and NEPA project decisions may need to be bridged by an integrated resource analysis (IRA) on a smaller area of the landscape. For staged decision making to be most effective, an evaluation is needed to determine the best way to incorporate and implement decisions made at the broad forest level within a project area. IRAs that bridge forest plan decisions with project implementation are commonly considered NFMA assessments. Figure 2 (modified from Our Approach to Effects Analysis, USDA, 1990) illustrates that an IRA conducted at the landscape scale is one way of bridging NFMA and NEPA process decisions.

**Figure 2. STAGED DECISION MAKING**

The purpose of an IRA or landscape assessment is to identify opportunities and practices to achieve the desired future condition (DFC), not to decide what, where or how
resources will be managed. Table 1 illustrates how selected information elements are used in the diagnosis process to identify management opportunities. A VRU is the basic unit for diagnosis.

The EM diagnosis process consists of: 1) characterizing the historic or baseline and the existing conditions, 2) determining DFC and comparing it to the existing conditions, 3) considering consequences/effects, and 4) identify opportunities. With the DFC in mind, site specific project activities (NEPA project proposals) are developed. Table 1 also illustrates that the information elements chosen for diagnosing conditions should correspond to processes and functions of a "healthy ecosystem".

Table 2 illustrates how assessment opportunities translate to specific project activities with reasons based on EM principles. To determine where management activities are appropriate, the forest plan management area (MA) direction is applied. Harvest and tree planting activities are appropriate for MA 16 areas which are suitable for timber production and not for MA 19 areas which are classified as unsuitable lands.
Table 1. CHARACTERIZATION AND DIAGNOSIS OF VEGETATIVE RESPONSE UNIT # 1

General description of VRU # 1: Temperature and moisture conditions (warm, moist) approach optimum for vegetative diversity and growth in this VRU. Climax species are normally red cedar and western hemlock. A long growing season contributes to high species diversity. Fire intervals are variable but generally long. Mixed non-lethal burns can occur every 50-100 years with lethal burns every 200-300 years. Fire intervals are strongly correlated to aspect. Fuel loadings are the highest of any fire group in western Montana.

<table>
<thead>
<tr>
<th>INFO ELEMENTS (PROCESS/FUNCTION)</th>
<th>HISTORIC OR BASELINE CONDITION</th>
<th>EXISTING CONDITION</th>
<th>DESIRED FUTURE CONDITION</th>
<th>CONSEQUENCES OF NO ACTION (WITHIN 30 YEARS)</th>
<th>OPPORTUNITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patch Size</td>
<td>large (100-300 ac)</td>
<td>large, some small patches due to past harvest &amp; different burn intensities</td>
<td>manage for a variety of patch sizes within the historic range</td>
<td>same as existing</td>
<td>increase average patch size by harvesting adjacent to small patch clearcuts</td>
</tr>
<tr>
<td>Species Diversity</td>
<td>high in seral stands, moderate in climax communities</td>
<td>moderate due to high intensity burn &amp; past harvest</td>
<td>moderate to high</td>
<td>where high fire intensities occurred, limited tree regeneration &amp; decrease in amount of some desirable species</td>
<td>revegetate, enhance &amp;/or accelerate recovery of forage &amp; cover; improve watershed/fisheries conditions</td>
</tr>
<tr>
<td>Snag Numbers &amp; Diversity</td>
<td>high</td>
<td>high, except in old harvest areas &amp; adjacent to system roads</td>
<td>retain high density of large diameter PP/DF/L where available</td>
<td>high</td>
<td></td>
</tr>
<tr>
<td>Down Woody Material</td>
<td>high (&gt;25 tons/acre, large diameter)</td>
<td>moderate due to past prescribed burning &amp; high intensity wildfire</td>
<td>retain large diameter down woody material &amp; conditions which favor long fire intervals</td>
<td>very high, large concentrations of smaller diameter fuels where moderate intensity burn occurred</td>
<td>reduce smaller diameter (&lt;10&quot;) fuels in some areas; recover merchantable timber products</td>
</tr>
</tbody>
</table>
Table 2. PROPOSED ACTIVITIES AND THEIR REASONS, 
BY MANAGEMENT AREA FOR VEGETATIVE RESPONSE UNIT #1

<table>
<thead>
<tr>
<th>MANAGEMENT AREA</th>
<th>PROPOSED PROJECT ACTIVITIES</th>
<th>REASON FOR MANAGEMENT ACTIVITY</th>
</tr>
</thead>
<tbody>
<tr>
<td>16 (Timber)</td>
<td>Plant white pine &amp; Douglas fir to increase species diversity.</td>
<td>Seed sources may be limited &amp; not diverse. Planting is desirable in terms of species and genetic diversity. Potential for soil loss on steeper slopes is reduced &amp; nutrient release following a fire would be captured in tree growth. Planting may also accelerate transition from early to mid seral stages.</td>
</tr>
<tr>
<td>16 (Timber)</td>
<td>Remove merchantable trees killed by the fire.</td>
<td>Recover economic value of timber. In addition, standing dead trees (particularly smaller diameter) in high &amp; moderate intensity burn areas are likely to fall within next 30 years &amp; contribute to higher intensity fires if a fire start were to occur. Also in forest plan.</td>
</tr>
<tr>
<td>16 (Timber) &amp; 19</td>
<td>Leave large diameter PP/DF/L snags at 10 to 15 snags/acre.</td>
<td>These higher snag levels would compensate for past harvest areas &amp; roadside firewood areas which tend to be deficient in snags.</td>
</tr>
<tr>
<td>19 (Unsuitable due to Slope/Soil Instability)</td>
<td>Seed native species on unstable slopes adjacent to fisheries stream.</td>
<td>Vegetative cover &amp; its ability to recover quickly was reduced by intense fire in &amp; adjacent to riparian areas. Seeding would hasten watershed &amp; recovery.</td>
</tr>
</tbody>
</table>

16
A NEPA project analysis can be streamlined by determining the general types and locations of management opportunities early on, thus reducing the amount of site specific data and analysis. For staged decision making to be most effective, there has to be time between the landscape assessment and the project analysis stage to incorporate assessment findings into work programs. If there is no lag time between the IRA and the NEPA project, the tendency is to collect site specific data on the total area.

With a staged decision making process, bridged by a landscape assessment, the cumulative effects analysis can also be staged. According to "Our Approach to Effects Analysis" (USDA, 1990), it is preferable to at least partially assess effects of past and existing activities prior to detailed project planning. This evaluation should identify existing conditions, such as watershed, soil, vegetation, insect or disease, etc., which exceed or are close to exceeding natural ranges, forest plan standards, or other important thresholds.

Identifying and analyzing the cumulative effects of current conditions and management opportunities requires a broad scale examination which often matches the landscape assessment scale (USDA, 1990). Since identifying cumulative effects by assessing existing conditions is a logical part of determining management opportunities, the cumulative effects components should be included when determining information needs for a landscape assessment.

**Integrating EM Principles and Forest Plan Direction**

Forest plans (FPs) guide all natural resource management activities and establish management standards for each National Forest. The goals, objectives, standards, schedules of management practices, and monitoring and evaluation requirements comprise the management direction (USDA, 1987). FPs describe management practices, the desired levels of resource production and management, and the availability and suitability of lands for management. They blend scientific, ecological principles and social wants, needs and desires. FPs provide the broad direction to be incorporated into all resource management activities.

Many past natural resource decisions have been based primarily on social and economic considerations (USDA, 1994). A dilemma may arise when trying to combine ecological and social principles of EM with FP direction. Management activities based strictly on ecological principles can conflict with forest plan
standards, guidelines or management area direction. For instance the vegetative opening size standards in the FP seldom correspond to historic landscape patch size.

Possible approaches to combining EM fundamentals and FP direction are: 1) to develop the DFC and management opportunities based strictly on ecological principles; and 2) to develop a DFC based on both the ecological and social principles of EM.

With either approach, if the DFC results in a purpose and need for management activities that conflict with the FP, the decision-maker can: a) recommend amending the FP to agree with EM objectives, thus alleviating any conflicts prior to NEPA analysis; or b) in the NEPA stage, develop a range of alternatives which partly or fully meets FP direction. The NEPA effects analysis will identify the differences and consequences of adhering to the current direction, incorporating social desires or adhering to a strict ecological approach. It is generally accepted that at least one alternative must be wholly consistent with the FP.

Eliminating opportunities that are inconsistent with the FP, such as increasing average patch sizes, may compromise the intent of EM. As noted above, the forest plan amendment process may be instigated by the outcome of an EM landscape assessment. Indications are that either dealing with conflicts in the NEPA stage or amending the forest plan is cleaner than trying to resolve conflicts along with developing management opportunities in the IRA. When social and ecological components are incorporated in the IRA it becomes confusing to track objectives and resultant actions (Carlin, 1996). The "Landscape Analysis Process for the Helena National Forest" (Helena National Forest, 1995) describes their approach to integrating EM with forest plan implementation.

No matter how EM principles are incorporated, it is imperative that the FP, the NFMA, the Endangered Species Act and other resource laws, as well as the requirements in other substantive legislation and agreements such as the Inland Native Fish Strategy (INFISH) are considered when identifying information needs for an EM landscape assessment.

Conducting EM Landscape Assessments

Effective EM implementation requires clear problem definition, an awareness of knowledge of management goals and objectives, and a clear and solid assessment of
biophysical, social conditions, trends and management opportunities before creation and selection of possible solutions (USDA, USDI, 1996). The previous topics emphasized the big picture, the management procedures, goals and requirements. Here the focus is on identifying what is required for a clear and solid EM assessment.

Reviewing the general steps and tasks for conducting an EM assessment and *asking what do I need to know to accomplish this step* will help identify specific information needs and elements. Appendix A, Issues and Analysis Elements, provides a list of things to consider. The following outline presents four general steps:

1. **Characterize**
   - Determine the geographic, spatial bounds of the assessment.
   - Identify analysis units: VRUs for terrestrial and riparian areas, aquatic units and the socioeconomic unit(s).
   - Describe the physical, biological, social and ecological components of the total landscape and the VRUs. Describe existing conditions and natural/historic ranges of variability in terms of composition, structure, function and processes.
   - Identify interrelations between ecosystem components.
   - Identify rare elements, e.g., rare communities, geologic or other significant landscape features.

2. **Diagnose/Evaluate**
   - Determine an ecologically sound DFC for VRUs and the landscape, using the important ecosystem processes and components identified in the characterization step. Describe DFC in terms of physical, biological, ecological and social conditions.
   - Compare existing condition to DFC.
   - Identify *what* the management opportunities are.
   - Identify areas *where* conditions are inconsistent with the DFC.
   - Determine *how* to achieve desired vegetative, soil, and water conditions that maintain healthy ecosystems and that produce values and uses needed by society.
   - Develop management scenarios that combine the what, where and how to meet EM goals (i.e., minimize impacts, maintain processes and ecosystem health, preserve biodiversity, meet social needs and values).
3. **Risk/Effects**  
   - Compare trade-offs in terms of composition, structure, functions and processes versus outputs. Identify obvious risks, consequences, and some of the probabilities associated with no action, including cumulative trends.

4. **Issues**  
   - Identify issues which need to be addressed and resolved at the landscape scale, such as land use, ecosystem health, biodiversity, productivity and resiliency. Use what is known about ecosystem dynamics and functions to help resolve issues.
   - Identify existing conditions which exceed or are close to exceeding natural ranges, or other important thresholds.

The "Landscape Analysis Process for the Helena National Forest" (Helena National Forest, 1995) contains a more detailed description of one approach to landscape assessments. And the "Ecosystem Analysis at the Watershed Scale" (USDA, 1995a) presents an issue-driven approach to ecological assessments, where identifying issues are placed first in the assessment process. No matter what approach is used the basic information needs are the same.

*At the landscape scale the objective is to look at trends rather than detail.* Later in the NEPA project analysis stage, the EM landscape assessment will provide the context for evaluating cumulative effects at the broader landscape scale and provide some information about site specific project effects.
Summary of EM Assessment and NEPA Processes

**NFMA EM Landscape Assessment:**

1. Describe physical, biological, social and ecological environment.
2. Develop the desired landscape conditions.
3. Diagnose the landscape by comparing existing conditions and trends, to the desired conditions and trends.
4. Identify management opportunities.

Once management opportunities that help achieve the DFC have been identified, **then a purpose and need exists**, and site specific proposals are selected to be analyzed through the NEPA process.

**LEADS TO NEPA Project Analysis at Various Levels:**

- Categorical Exclusions
- Environmental Assessments:
  - Chapter 1 - Purpose and Need
  - Chapter 2 - Issues and Alternatives
  - Chapter 3 - Affected Environment
  - Chapter 4 - Environmental Consequences
- Environmental Impact Statements

**RESULTS IN:** Outputs, commodities, amenities, and healthy sustainable ecosystems.

Knowledge of management’s direction and broad goals is a prerequisite to conducting an information needs assessment. If resource managers and specialists agree upon the overall goals, objectives and procedures, then it is likely that all essential information needs and elements will be identified in the INA process. This is the basis for the **Understand** step of the MRI process.
C. INA Concepts

This section addresses concepts and important considerations for conducting an information needs assessment (INA). It includes the purpose and parts of an INA, and the role of the INA in developing a multiresource inventory. An INA fulfills the Identify step of the MRI process.

What Is An INA and Why Conduct One?

An information needs assessment is a definable process that documents what questions need answers, when, at what cost, and with what reliability. The purpose of an INA is to identify an organization’s requirements for the least quantity of information of the highest quality in the most timely manner (Hoekstra, 1981). Determining information needs is fundamental to effective information management.

There’s a saying, "If you don’t know where you’re going, you’ll never get there". Conducting an INA is like making a road map. You decide where you want to go, what you’ll need along the way, and what the destination looks like. Without this "map" you may reach your destination and not recognize it, and you’ve probably taken the scenic route getting there. The scenic route usually has side roads and detours, it can be fun and full of learning experiences, but it usually takes longer and costs more to reach your destination.

The INA Process

An INA leads from the general to the specific. The focus is on what is needed first, then the data. The key is to explicitly link data to management issues or decisions (USDA, 1991). The basic steps of an INA include: 1) reviewing laws, regulations, cooperative agreements, and memorandums of understanding to identify the information required at the broadest level of the organization; 2) examining emerging issues both nationally and locally; and 3) looking at data the decision maker needs in order to manage the resource at the local level (USDA, 1995c).

To determine information needs, the first step is to identify questions that need to be answered and management decisions that need to be made terms of specific resource
related issues and objectives. The decisions for a landscape assessment are: what alternative management activities should be considered to maintain and restore ecosystems, and when and where might these activities occur. The next step is to identify the information necessary to make those decisions and address the issues. Then you are able to choose the most useful information elements and determine if they already exist and what new data must be collected. This is the INA process in a nutshell.

Managing natural resources requires making decisions and an INA is a decision support process. To make decisions, resource managers generally need to know: 1) how much of a resource there is, its condition, and its location; 2) what the potential of the land and resource base is under various management alternatives; and 3) what the suitability of the land is and resources for management. The specific data elements will depend on what decisions are to be made and how the information will be used (USDA, 1995c). Examples of these three general types of information needs are:

1. **Inventories of elements:** Census or estimate of objects; estimates of univariate and multivariate distributions.
2. **Evaluation of potentials:** Landslide potential; erosion hazard; regeneration potential; natural vegetation potentials.
3. **Evaluation of suitability:** Wildlife habitat suitability; suitability for specific management activities and practices.
Summary and Role of an INA

Figure 3. FLOWCHART SHOWING THE OF INCORPORATION OF AN INA IN A MULTIRESOURCE INVENTORY

An INA defines what is needed (both the kind and quality) to make decisions, and it provides the foundation for undertaking a search for existing data. By comparing existing data to the identified needs and products, you can determine if new data or an inventory is necessary. Theoretically a complete new inventory could be designed based on an INA, regardless of existing information.

In summary, conducting an INA is central to efficiently accomplishing any level of land assessment or analysis. It also lays the foundation for designing an integrated multiresource inventory. Chapter 4 provides an outline and discussion of the INA process developed specifically for a MRI project.
D. Identifying and Evaluating Information and Data Sources

This section promotes an integrated approach to selecting the information and data sources to be used in an assessment. It addresses the Evaluate step of the MRI process by presenting key factors to determine if existing information and data sources are adequate for the needs identified in the INA.

A source is a place from which data can be obtained. Identifying potential sources for the desired information is part of an INA. Once you identify options then you can pick the most efficient methods of acquiring information. Evaluating information sources completes the "road map" by identifying how to get there.

"We must acknowledge that it is impossible to have all the current information about ecosystems, but we must plan based on what we have and use this information to determine what else we need. It is imperative to know what the risks are, based on what is known and the risks we will be taking because of what we don’t know." (Comanor, 1993)

Finding Data Sources

The INA provides the basis for undertaking a search for existing data (USDA, 1995c). Forms of existing data include: personal knowledge, inventory reports and databases, maps and overlays, old project files and records, computer spatial databases, remote sensing products and libraries. Sometimes personal knowledge may be the only or most readily available source of information, especially for past conditions or occurrences of rare elements.

Data can be found in most land and resource administrative agencies. The tendency is to look within one’s local unit and agency. Parochialism should not limit the search. The process of searching for existing data should be separated from the process of evaluating the data’s usefulness. Even though the scale of a remotely sensed vegetation map might not be suitable for determining management opportunities, it may be valuable for preliminary characterization or for stratifying the area for ground sampling. "A primer on evaluation and use of natural resource information for corporate data bases" (USDA, 1995c) is an excellent reference for locating digital and geo-referenced data.
Evaluating Existing Data

Existing data requires careful evaluation. It is usually more economical to use existing data, to the extent practical, than to collect new data, but in some cases, new data is needed. It is important to learn from the past. When the FS started forest plans, field units were instructed to use existing data. In some cases the existing data sets were outdated or inappropriate for integrated forest planning. Using this data was a costly effort resulting in delays in implementation as new inventories were completed and forest plans redone (USDA, 1995c).

Effective information management requires careful consideration of desired and required detail and reliability (standards). The level and reliability of information requires evaluation before significant resources are committed to gathering data. Do you need to characterize only forested ecosystems or all ecosystems in the assessment area? Do you need to know what percent of the area is forested or exactly how many acres are in the ponderosa pine forest type?

Selecting the combination of data sets that best meets the information requirements of an assessment is generally an iterative process. Selection should be based on a number of factors including: data availability, analysis procedures, accuracy requirements, costs, and timeliness. Prior to collecting and analyzing data the relative risk of incorrect decision must be weighed against the cost in dollars, time and personnel. Both the user (resource specialist) and the "decision maker" must be involved in defining information requirements because inadequate information could lead to poor management decisions as well as damage relationships with the public. Only after defining requirements and risks can you identify what kinds of data are already available and whether they are useful and cost effective for a specific purpose even if biases exist (Bourgeron et al, 1993).

There is a difference between evaluating data suitability and evaluating data quality. Evaluation of suitability focuses on what the data purport to represent. Evaluation of quality tests to see if data meet the purported specifications (USDA, 1995c). Suitability should be evaluated before quality, depending on the risk you may be willing to use the existing data even if errors or biases exist. Figure 4 illustrates a process for evaluating the suitability and quality of the data (USDA, 1995c). If suitable data of adequate quality are available, you need to decide if they need to be converted or updated, and you should determine if it would be more cost-effective to gather new data instead of using existing data.
The three primary criteria for evaluating sources are: 1) adequate data documentation, 2) ease of interpretation and use for intended purposes, and 3) cost efficiency of using existing data, are described below (USDA, 1995, Lund, 1986).

1. **Adequate data documentation**
   - sources of original data and methods of collection
   - scales or intensity and resolution of original data, including minimum map size or broadest sampling frequency
   - agency inventory programs that relate data and its limitations as perceived by the originator and users
   - significance or importance of the resource to the agency and rationale for classification schemes or setting priorities
   - quality control checks applied in collection, compilation and summary
   - data collection and compilation dates
   - name, phone number and address of person to contact for further information
2. **Ease of interpretation and use for intended purposes**
   - data in a form that users can readily understand
   - data used without special reinterpretation
   - variables defined and used in the same way as currently required
   - data still valid (represents existing conditions)
   - sample units readily identifiable (common map units across spatial temporal scales)
   - sampling techniques statistically valid and degree of reliability can be determined
   - standards same as what are currently needed
   - adequate quality control checks applied in data collection, compilation, and summary

3. **Cost efficiency of using existing data**
   - cost of collecting new data and if existing data are basic enough to be reinterpreted, and what are the saving as opposed to collecting new data?
   - data relevant and valid for the time span required
   - likely cost of repeating the inventory if data collected is inadequate

Determining where or how information needs will be met completes the project road map by identifying how you will reach your goal or destination. Efficiency in conducting a landscape assessment means determining what is sufficient to meet management goals and using existing information to its fullest extent.

**E. Defining Objectives and Integrating Inventories**

This section further elaborates on the **evaluate** step of the MRI process and sets the stage for the **design** step.

Efficiency results from consistency, reaching common terminology, definitions, inventory elements, etc. Data compatibility is often of much greater importance than efficiency (in data collection) (Illes, 1994). Applying **standards** across all units will allow comparison of information and avoid the time and energy required to develop conversion routines and other adjustments that are frequently necessary. A starting point is an integrated inventory on each forest so shared issues can be dealt with comparably and at least are based on shared assumptions (Comanor, 1993).
An integrated inventory is an inventory or group of inventories designed to meet multilocation, multidecision level, multiresource, or monitoring needs (Lund, 1986).

Methods for Obtaining Multiresource Information

Lund (1986) discusses four possible methods for obtaining multiresource data:
1. taking additional measurements and observations at existing sampling units within existing sampling frames
2. adding additional data from maps, overlays, and more sample data locations
3. developing new sampling frames and designs
4. using data from other resources in its present form

Any of these methods can work if common sampling units were used. The concept of common map units is key to aggregating data. The "Integrated Resource Inventory Training Guide" (USDA, 1995b) contains valuable information on establishing common map units that comply with national hierarchical principles as well as other agency direction.

Method 4, in which data from a variety of sources is simply combined together to form a base set is probably the easiest and the most common method used in FS landscape assessments. It is probably the least desirable because:

- Bias can result if data are collected on sampling units of different sizes.
- There is no assurance that available data are appropriate without evaluation.
- Total cost may be higher than necessary if all the data collected is not used or some data are collected more than once.
- It is difficult to determine interactions between ecosystem components if variables were measured at different times and places.

If different standards, definitions and inventory techniques are used, the reliability of the combined data should be questioned. These are the same problems the KNF recognized in initiating this study. These "pitfalls" can be minimized by well defined needs, specifying the limitations of existing data, properly defining inventory objectives and agreeing on standards. Standard methods are needed to aggregate data. The problem is often too much rather than too little data (Illes, 1994).
Establishing common map units and quality standards are critical to developing multiresource inventory sampling schemes (Alverson, 1981).

**Defining Inventory Objectives**

Prior to designing an inventory the client must be able to articulate needs in specific terms. The intended purpose, process and products must be understood by the client/user as well as the designer (Alverson, 1981). Some questions to ask before assembling a new inventory (USDA, 1995c):

- What do laws, charter, or higher echelons require and what data are needed to meet those requirements? (For example: What information or data is required by the Code of Federal Regulations to determine if an area is suitable for timber harvesting?)
- What current and future issues and resource decisions does the manger face and what additional data are needed to face them?
- What is the geographic area in question?
- What is the risk (cost) of making an incorrect decisions? How **accurate** must the data be?

To answer these questions the resource specialists or information manager must know the decision making process and all "stakeholders" must be involved in defining the inventory elements. In other words an integrated INA is necessary.

Needs assessments are useful, but the answer to the question "what is required?" is not completely known or knowable. It is important to recognize that when assessing inventory needs, it is impossible to compile a complete list because the rules keep changing (Illes, 1994). The point is deciding (what is needed) is not the same as knowing.

Managers and specialists often have difficulty in specifically defining what they need or really want. The client must convey what is needed, when, and the error that can be tolerated, type and size and finally the risk (probability of error statement being wrong) management is willing to take (Cunia, 1981). The perceived or future data uses will greatly clarify actual needs. For example: if you need current timber volume then no growth information is needed; but if you want volume again in the future, you do need growth. Learning from past inventory successes and failures is
one of the most important tools an inventory designer can use (Alverson, 1981). How well needs are identified directly affects the usability of the end product.

The INA should provide enough detail to develop inventory objective statements which define the primary elements/attributes to be estimated, limitations associated with the attributes, the precision required and the area to be surveyed. The sampling design can meet the purpose of the survey only if the objective is explicitly defined (Bourgeron et al, 1993). An example of an inventory objective statement is: "to estimate the total cubic foot volume of live and dead trees with a diameter of 5 inches or more in the Pine Creek watershed".

The first step in designing an inventory is specifying the objective(s). Failure to define objectives can result in the collection of the wrong kind of data, too much or too little data, or unreliable data (Cunia, 1981, Lund, 1986).

Because information management is a complex, time consuming, costly process, it is critical to make sure the results are taken to completion and presented in a usable form. A strong foundation and standardized procedures are essential if efficiency is to be achieved by integrating inventories. Many agencies have done user needs summaries, some as simple as one-on-one discussions over coffee; others where the collection of needs became, like the collection of anything else, an inventory. The amount of effort and accuracy of the identify step in an INA will determine the usefulness of the subsequent inventory and data (Alveson, 1981). Separating the doable from the impossible dream and arbitrating priorities is particularly difficult if there is a large number of diverse users, as in a multiresource or multilevel inventory approach.
Chapter 3
INFORMATION NEEDS ASSESSMENT DESIGN

The study methods are presented in this chapter. A conceptual framework for developing an information needs assessment process for EM landscape assessments is presented first, followed by a description of the survey area, data collection methods and influencing factors. A detailed description of the study is followed by a diagram summarizing the study design.

The study objective is to develop a formalized INA process for EM landscape assessments. It is intended to provide resource managers and specialists (IDTs) with information, methods and tools to assist them in defining, evaluating and prioritizing their information and data needs. This study lays the foundation for the multiresource inventory project goal of improving efficiency by integrating data collection and analysis methods.

A. Conceptual Framework and Study Design

This developmental applied research study is a composite of deductive and inductive procedures, a compilation of information, a pilot survey and two partial tests of the INA process, and a lot of trial and error (monitoring and evaluation). A flowchart of the INA design process is displayed in Figure 5.

Two approaches are generally used to determine information needs: a top-down approach, where information requirements are defined at the highest organizational level first, and each successive level adds to the requirements; and a bottom-up approach, where information requirements are defined at the local level and aggregated upward (Lund, 1986). A bottom-up approach was selected by the client (Kootenai National Forest), because commitment to the process and results are critical to the project’s success. It was assumed that specialists at the forest and district levels have an adequate understanding of the higher level’s requirements.

B. Study Area

The primary study site is the Kootenai National Forest. The initial survey sample population was the 11 key resources specialists assigned to the MRI project task force by the KNF. These resource specialists included: a wildlife biologist, two
silviculturists, a hydrologist, an archaeologist, an ecologist, a fire and fuels specialist, an information engineer, a forestry technician, a NEPA coordinator and a planning operation research analyst. They were responsible for including the opinions of their contacts and peers at upper and lower levels in the Forest Service. The scope of the survey was expanded through interviews of non-task force Forest Service managers and specialists. Survey information was supplemented with literature provided by specialists and independent research. Reviews of preliminary INA results included task force specialists as well other Forest Service personnel within Region One. Two district IDTs participated in partial trials of the INA process.

C. Data Collection

Data was collected by surveying and interviewing Forest Service resource managers and specialists and reviewing literature. This opinion data is nominal and subjective, and is intended for use in a descriptive analysis, i.e., the resulting INA example checklist.

The focus of data collection was identifying information elements. The information elements (dependent variables) represent more universal and long-term data requirements than the general information needs, or current issues and objectives. Information elements provide enough detail to determine where functional resource areas have common needs without taking the time to define detailed data, variables or measurement units. In this study information elements are the common denominators for determining overlapping needs and for making resource decisions.

An example of the relationships among the objectives, information needs and elements is: If the ecosystem management objective is to determine vegetative condition and health, and the information needed is a description of composition; then some information elements would be forest type, size class, successional stage and density. If an issue is old growth forests, and the information needed is the amount of potential old growth, then elements might include successional stage, stand age, and forest type. The common elements for both information needs are forest type and successional stage. The Needs Outline Report, in Appendix B, provides more examples of these relationships.
D. **Influencing Factors**

The major factors influencing this study are: 1) The methods and procedures needed to satisfy the stated objective are not well established; 2) The validity and completeness of the information gathered in the surveys is dependent on the array of specialists, their degree of involvement and level of expertise, and on the feedback received through reviews; 3) Demonstrating the utility of the INA process is contingent upon the development of a relational database and summary reports; 4) The degree of improved efficiency in assessments, analysis and future inventories is dependent on completeness of information gathered, and on the acceptance and use of a formalized process; and 5) Obtaining adequate input, support and cooperation of agency personnel, especially those not assigned to the project.

E. **Study Process**

This study is a developmental, applied research problem analysis. The iterative process of conducting an exploratory analysis of information needs for EM landscape assessments required the following activities.

I began this study by researching and reviewing literature to identify basic concepts and methods. Research topics included: resource inventories, current inventory methods, conducting resource assessments, integrating information, Forest Service management direction, decision making, landscape ecology and ecosystem management principles and concepts, and identifying and evaluating information sources, and information needs assessments. Based on this research and personal experience, I hypothesized the questions pertinent to an INA for the given study objective and MRI project goals. I developed the INA questionnaire and instructions in Appendix C.

The Forest Service (client) assigned a diverse group of specialists to the MRI project. These specialists were the IDT for the pilot INA survey. A meeting was held to establish and discuss study objectives and the role of the task force. This meeting was followed by sending the questionnaire and directions to the task force IDT.

Using a word processing format, I compiled an aggregated response list from the pilot survey. Based on my knowledge and experience, I analyzed the survey results to identify weaknesses and data gaps. Then I conducted one-on-one interviews to clarify needs and terminology, and to gather additional data. I was given "specialist
background references" (such as INFISH guidelines) to interpret and incorporate in the INA. I used these references and additional literature to supplement the pilot survey data.

From compiling the survey I learned that the word processing format did not provide the summary and analysis features I needed. I looked at alternative formats, including spreadsheets and databases. I wanted to maintain the connection among the overall issues and objectives, their information needs and the associated information elements, and to have the ability to change the database structure if additional data fields were needed. Oracle, a relational database software package was selected for the INA database because it is widely used by the Forest Service and the Oracle Server is available on both the Data General and IBM computer systems.

With the help and expertise of Forest Service computer specialists, I designed and developed an INA database to store, analyze and summarize survey data, and to produce an INA example checklist. Database design required identifying the important attributes to include in the database. This meant defining the database fields, determining the relationships among data, and selecting the size and characteristics of the data fields. I created a data dictionary with examples for future use. I populated the database using the opinion data collected from my initial survey, interviews, literature, and knowledge of Forest Service data and sources.

A computer specialist designed the data input forms and created some Oracle Reports to summarize the data. These reports were used to produce an INA checklist. I worked with a number of computer specialists and learned to use the database, to write SQL (structure query language) queries and to modify and create more reports. I wrote directions for using the database, queries and reports.

Using research on INAs, the pilot INA experience, and my experience on Forest Service IDTs, I develop a more structured and formalized INA process tailored for IDTs conducting landscape assessments. Based on research and experience, I compiled pertinent background information to set the context for these assessments and explain the INA goals.

I conducted partial trials on two ranger districts to get feedback on the INA example checklist and test the INA process. I subsequently incorporated the recommendations into the INA checklist and refined the INA process.
In conjunction with my initial research, I developed a source evaluation process and forms to be used in the INA process. An evaluation of sources is needed to objectively choose between existing data sources and to assess the need for new data collection. Developing a formal evaluation process required research to determine appropriate evaluation criteria and knowledge about Forest Service data and culture to select criteria that would be readily available.

Figure 5. FLOWCHART OF THE INA DESIGN PROCESS
Chapter 4
RESULTS

The results of this study serve a two-fold purpose. First it provides a process, framework and tools for conducting an INA at landscape scale. Secondly it provides a preliminary data elements list with key attributes for designing a multiresource inventory.

This chapter presents the formalized INA process. The first section outlines and explains the INA and source evaluation processes, and describes how the database reports are used in the process. The INA database structure, features and reports, are presented in the second section. This chapter is intended to provide guidance for interdisciplinary teams using the INA process and database.

A. INA and Source Evaluation Processes

This section provides a summary and key information about INAs, and discusses IDT expectations. An outline of the INA process developed specifically for landscape assessments is followed by guidelines and an explanation of each INA step.

IDT Introduction

The INA process is intended for IDTs beginning a landscape assessment. It is anticipated that several IDT meetings will be needed to complete the INA. The amount time the INA takes will depend on the IDTs experience. Although the process requires time up front, overall time and energy will be saved if all participants have a clear idea of expectations before starting the assessment. A formalized INA is a way to establish common goals and promote understanding. This process can be used to document both what is needed and what was determined to be non-essential. The data gathered in the INA will be recorded in the INA database.

Everyone participating in the assessment needs to understand the INA process and its purpose. Cooperation, coordination and open communication are crucial to a successful assessment.
INA objectives include:

- Organizing participants to do an assessment and documenting the plan.
- Identifying the kind and quality of information needed to make resource management decisions.
- Helping insure that excess data is not collected or analyzed.
- Placing all team members "on the same wavelength" by identifying expected outcomes and individual responsibilities.
- Identifying opportunities to share information and tasks.
- Identifying the products needed (maps, reports, descriptions, measurements)
- Identifying what information and data sources will be used.

The INA process proceeds from the general to the specific, but additions and changes may be incorporated throughout the process. A series of steps are used to determine what information and data is essential to completing the assessment. All steps include: 1) Communication and discussion to achieve consensus and integration. 2) Defining key attributes and recording them in the INA database. 3) Choosing what will be included before moving to the next step.

How the IDT conducts an INA depends on the team's experience level and the leader's preference. A combination of approaches will probably be the most efficient. Approaches include:

1. Prework - individual review of INA example checklist or listing their specific elements and requirements.
2. Brainstorming - to identify objectives, needs, elements and or sources
3. Using subgroups with common needs or interests to clarify, prioritize needs and choose sources.
Figure 6. STEPS TO DETERMINE THE KIND AND QUALITY OF INFORMATION FOR A LANDSCAPE ASSESSMENT

Step 1
IDENTIFY ISSUES & /OR OBJECTIVES (IOs)
1. Identify Objectives of Policy & Management Direction
2. Identify Current & Emerging Issues
3. Identify Resource Management Decisions to be Made
* Clarify and Agree on IOs & Reasons
4. Prioritize IOs (if applicable)

Step 2
IDENTIFY INFORMATION NEEDS (INs)
1. Identify Info Needs to Meet or Address IOs
2. Identify Resource Area
3. Identify Mandate(s) (if applicable)
4. Identify Information Kind(s)
* Clarify and Agree on INs
5. Prioritize INs (considering importance for IOs)

Step 3
IDENTIFY INFORMATION ELEMENTS (IEs)
1. Identify Elements to Meet INs
2. Review, Consolidate and Compile an IEs List (standardize wording and identify common elements)
3. Prioritize IEs (considering importance for INs)
4. Define Characteristics of IEs
   a. temporal bounds
   b. spatial bounds
   c. variable
   d. unit of measure
5. Identify Steward, Sources and Status
6. Assign Categories (for summary and analysis purposes)
   a. strata
   b. EM class
*
7. Prioritize and Select IEs for Assessment
8. Assign Responsibilities (for identifying and evaluating information/data sources)

Step 4
IDENTIFY and EVALUATE SOURCES
1. Identify Specific Source(s) (best 1-3 sources)
2. Define Characteristics of Existing Sources (to determine usability and suitability)
3. Evaluate Existing Sources
   a. Compare existing to identified needs (INs and IEs descriptions from Steps 2 and 3)
   b. Costs to modify (if not readily usable)
   c. Accuracy/reliability and risks
4. Recommend and Select Source(s)
   a. Existing data
   b. New or supplemental data
   c. Get Decision Maker's Approval
5. Assign Responsibilities (for obtaining, organizing and displaying data and information)

NOTE: Tasks above the dashed line can be accomplished by individuals or subgroups while those below the line are accomplished as an IDT.

The four steps outlined in Figure 6 are described in more detail on the next pages. The descriptions include examples and which database fields should be completed in each step. For ease of identification, database fields are italicized in the remainder of this section. The example reports and queries referenced in this section are shown and described in INA Database section of this chapter.
Step 1 - *Issues and Objectives*

The purpose of this step is to set the context for the assessment.

The **first task** is to achieve a common level of understanding of management direction and assessment objectives and process. This foundation can be laid by reading Chapter 2 and or discussing the topics in chapter 2. It is imperative that the IDT members are aware of the management goals and objectives of their organization.

The following questions and instructions can facilitate discussion and remind the team of what to consider as they identify issues and objectives, information needs, and information elements.

- What information and data is required by legal mandates, agreements and policies (including forest plan, NFMA, Endangered Species Act, EM, etc.)?
- What management decisions are to be made at the landscape level (i.e., what is a landscape assessment supposed to accomplish)?
- What information and data is required to make those decisions?
- What current and emerging issues will need to be addressed to make those decisions?
- What steps or process will be needed to conduct this assessment?
- What characteristics are the best indicators to diagnose/evaluate ecosystem health?
- What characteristics should be used to determine and describe the desired future condition?
- What are we currently including in resource assessments that should to be continued, improved or dropped?
- At the landscape scale the objective is to look at trends rather than details.
- The goal is to identify all information **necessary** for this assessment (but not all the site specific data for a NEPA project level analysis).
- Remember that the spatial and temporal bounds (scales) should match the scale of the issues and objectives.
- List all important information and data, even if it is not available at district or forest level at this time.
When the team agrees on the assessment goals, then the **second task** is to identify and select the issue or objective statements (define the specific route).

**Definitions:** An issue is a point of debate, discussion or dispute which is generally a matter of public concern. Objectives are the things you want to achieve through resource management. Objectives are generally more measurable and less theoretical than broad overall goals.

Because issues and objectives may be closely related (just a matter of how they are phrased), it is not critical in this step to distinguish between them. The *steps* of the "Ecosystem Analysis at the Watershed Scale" (EAWS) process (USDA, 1995b) could be used as objectives. The core topics and questions would then correspond to the information needs level of the INA process.

**Example:** An example issue is: Are current fuel conditions increasing the probability of uncharacteristic fires on the landscape? An associated objective might be: To minimize the probability of uncharacteristic fires on the landscape, by maintaining or restoring fuel conditions within historic/natural ranges. Both require the same information to make the management decisions about: what alternative activities should be considered to reduce the risk of uncharacteristic fire events, and where should these activities be implemented.

For additional examples see Table 5 *Issues and Objectives Report* or Appendix B. Appendix A lists pertinent issues related to resource management in Region 1 and on the Kootenai Forest in recent years.

**Database Fields:** The **third task** is to complete and enter data in the database for the following table fields:

- **Issue/Objective description** field (issue or objective statement).
- The *comments* field can be used to clarify the issue or objective, its purpose or record other notes.
- The *reason* field identifies the purpose or where the issue or objective fits into the general steps for conducting a landscape assessment.
- If applicable the team can assign a *priority* to each issue or objective.

**How:** The initial task of identifying issues and objectives can be accomplished by an IDT brainstorming process, or by individual resource specialists writing their own
issues and objectives or selecting issues and objectives from the INA checklist prior to the IDT meeting. The more concisely and specifically the issues and objectives are identified, the more easily and clearly the information needs and information elements can be identified in steps 2 and 3.

After the IDT agrees on the issues and objectives and the priorities, a project specific Issues and Objectives Report can be generated so the next steps can be initiated.

**Step 2 - Information Needs**

The purpose of this step is to identify the information needs; what you need to know not what data. Generally information needs include: what is present, where it is, and how it works in relation to larger and smaller scales.

**Definitions:** Information is the interpretation of data used in decision making. Information is derived from study (analysis of data or other information), experience or instruction.

The **first task** is to identify and define the information needed to address the issues or meet the objectives selected in step 1 (write information need statements).

**Example:** Several information needs can be required to satisfy one issue or objective. For the fuel issue "Are current fuel conditions increasing the probability of uncharacteristic fires in the landscape?", you need to know: 1) if current fuel conditions differ from natural/historic ranges and where; 2) if current fuel patterns differ from the natural/historic range of patterns and where; 3) what the characteristic fire regimes were and where; 4) how fuel conditions and fuel patterns interact and affect fire regimes. More specifically the information needs are: 1) what are the current and historic fuel complexes (composition and structure of live and dead fuels); 2) what are the current and historic fuel patterns; 3) what are the natural/historic fire regimes; 4) how did natural/historic fire processes function; and 5) where do the conditions and patterns occur.

For additional examples, see Table 6 Information Needs Report or Appendix B. The Short Needs Outline Report, and Table 8 Information Needs Report generated by resource area can be helpful with the first task.
**Database Fields:** The second task is to complete and enter data in the following database fields:

- *Information Need description* field (information need statement).
- The *comments* field can be used to clarify the information need and record other notes.
- The *resource area* requesting or interested in the information.
- The *mandate* (if applicable) requiring the information to be evaluated or displayed.
- The *information kind* identifies the information need as qualitative, quantitative and or map.
- The *importance* field records the priority or relative importance of the information need in relation to the issue or objective.

The third task is to finalize priorities and select the information needs for the assessment. A *project specific Information Needs Report* can be used with this task.

**How:** The initial task of identifying information needs can be accomplished by an IDT brainstorming process, or by individual specialists as meeting prework. In either case the more specifically the information needs are identified, the more easily and clearly the information needs can be identified in step 3. To speed up the task of prioritizing information needs, initial coding of *importance* can be done by the specialist(s) who identified the information need. But the final priorities should be determined by the IDT while clarifying and agreeing on the information needs.

Once the information needs have been clearly stated, agreed on and prioritized by the IDT, a *project specific Information Needs Report* can be generated so the next step can be initiated.

**Step 3 - Information Elements**

The purpose of this step is to identify and define the essential data needed for the landscape assessment, so only data that is essential to the decision process is collected. By determining which information elements are common among resource functions, data collection and analysis efforts can be integrated. Existing data can be compiled to achieve several goals with minimal repetition. Information elements are the building blocks for conducting an integrated assessment and for designing an integrated inventory.
Definitions: Information elements are key characteristics, attributes or components of information. They need to be specific enough to identify what to measure. They can be raw or derived data elements.

The first task is to identify and define the information elements for the information needs selected in step 2.

Example: To satisfy one information need several information elements are usually needed. For example, the information need of the natural/historic fire regime would be described by the following information elements: 1) fire frequency; 2) fire size; and 3) fire intensity. These elements would be used to describe a characteristic fire regime for each vegetative response unit.

For more examples see Table 7, the Information Elements Report or Appendix B. Appendix A also provides examples of elements for EM assessments. Table 11, the Needs Outline Report and can be helpful with this task. Also Tables 8 and 9 Information Need Report generated by resource area or by strata and Common Elements Report, shown in Table 10 can assist in determining subgroup assignments.

The second task is to review the information elements. Group and reword similar information elements to form a consolidated elements list. Generating the Information Elements Report with a key word description can help with this task.

Database Fields: The third task is to complete and enter data in the following fields in the database:

- Information Elements description field.
- The comments field can be used to clarify the information element and to record other notes.
- The importance field identifies the priority or relative importance of the information element for meeting the information need.
- The fields temporal bounds, spatial bounds, variable and unit of measure define information element’s characteristics.
- The steward is the functional group responsible for or having the most knowledge of the information element.
- The status is an estimate of how complete the information element is in both coverage and adequacy.
• The source field lists one or more general categories where the information element can be obtained.

• The strata field categorizes the information elements into environmental components. (Strata categories can be used in forming IDT subgroups.)

• The EM class field categorizes information elements into ecosystem classes (i.e., composition, structure, function, process).

The fourth task is to finalize priorities and select the information elements for the assessment. Table 12 Importance and Status Query, a project specific Information Element Report and Needs Outline Report can help with this task.

The fifth task is to assign responsibilities for identifying and recommending the sources (determine who and how step four will be accomplished).

How: Although the first task of identifying information elements can be accomplished by an IDT brainstorming process, it will probably be more effective for the resource specialists, individually or in subgroups, to identify the information elements. At the same time the information element database fields should be completed and the information elements importance rated. The more specifically and clearly the information elements are identified, the more readily common elements can be determined. For the second task, IDT leader or assigned specialists need to review the elements. Because an information element may be of low importance for one resource and high for another, the fourth task of final prioritizing should be done as an IDT while discussing and agreeing on which information elements to include in the assessment. As information elements are selected, there should be a clear concept of how the element will be used in the EM assessment. Table 1 illustrates how information elements are used to determine opportunities. When responsibilities for recommending sources are assigned, these "stewardship" assignments can be coded in the database to produce an assignment list.

At the end of this step the kind and general quality of information has been identified. A pretty good road map or plan has been developed for the assessment. The purpose of the information and how it will be used has been outlined. Desired products have been identified. By identifying the common information elements, mapping and data analysis efforts can be coordinated. The information element’s characteristics have been defined. But you have not determined where you will get the data. You do not
have an estimate of the cost of the data, and you have not determined if additional
data or field inventories are necessary. This leads to step 4.

**Step 4 - Source Identification and Evaluation**

Frequently more than one data source is available. So you want to choose the "best" source and most efficient means of obtaining the necessary data. This step answers the questions: What sources exist? Where are they located? and Are the existing sources usable and of adequate quality? The source identification and evaluation step has two purposes: 1) to decide what existing data will be used in the assessment, and 2) to identify whether new supplemental data or a new inventory is warranted. In this step, one or more project specific sources are identified for the information elements selected in step 3.

**Definitions:** A source is a place from which information or data can be obtained.

The **first task** is to identify specific data sources for the assessment and their attributes. To objectively evaluate the source’s usability and adequacy, the following criteria will need to be determined and considered:

- steward (who knows the most about the source)
- date or age of the data (how current the data are)
- temporal bounds (time period)
- spatial bounds (geographic coverage)
- status (percent of geographic area included)
- kind (and map scale if applicable)
- format (i.e., field notes, summarized reports, automated, digital)
- method of collection and procedures (sampling units/design especially for map and field data)
- determine the reliability/quality (is it good enough for the decisions to be made?)

Table 13 Sources Query and the Importance and Status Query provides general sources for beginning this task.

**Database Fields:** The **second task** is to compare the sources’ attributes to the needs which were determined in INA steps 2 and 3. The database fields pertaining to this
task are: information needs, information kind, information elements, steward, source, spatial and temporal bounds, variable and unit of measure. Project specific Information Needs and Information Element Reports provide assistance for this step. Common Elements Report may also help with this task.

The third task is to use an evaluation process. If the source is not readily usable, a cost estimate for modifying or reformatting the data should be made. Existing data should be used whenever possible, but combining sources to "complete the picture" often reduces accuracy and reliability. Another consideration is the risks associated with a decision based on inadequate information.

Examples: Figure 4 provides a flowchart of a data evaluation process. Appendix D contains forms, instructions and examples for a formal documented approach for evaluating sources. The forms provide a format for evaluating and comparing sources, and for determining whether new data must be collected. The formal approach documents data reliability and weaknesses. If the evaluation forms are used the rationale and decision to use existing sources or collect more data is documented. This can be very beneficial when IDT members or the decision maker changes during the assessment.

The fourth task is to recommend and select the sources for the assessment.

The fifth task is to assign responsibilities for obtaining, analyzing and displaying the required data.

How: An integrated, subgroup approach to identifying and choosing sources will assure that IDT members’ needs are met. This approach should facilitate integrating data collection and analysis. Project specific Information Needs and Information Elements Reports and Information Element Report generated by strata and or resource area can be used for making subgroup assignments. In the evaluation process the specialist’s role is to identify, compare and recommend the sources to be used and to identify whether new or supplemental data is needed. The decision-maker’s role is to decide whether and when new data needs to be collected.

Once you have determined what data you have and don’t have, then you can pick the most efficient methods of acquiring it. An integrated approach to determining which sources will be used promotes sharing of existing data. When data gathering and
analysis duties are shared, work is not duplicated and the end results are comparable (i.e., estimates of areas in a similar condition are consistent).

The conclusion of the INA process is the selection of specific sources to be used for the landscape assessment. This completes the assessment plan. If new information needs are identified as the assessment progresses they can be incorporated into the plan by editing the database.

B. INA Database

The Information Needs Assessment Database (INA Database) is a tool designed to capture, display and summarize the information gathered in the INA process. This section describes the database structure and discusses the purpose and features of the database. It includes examples of some of the many reports and queries.

Introduction and Purpose

The INA Database assists with the planning and execution of landscape assessments. This information management tool helps IDT specialists and resource managers group, analyze and prioritize their information requirements. It also captures essential information for designing resource inventories.

The INA Database is designed to be used by IDT project leaders. With the existing queries and reports, they can: 1) develop an assessment plan, 2) make assignments lists for IDT members, and 3) identify opportunities to share work. A primary purpose of the INA Database is to make it easy to identify which information elements are needed most frequently and which are required by several resource functions (for multiresource integration). The database provides the framework for collecting the INA "data" (like a survey form). These data can be easily updated as management direction or needs change, saving the time and expense of a whole new INA. Information needs can be prioritized to be project specific.

INA Database Structure

The INA Database uses the Oracle Relational Database Management System. The INA application is available on the Forest Service's IBM computer system (operating system Version 2.0).
The features of a relational database (Abbey, Corey, 1995) are:

- A relational database is data-driven, not design-driven. It is designed once, and the data can be changed without affecting the applications. If new data needs arise, the database does not need to be restructured to add fields. New fields and relationships can be added without redesigning the database.

- The data is self-describing because you use meaningful labels. For example, the information need is identified as information_need.

- Data is stored in one place, read from one place, and modified in one place. Data is stored once, so maintaining consistency among all applications is easier.

- Rules that control how the data will be stored are defined and enforced.

A relational database structure was chosen in order to maintain the connection between the overall issues and objectives, their information needs and the associated information elements. The key to a relational database is establishing the relationships between data elements and structuring the information to reflect those relationships (Abbey, Corey, 1995). With this structure data redundancy is minimized and search and retrieval is fast.

The INA Database is structured to feed into the INA process. There are three primary database tables: 1) Issues and Objectives, 2) Information Needs, and 3) Information Elements. There is also a proposed Source Table which is described in Appendix E.

Figure 6 shows the database's table structure and illustrates that the Issue Objective Table must have one or more information needs, and the Information Needs Table must have one or more information elements. Each primary table has several attributes (descriptor fields). Some of these attributes are recorded in the primary table along with the master record. Other attributes or detail records are recorded in match tables. A match tables links the master record to the detail record(s). For example an issue or objective can have one or more reasons (details) why it is needed. The relation of the reasons to the issues is coded in the issue or objective Reason Match Table. Each match table has a reference table which contains an index or list of acceptable values.
Figure 6. SCHEMATIC OF INA DATABASE
TABLES AND THEIR RELATIONS TO ONE ANOTHER

Relationships are expressed by lines between the table boxes. Solid lines represent mandatory relationships. Dashed lines represent optional relationships.

A crow's foot (—^) indicates that each occurrence of the first entity is related to one or more occurrences of the second entity.

Each issue/objective must have one or more information needs and one or more reasons. These relations are stored in the match tables. Reference tables store lists of acceptable values.
Table 3 shows the kinds of information stored in the three primary tables of the INA database. Definitions and examples of database fields are presented in the INA Database Data Dictionary, Appendix F.

Table 3. LIST OF FIELDS ASSOCIATED WITH THE INA DATABASE TABLES

<table>
<thead>
<tr>
<th>Table 1: Issues and Objective</th>
<th>Table 3: Information Elements</th>
</tr>
</thead>
<tbody>
<tr>
<td>Field 1 Issue/Objective ID</td>
<td>F1 Info Element ID</td>
</tr>
<tr>
<td>F2 Issue/Objective Description</td>
<td>F2 Information Element Description</td>
</tr>
<tr>
<td>F3 Comments</td>
<td>F3 Comments</td>
</tr>
<tr>
<td>F4 Priority</td>
<td>F4 Importance</td>
</tr>
<tr>
<td>F5 Reason</td>
<td>F5 Steward</td>
</tr>
<tr>
<td>F6 Operator ID</td>
<td>F6 Status</td>
</tr>
<tr>
<td>F7 Update Date</td>
<td>F7 Spatial Bounds</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Table 2: Information Needs</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1 Information Need ID</td>
</tr>
<tr>
<td>F2 Info Description</td>
</tr>
<tr>
<td>F3 Comments</td>
</tr>
<tr>
<td>F4 Importance</td>
</tr>
<tr>
<td>F5 Resource Area</td>
</tr>
<tr>
<td>F6 Kind</td>
</tr>
<tr>
<td>F7 Mandate</td>
</tr>
<tr>
<td>F8 Operator ID</td>
</tr>
<tr>
<td>F9 Update Date</td>
</tr>
</tbody>
</table>

| F11 Unit of Measure         |
| F12 EM Class                |
| F13 Strata                  |
| F14 Operator ID             |
| F15 Update Date             |

Appendix G contains detailed directions on accessing the database and updating forms. It contains specific instructions for entering and editing data, and for executing the reports and queries. Data entry forms are included at the end of Appendix G. Data input time depends on how the issues and objectives and information needs are formulated. The number and complexity of information needs and the number of elements will determine the amount of time required to add new data to the database.
INA Database Features

The INA database was designed to:
- format the INA data to obtain "comparable" results (it serves as a standardized questionnaire)
- preserve relationships among the objectives, needs and elements
- display INA results (needs and products)
- consolidate and format information elements
- summarize INA data and assist in prioritizing and evaluating needs
- identify users and stakeholders
- aid in determining quality and accuracy requirements
- facilitate identifying and evaluating sources
- assist with evaluating elements for an integrated inventory
- assist in identifying inventory objectives and design specifications
- be easily updated to reflect project specific needs
- be easily updated as processes and management direction evolve

Table 4 illustrates which fields apply to the design objectives listed above. For example if you want to prioritize information needs or elements you can use: fields 2, 4, 5 and possibly 3 from the Issues and Objectives Table, fields 2, 4, 7 and possibly 3 from the Information Needs Table, and fields 2, 4, 13, and possibly 3 and 12 from the Information Elements Table.
### Table 4. POSSIBLE USES OF DATABASE FIELDS FOR ADDRESSING EIGHT DESIGN OBJECTIVES

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<th>FIELD NUMBER &amp; NAME</th>
<th>ID NEEDS &amp; PRODUCTS</th>
<th>PRIORITIZE NEEDS</th>
<th>ID USERS &amp; STAKEHOLDERS</th>
<th>QUALITY &amp; ACCURACY NEEDED</th>
<th>ID SOURCES</th>
<th>EVALUATE SOURCES</th>
<th>EVALUATE INTEGRATED INVENTORY</th>
<th>INVENTORY OBJECTIVES &amp; DESIGN SPECS.</th>
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**NOTE** Note: X - field relevant to objective  ? - field possibly relevant to objective

ID - Identify              Specs. - Specifications
Reports and Queries

A number of reports and queries are available to help IDT leaders promote data integration, display needs and responsibilities. Appendix H lists and briefly describes the 14 reports and 17 queries currently available. Appendix G includes the table descriptions for writing additional queries and reports, and shows the present file organization. Several reports are displayed in the following tables to illustrate the utility of the database. For definitions of the values in the reports refer to Appendix F.

The Issue and Objective Report shown in Table 5 displays the fields on the issues and objectives database table. Note in the upper left hand corner of the report that this example was generated by querying for issues or objectives with a priority of "H" for high. The report can also be generated to show all the issue/objectives statements for a given resource area, strata or for a given description such as the word "change". If I was the decision-maker, I could review this list and prioritize which objectives or issues I wanted my team to spend the most time on. Then the wildlife biologist could get a report that showed the high priority Issue/Objectives that were associated with the wildlife resource area.

Table 6 provides an example of the Information Needs Report and the fields on the information needs database table. It can show all information needs or only the ones associated with a given resource area, importance, strata, steward or specified description. If I was the responsible for designing a field inventory for vegetation, this report could be used to list all the information needs having importance of high and associated with the biological flora (vegetation) strata. Using this report I could design a field survey for vegetation knowing what information the survey should provide.

Table 7 shows an example of the Information Elements Report and all the fields in the information elements database. Detailed information about the elements is provided on this report. For example: Information element 14, fire regime, is assigned an importance of high; The steward responsible for this element is fire and fuel; The status of 50 shows that the fire regime data is 50 percent complete; The SB (spatial bounds) column shows that fire regime needs to be summarized or displayed by geographic area, physiographic area and by vegetative response unit; The TB (temporal bounds) is both existing and historic time periods; A number of potential
sources for fire regime have been identified including: 1- field survey, 4- a database, and 7 - published literature; Variables for fire regime include frequency, intensity, etc.; The measurement unit is not specified; The EM Cl (class) show that fire regime provides information about forest composition, function and process; And the fire regime was classified into the biological flora and ecological process strata. This report can provide a list by resource area, strata, importance, steward and/or a description.

Table 8 show an example of the Information Elements Report listing the elements associated with an information need that the soil scientist ("S") was interested in. It shows that the elements needs to be summarized for the physiographic area and many of them can be gotten from a source of 5 (existing map).

Table 9 shows the Information Elements Report can be generated by Strata in this case the physical terrestrial strata (P-Ter) and that several of the element are complete because status is 100(percentage).

To see which information elements are common among resource areas, I would run the Common Elements Report show on Table 10. It lists the element and how it needs to be described, which information needs require the element and the resource areas having the information need. It can be generated for all elements or just those of a given importance value, such as H. For example the Common Elements report shows that Seral/Successional Stage element is needed to satisfy several information needs, and which resource areas identified those information needs. Because many areas need this element there is a potential to collect it once for all of them and so they all should be involved in deciding which group or classification scheme(s) are used to describe the stage.

Table 11 concisely displays the issues and objective and their associated information needs and elements in an outline form. The outline can be generated by resource area, strata, steward priority, and/or importance and also by description. The report can be used to produce a summary for a given resource area or data steward, thus providing a list of responsibilities. With the Needs Outline 2 Report, information elements are listed in alphabetical order to group similar ones, like different types of "sites" together.

The Importance Status Query in Table 12 displays the importance, status, steward and resource area interested for each element. This query shows who needs the element,
who is responsible for the element, how important it is to the project and how complete the data is. And it can be useful in prioritizing and summarizing the elements for a given project.

Table 13 shows an example of a source query where a potential source of field survey has been identified. This report could be used in designing a multiresource inventory and shows the comments about the information element and the identified variables.

These reports and queries also aid in editing and updating the database.
### Table 5. ONE PAGE EXAMPLE OF AN ISSUE AND OBJECTIVES REPORT

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<tr>
<th>IO ID</th>
<th>Issue/Objective Description &amp; Comments</th>
<th>Priority</th>
<th>Reason</th>
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</table>
| 196   | HYDROLOGY/STREAM CHANNEL/WATER QUALITY COND. & PROCESSES & CAUSES OF CHANGES  
       | EAWS STEPS 3,4&5-DOMINANT COND./FEATURES & PROCESS & CAUSES OF CHANGES/TRENDS | H        |        |
| 197   | VEGETATION -ARRAY & LANDSCAPE PATTERNS, PROCESSES & CAUSES OF CHANGES  
       | EAWS STEPS 3,4&5-RIPARIAN & NON-RIP.-PLANT COMMUNITY COND.&SERAL STAGES &PROCESS | H        |        |
| 198   | ANIMAL SPECIES & HABITATS - CONDITIONS & CAUSES OF CHANGES  
       | EAWS STEPS 3,4&5- REL. ABUND. & DISTRIB. OF SPECIES OF CONCERN & THEIR HABITATS | H        |        |
| 199   | HUMAN USES, SOCIAL/CULTURAL VALUES & ECONOMIC FACTORS  
<pre><code>   | EAWS STEPS 3,4&amp;5-MAJOR USES &amp; INFLUENCES &amp;RELATIONSHIPS TO ECOSYSTEM PROCESSES | H        |        |
</code></pre>
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<td>QL</td>
<td>CAA</td>
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<td>ENG</td>
<td>M</td>
<td>FP</td>
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<td>ENG</td>
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Table 7. ONE PAGE EXAMPLE OF AN INFORMATION ELEMENTS REPORT

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Table 9. **ONE PAGE EXAMPLE OF AN INFORMATION ELEMENTS REPORT BY STRATA**

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| 6  | ASPECT               | USGS   | 100  |        | ELU| E  | 5   |          |      |       | P-TER  |
|    |                      |        |      |        | PA |     |      |          |      |       |        |
|    |                      |        |      |        | WS |     |      |          |      |       |        |

| 49 | SOIL - EROSION/EXPOSURE | USGS | 100  |        | ELU| E  | 1   | AMOUNT  | %    | F     | P-TER  |
|    | AMOUNT OF BARE SOIL    |      |      |        |    |     |      |          |      |       |        |

| 74 | ELEVATION             | USGS  | 100  |        | ELU| E  | 5   |          | FT   | F     | P-TER  |
|    |                      |        |      |        | PA |     |      |          |      |       |        |

| 76 | SLOPE                 | ELU    | E    | 5      |    |     |      |          | %    | F     | P-TER  |
|    |                      | PA     |      |        |    |     |      |          |      |       |        |

<p>| 79 | ASPECT                | USGS   | 100  | PA     | E  | 5   |      |          |      |       | P-TER  |</p>
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<td>GROUP/CLASSIFICATION</td>
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<td>PL</td>
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<td>VIS</td>
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<td>GROUP/CLASSIFICATION</td>
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Table 11. ONE PAGE EXAMPLE OF A NEEDS OUTLINE REPORT

<table>
<thead>
<tr>
<th>RESOURCE</th>
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<th>INFORMATION NEED (ID)</th>
<th>INFORMATION ELEMENT (ID)</th>
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- ACTIVITY - FUEL TREATMENT - SECONDARY OR INDIRECT (575)
- ACTIVITY/USE - ROADS (120)
- ACTIVITY/USE - TIMBER HARVEST (346)
- ACTIVITY/USE - TIMBER MANAGEMENT - OTHER SILVICULTURE ACTIVITIES (182)
- ACTIVITY/USE - TRAILS (EXISTING & HISTORIC) (172)
- LAND OWNERSHIP & BOUNDARIES (287)
- ROAD ACCESS/CLOSURE (375)
- SITES - COMMERCIAL & RESIDENTIAL SITES (174)
- SITES - HERITAGE RESOURCE SITES (153)
- SITES - OTHER HUMAN STRUCTURES & FACILITIES (175)
- USE - RECREATION / FACILITIES & OPPORTUNITIES (137)
- WILDLAND URBAN INTERFACE(S) (563)

SOCIAL & CULTURAL VALUES - CURRENT & REFERENCE CONDITIONS/TRENDS (397)

- CONCERN LEVELS FOR SCENERY MANAGEMENT (796)
- DISTANCE ZONE MAP (804)
- FOREST PLAN DESIGNATION/DIRECTION (390)
- RARE & UNIQUE HABITATS/SPECIAL FEATURES (82)
- REGENERATION STOCKING LEVELS (831)
- RESOURCE VALUES - ECOLOGICAL FUNCTIONS & SERVICES (558)
- SCENIC CLASS & MAP (300)
- SEEN AREA MAP (803)
- SITES - HERITAGE RESOURCE SITES (153)
- SPECIAL MANAGEMENT AREAS (140)
- UNIQUE LANDFORMS & LANDSCAPE FEATURES (CAVES) (306)
Table 12. ONE PAGE EXAMPLE OF AN IMPORTANCE STATUS QUERY

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<td>X 50</td>
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<td>X</td>
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Table 13. ONE PAGE EXAMPLE OF A SOURCE QUERY

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<th>IE Id. Description</th>
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<tbody>
<tr>
<td>53 REGENERATION STATUS/SUCCESS RATES</td>
<td>5 YEAR REGEN REQUIREMENT (PROGRESSING, CERTIFIED, FAILURE) PLANTED &amp; NATURAL</td>
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<tr>
<td>57 TIMBER VOLUME</td>
<td>EXISTING &amp; POTENTIAL SITE PRODUCTIVITY (BF &amp; CF VOL/AC)</td>
</tr>
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<td>60 FOREST - OLD GROWTH</td>
<td>DESIGNATED OR VERIFIED OG AMOUNT LOCATION TYPE/KIND</td>
</tr>
<tr>
<td>71 PLANT SPECIES - TES</td>
<td>ELEMENTS OF OCCURANCES (TNC/NATURAL HERITAGE) AMOUNT LOCATION OCCURRENCE</td>
</tr>
<tr>
<td>80 SOIL DESCRIPTION</td>
<td>DEPTH, STRUCTURE, TEXTURE, DRAINAGE AMOUNT COMPOSITION DEPTH GROUP/CLASSIFICATION PRODUCTIVITY TYPE/KIND</td>
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<td>82 RARE &amp; UNIQUE HABITATS/SPECIAL FEATURES</td>
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<td>84 INSECT &amp; DISEASE REGIMES</td>
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<tr>
<td>85 TREE MORTALITY</td>
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</tbody>
</table>

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INA Example Checklist

The example checklists are another tool for the INA process. Their purpose is to streamline the INA process by providing a starting point and example issue and objectives and information need statements and a list of information elements for landscape assessments. They also provide a preliminary data elements list for a multiresource inventory.

The Issues and Objectives, Information Needs, and Information Element Reports and the Needs Outline Report are example checklists. These lists from the INA database are the result of a synthesis of data. The majority of this data came from the initial survey of Forest Service resource managers and specialists on the MRI task force. Data from follow up interviews and supplemental references was incorporated in the database, along with feedback from reviews and preliminary tests with district IDTs. The elements list is not definitive or complete. It contains about 90% of the basic elements an IDT might consider using. In order to obtain a more consistent level of detail in the elements list, the issue/objective and information need statements were modified from the original survey and based on EM processes and objectives. For a more complete description of how the checklist was developed refer to Chapter 3.

For landscape assessments, 90 to 95% of the issues, objectives and information needs are expected to be the same on the Kootenai National Forest. Some areas may have characteristics, such as grizzly bear habitat or urban fire interface, that require additional specific data unique to that landscape. Appendix B contains the Needs Outline Report for the issues and objectives, information needs and information elements that the Three Rivers Ranger District rated as high priority and importance.

These checklists should save or reduce the amount of time spent doing an INA by providing example statements to work from. As the IDT and decision-maker agree on which issues and objectives, information needs and information elements are needed for their assessment, the database can be updated to reflect their specific project area needs in a relatively short time. The checklist can also serve as documentation of what information needs and elements were determined unnecessary for their specific project. Each district or forest could develop its own lists based on this example, and use it with minor changes on subsequent assessments.
Chapter 5
DISCUSSION and CONCLUSIONS

The study objective was to develop a formalized INA process for EM landscape assessments. The primary purpose of the INA was to determine the elements needed to design a multiresource inventory. In developing the formalized INA process it became evident that a formal approach would be beneficial for organizing and conducting landscape assessments and NEPA analysis. An INA database was developed as the framework for the INA process. The database was populated with opinion data. The opinions consist of the information and data requirements for landscape assessments.

A. Discussion and Observations

In this section the comments, problems and influencing factors encountered in the study are discussed.

A formal INA was requested to support multiresource inventory development. The purpose of the INA was to develop ownership and understanding of management expectations. The MRI task force was intended to be the IDT that would identify the information elements for landscape assessments and assist with the next steps in the MRI project. Instead, the task force provided valuable experience leading to formalizing the INA process.

An INA was initiated with a questionnaire. Each specialist was asked to identify issues or objectives, decisions to be made, legal mandates and required information, data elements and sources. The questionnaire produced mixed results. Some specialists had well defined objectives or issues, specific needs and very detailed data requirements. Others had very general objectives, few needs, and incomplete or little detail about the data elements. One key specialist did not complete the questionnaire. This is fairly typical of how IDTs function.

Differences in terminology and level of specificity were expected but not to the degree encountered. These differences made the summarization of the results difficult. The results were obviously incomplete in some areas. One-on-one interviews provided some clarification and more details.
The initial survey data was compiled in a tabular word processing document. Displaying the data for review and editing was difficult because: 1) Part of discerning needs is knowing the objective or reason behind them. It was hard to show the rationale and intent, and the relationships among issues and objective, information needs and information elements. 2) Specialists worded similar needs and elements differently. Without the ability to query on "key words" it was difficult and tedious to group needs and elements into common categories. 3) Without the ability to query, it was difficult to sort and display subsets of data, to list information needs and elements by resource area, to display common needs, or to show which needs and elements were most frequently identified. And 4) editing and updating the data was difficult and tedious with the word processor format. INAs are a part of every assessment, so there is an advantage to a format that is easily updated as direction, knowledge and processes evolve.

These shortcomings are why the INA database was developed. A relational database provides a way to link the general management objectives and issues (reasons) to the required information elements. The database provides more structure than the original questionnaire by virtue of a data dictionary and examples. The ability to query on key words or phrases makes grouping and standardizing terminology easier. And the database provides the flexibility to update, summarize and display data in a variety of ways.

After the survey data was compiled, a task force (IDT) meeting was held to obtain agreement and prioritize the objectives and issues and information needs appropriate for landscape level assessments. The discussion of issues and objectives centered on theoretical aspects of how and when to integrate the social principles of EM and the forest plan standards and guidelines with biophysical and ecological principles. There was also disagreement on whether determining the desired future condition is part of the NFMA or NEPA process (i.e., the objectives and end products of EM assessments were unclear). The meeting resulted in more questions than answers. The lack of agreement on management goals led to more interviews and literature review.

Uncertainty about processes and expected outcomes was also encountered in the district trials. Several team members were new and unfamiliar with management objectives and EM assessments. All were unfamiliar with the new formal INA process. The assumed level of knowledge of both task force and district IDT was inaccurate. It is apparent that there is not a common agreement or understanding of
the EM assessment process and objectives on the Kootenai National Forest. Unclear objectives, lack of standards or shared assumptions are common barriers to integration (Lund, 1986).

Another barrier is inadequate communication and coordination. This contributed to the difficulties in defining objectives in the task force group. Meetings were not attended by all task force members; representatives needed updating on project background, goals, processes, etc. I was not on the Kootenai Forest most of the time, and the time between IDT meetings probably contributed to inefficiencies and lack of decisions, but lack of established processes and lack of understanding ecosystem management was the major hurdle.

Some specialists found the mixture of issues and objective statements in the initial INA checklist example confusing. They said the issue/objective statements needed more consistent organization. The value of identifying either an issue or objective is to provide a purpose or reason for the more specific information needs. IDT members familiar with the NEPA process often associate issues with NEPA analysis, where the issues drive alternatives. For landscape assessments, phrasing issue/objective statements as objectives is probably the best approach. The original issue and objective statements were modified to make them all objective statements.

The Needs Outline Report is part of the INA example checklist. On both the Three Rivers and Murphy Lake Ranger Districts, the IDT members found the report difficult to use as a checklist because of the length and overlap in information needs and elements. Information needs and information elements can be repeated under more than one issue/objective statement because the same information need can apply to more than one issue or objective. Suggestions to combine issue/objective statements into broader objectives led to editing the database. This reduced the size and complexity of the Needs Outline Report. An IDT leader suggested using the steps of the Ecosystem Analysis at the Watershed Scale (EAWS) process (USDA, 1995b) as the framework for the INA checklist. A shorter and simplified example was developed by using EAWS steps for the objective statements, and the core topics and questions for the information needs.

I spent considerable time rearranging issues and objectives and information needs, while trying to work out a consistent meaningful format to reduce the complexity. I am convinced that a prerequisite for conducting an efficient INA is having predefined
objectives and a standardized process for the landscape assessment. Having an outline of the desired format will save data input time.

It was evident on both districts that IDTs specialists are more experienced at identifying elements and data needs than in defining objectives and information needs. Some specialists did not differentiate between information and data.

Based on these study experiences, I believe it would be more efficient for the forest planning team to establish the basic issue/objective and information need statements at the forest level, rather than using a group such as the MRI task force.

Current management direction encourages the use of existing information whenever possible. On one district it was apparent that some specialists were unaware of existing sources and/or their status, especially the sources available from other resource functions. This situation is not uncommon.

Finding, learning about and evaluating alternatives sources takes time. Some specialists suggested including (expressed benefits and a need for) a database table and fields to track specific sources and their associated attributes. The benefit of recording source data in the INA database is that this information would be readily available for the next assessment. This data about sources would also be available to other districts and for combined district analysis or forest planning and monitoring.

Neither the formal source evaluation process using forms found in Appendix D nor the informal flowchart in Figure 4 process have been tested.

Functionalism and parochialism were encountered. Most task force members support integrated data collection and analysis. There are concerns that standardization necessary for integration will compromise individual needs and flexibility. Some districts have started and invested time in their own integrated inventory and assessment processes, but methods are not well documented, shared or accepted across the forest. This individual district approach is not cost effective. To become more efficient there needs to be more standardization across the forest. And as long as functionalism in funding and management targets exist, the development of a multiresource inventory will be difficult. A multiresource funding allocation is needed to help overcome this obstacle.
B. Management Implications

The tools developed in this study (the database, INA checklist, and source evaluation) can be used to make the INA process more efficient.

The INA database is a structured but flexible tool. Data can be modified as management objectives, social issues and regulations change. Information management is essential to efficiency. An INA is a decision process to determine what information is essential to meeting objectives. Data is expensive to collect, organize, input, summarize, and maintain. The INA database can be used to sort out and narrow the list of information elements for making resource management decisions. When a district completes a project specific INA, they can see which elements are needed most frequently. Once elements and characteristics are recorded, a number of fields can be used as decision criteria for assigning importance or priority. For example, priorities can be based on the number of times the element is listed and/or the number of resource areas that need the element. The steward field can serve two functions. It can be used to identify who knows most about the quality, accuracy or shortfalls of the data and who is responsible for collecting and summarizing the data element. Reports can show which resource areas have common information needs and elements. This knowledge can be used to share work, reduce duplication and help achieve comparable results.

The INA database can be used to evaluate the effect of alternative management direction on information and data requirements. This allows the manager to ask questions such as: What if information requirements or priorities change, or standards are relaxed, then what information and data do we need? For instance, if management wanted to determine how information or data requirements may differ between a typical NFMA assessment and EM assessment, priority and importance fields could be coded differently so that database reports could display the differences between these alternative approaches.

The idea of developing an INA example checklist came from assumptions that natural resource managers have consistent overall objectives and issues, and that information needs and elements for most landscape assessments are similar. Once issues or objectives and information needs are defined, it is more efficient to work from examples than to create a new list for each project. Another efficiency is that once elements are initially identified, they will be considered in subsequent assessments; and showing the elements considered, but not included, serves as a "record of
decision". Starting with a checklist can save time in prioritizing needs for specific assessment. The data (lists) from this study are intend to be a starting point which will be improved with collective experience. Using an INA list from one project to the next will lead to consistency and thus efficiency in conducting assessments.

Part of information management is locating and choosing sources. If an IDT uses an integrated approach to evaluating and selecting sources, this should lead to objectively determining which sources to use rather than using what is handy and familiar. An integrated approach gives more emphasis on choosing the "best" sources and most efficient means of obtaining needed information. By integrating data collection and analysis, work is shared, not duplicated and the end results will be comparable (i.e., estimates of the amount of area in similar conditions will be consistent).

Because data are expensive, source evaluation is very important. A source evaluation weighs the reliability of existing data in relation to issues or objectives. The degree of risk that the manager is willing to accept leads to determining if the cost of a new or supplemental inventory is warranted. When project time tables are short there is pressure to patch together and stretch current data even if EM requires new information. And when different standards, definitions and inventory techniques are combined, data should be questioned. Concerns about risk and credibility are part of the reason for initiating this study. The decision-maker should take an active role in determining data needs and methods. The INA source evaluation process can help the district and forest level managers identify where information is inadequate. Documented source evaluations that show what is working and what is lacking will be very useful in designing a multiresource inventory.

C. Considerations and Recommendations for Designing a Multiresource Inventory

This section presents considerations and recommendations for the next steps of the MRI process. It outlines how the INA process and tools apply to designing a multiresource inventory. The activities leading to designing a MRI are interrelated and more iterative than step-wise.

Each resource area has its own sphere of required information. Some specialists may not trust each other's work and/or may not want to relinquish their data collection authority (Lund, 1986). Cooperation and coordination are the most important factors in achieving integration and insuring that data collection methods (single or
multiresource) meet the agency's needs. Lund (1986) reminds us that integration is desirable only to the extent that it meets the need for which it is intended; and sometimes it can be less efficient to integrate inventories.

A more detailed INA will be needed to develop a multiresource inventory. A common problem in designing an integrated inventory is unclear inventory objectives (Lund, 1986). There must be consensus with respect to the priority resource questions to be addressed. Specialists with common needs must work together to define inventory objective statements and products. It is important to get the right mix of specialists, i.e., those responsible for the inventory, the users and the decision-makers (Lund, 1986). All "interested parties" must come together and agree on standards. This ownership is a necessity for a multiresource inventory to be accepted and used. It will be a waste of time and resources to attempt to design a multiresource inventory if standards, terminology, mapping units and accuracy are not agreed upon. Without clearly articulated objectives, it is impossible to develop appropriate sampling designs.

As discussed in section A of this chapter, the agency needs to define a process or framework for landscape assessments prior to designing an integrated inventory. A preliminary list of essential elements is needed to start the inventory design phase. The information elements list from this study could be prioritized by the INA task force to determine the essential elements. A better approach might be for several districts to use the INA process and database to develop their own lists of essential information elements. The information elements fields in the database will need to be reviewed for common terminology. The recently developed Region 1 protocols should be consulted. Once these elements are agreed on, then the interested parties can begin determining which common elements should be considered for integrated data collection.

Completing the INA database fields will assist in determining which elements are relevant for a multiresource inventory. Regardless of whether a single or multiresource data collection method is chosen, completing the database fields will identify inventory needs and lead to more standardized and consistent data.

When database fields are completed, reports and queries can be used to: 1) sort and choose common elements to consider for the integrated inventory, 2) identify spatial and temporal boundaries, 3) identify the "resource areas and stewards" that should be included in the design process, 4) identify or define measurement variables and
units, and accuracy, and 5) list or group elements having the same strata and/or priority. For instance, a list elements can be generate where priority is high, strata is biological flora and source is field inventory and used as a starting point for a multiresource inventory design.

When it has been decided which elements could logically be combined, then the elements that should be inventoried together can be identified. Some criteria to consider are:

- Is field sampling the most cost effective method?
- Where to survey and how hard is it to get there (accessibility)?
- What are the products desired?
- What crew skills, training, and equipment will be needed?
- What sampling methods are commonly used (double sampling, cluster sampling, point sampling, etc.)?
- What resolution and accuracy are needed?
- What sampling intensity is needed (plot size and frequency)?

The first criterion should be that field sampling is the most cost effective method. To choose the "best" source and most efficient means of data collection you will need to know which inventory methods are working well and which are inadequate. After multiresource elements are chosen database fields (i.e. spatial and temporal bounds, variables and unit measure) can be displayed to help finalize inventory statements and products.

An information management support system will need to be formed as inventories are designed. This support system includes: organization and quality control, inventory implementation, data analysis and reporting, and data maintenance. The Rocky Mountain Region's Integrated Resource Inventory Training Guide (USDA, 1995b) is an excellent reference on information support considerations and methods.

The amount of effort and the accuracy of the INA inventory will determine the usefulness of subsequent inventory data (Alverson, 1981).

D. Recommendations and Future Needs

Study findings indicate that several areas need more work for this formalized INA process to be useful for district assessments and for future MRI design.
1. **Information management:** a) The Kootenai Forest planning staff is the logical sponsor for the INA application. A coordinator and stewards are needed to direct its use and provide training. b) At the Forest level develop and endorse a general EM assessment process. Use the EAWS or a similar approach as the framework for the issue/objectives and information needs to reduce complexity of the INA example checklist. If the planning staff institutes the INA process, district IDT efficiency will improve. This step toward consistency and sharing analysis assumptions across districts will contribute to Forest Service credibility; and c) Chapter 2’s section on Forest Service resource management direction needs review and KNF endorsement.

2. **Training:** Inform IDTs about this formalized documented INA process. Conduct workshops to: a) promote the process; b) to improve and streamline the process and IDT directions; c) improve the information elements list and get consensus on those elements critical to making decisions required at the landscape scale (based on experienced IDTs from several districts); d) test the source evaluation process and tools; and e) obtain feedback on which elements to include in a multiresource inventory.

3. **Database enhancements:** a) to make the database usable to multiple districts for multiple projects, district and project identifiers (fields) are needed to allow unique data sets, so the database can be used as an *assessment planning and tracking tool*. Reports and queries will need to be updated to incorporate these fields. b) add a source database table to the INA database to provide an easily accessible source reference for subsequent projects and for information sharing between forests. A proposed source table and fields with a data dictionary are described in Appendix F. If this proposal is implemented, the source table would serve as a data collection point and could be populated on a project-by-project basis. Reports and queries need to be developed to speed up the source evaluation process. The proposed source fields are the same criteria used in the source evaluation forms. A source database table would have the most utility for districts that want a formal, objective, and documented source evaluation.

4. **MRI design:** As budgets get tighter and inventory dollars decrease the Forest Service cannot afford to have wide disparities in data collection methods, standards, and analysis. To be most cost effective the MRI design should be led by the Regional Office or by a group of forests if possible.
E. Summary and Conclusions

The goal of the formalized INA process is to improve efficiency in data collection and analysis. Efficiency can be achieved two ways: 1) By improving the way assessments are conducted; and 2) By improving the way data is collected.

This study provides information, methods, processes, and tools to assist resource managers and specialists in determining what data is sufficient for landscape assessments and where information needs overlap. The degree of success with which managers develop and evaluate options has significant implications for quality and cost effectiveness (USDA, USDI, 1996). Efficiencies come from determining what is sufficient, collecting and analyzing only data essential to the decision process.

I am proposing that the Forest Service adopt a formalized, integrated and documented INA process that takes advantage of collective knowledge and experience. A documented approach allows decisions to be reviewed and results can be used on subsequent projects reducing organization time.

The formalized processes and tools developed in this study have the potential to be applied or adapted to other forests in the Northern Region. They apply directly to any landscape scale assessment and can be adapted to forest planning efforts or NEPA projects. The INA process and database would be useful for multilevel as well as multiresource integration because information needs to be grouped, analyzed and prioritized at all levels.
LITERATURE CITED


USDA, Forest Service. 1990. Our approach to effects analysis: desk reference. USDA Forest Service, Northern Region.

USDA, Forest Service. 1991. Northern Region geographic information system implementation reference. USDA Forest Service, Northern Region.


Appendix A.

Issues and Analysis Elements
Issues

The following list is a summary of issue categories frequently identified in Forest Service memos and documents. For more specific information on these issues refer to Region 1 memo 1920 Forest Planning and Ecosystem Management 3/21/94 which identifies issues/problems to be addressed in Forest Plans and Subregional EM assessments (like the Columbia River Basin). Also refer to the Social Assessment for the Kootenai National Forest 1995.

- Watershed Conditions
- Vegetative Condition and Health
- Riparian Condition
- Sensitive Fish
- Sensitive Plants
- Sensitive Animals
- Wildlife
  - Species Habitat Requirements
  - Habitat Effectiveness
  - Old Growth Distribution
- Nutrient Cycling
- Soil Productivity
- Fuel and Fire Hazard
- Acceptable Management Activities
  - Land Uses
  - Mining
  - Logging Practices
- Sustainability
- Roadless and Wilderness Areas
- Access and Travel Management
- Recreation and Tourism
- Biological Diversity
- Forest Management Issues
  - Roads
  - Timber Harvest Levels
  - Clearcuts and Selective Harvests
  - Appeals of Timber Sales
  - Fires and Salvage Logging
  - Wildlife Management
  - Wilderness
  - Appearance and Environmental Quality
  - Ecosystem Management
Analysis Elements

In Sustaining Ecological Systems Desk Reference (1992), the following general elements and processes are suggested for landscape assessments.

Forested Systems
Amount, Patch Size, Patch Shape, and Stand Structure for:
- Early seral vegetation
- Mid seral vegetation
- Late seral park like stands
- Late seral/tolerant multilayer stands
- Mid- and later seral forest edge

Other Terrestrial Systems
Composition
Patch size
Patch shape
Structure

Aquatic
Composition
Extent
Structure

Processes
Fire regime
Hydrologic regime
Insect and pathogens regime

Probability of Change
Wildlife risk
Rate of succession
Risk of insect mortality
Risk of disease effects
Channel stability effects
Exotic species
Other --
Overall risk of change

Soil Productivity Damage
Soil erosion
Soil compaction
Soil displacement
Ground cover

Road Edge
Open roads
Closed roads
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Needs Outline Report
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<td>STREAM SEDIMENTATION REGIMES (427)</td>
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<td>STREAM WIDTH/DEPTH RATIO (459)</td>
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<td>AQUATIC SPECIES DISTRIBUTIONS &amp; HABITAT QUALITY-CAUSES OF CHANGES (395)</td>
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<tr>
<td>ACTIVITY/USE - ROADS (120)</td>
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<td>FIRE REGIME - NATURAL &amp; EXISTING (14)</td>
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<tr>
<td>MASS WASTING (411)</td>
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<tr>
<td>ROAD - STREAM CROSSING(S) (834)</td>
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<td>SOIL EROSION (410)</td>
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<tr>
<td>STREAM SEDIMENTATION REGIMES (427)</td>
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</tr>
<tr>
<td>USE - RECREATION / FACILITIES &amp; OPPORTUNITIES (137)</td>
<td></td>
</tr>
<tr>
<td>WATER DRAINAGES - UNNATURAL (419)</td>
<td></td>
</tr>
</tbody>
</table>

**United States Forest Service**

*Information Needs Assessment*

*Needs Outline Report*
### Human Uses, Social/Cultural Values & Economic Factors (199)

**Human Uses & Developments - Current & Reference Conditions/Trends (396)**
- Activity - Fuel Treatment - Secondary or Indirect (575)
- Activity/Use - Roads (120)
- Activity/Use - Timber Harvest (346)
- Activity/Use - Timber Management - Other Silviculture Activities (182)
- Activity/Use - Trails (Existing & Historic) (172)
- Land Ownership & Boundaries (287)
- Road Access/Closure (375)
- Sites - Commercial & Residential Sites (174)
- Sites - Heritage Resource Sites (153)
- Sites - Other Human Structures & Facilities (175)
- Use - Recreation / Facilities & Opportunities (137)
- Wildland Urban Interface(s) (563)

**Social & Cultural Values - Current & Reference Conditions/Trends (397)**
- Concern Levels for Scenery Management (796)
- Distance Zone Map (804)
- Forest Plan Designation/Direction (390)
- Rare & Unique Habitats/Special Features (82)
- Regeneration Stocking Levels (831)
- Resource Values - Ecological Functions & Services (568)
- Scenic Class & Map (300)
- Seen Area Map (803)
- Sites - Heritage Resource Sites (153)
- Special Management Areas (140)
- Unique Landforms & Landscape Features (Caves) (306)

**Economic Conditions & Diversity - Current & Reference Conditions/Trends (398)**
- Activity/Use - Timber Harvest (346)
- Economic Basis for Community (132)
- Fuel Treatment Methods & Costs (825)
- Harvest Method(s) & Costs (830)
- Reforestation Methods & Costs (824)
- Regeneration Stocking Levels (831)

**Human Uses, Social/Cultural Values & Economic Conditions - Causes of Changes (399)**
- Activity/Use - Timber Harvest (346)
- Forest Plan Designation/Direction (390)
- Harvest Method(s) (318)
- Land Ownership & Boundaries (287)
- Road Access/Closure (375)
- Sites - Commercial & Residential Sites (174)
- Sites - Other Human Structures & Facilities (175)
- Use - Recreation / Facilities & Opportunities (137)
- Wildland Urban Interface(s) (563)
Appendix C.

INA Questionnaire and Directions
KNF PHYSIOGRAPHIC AREA ASSESSMENT
INFORMATION NEEDS/ INVENTORY WORKSHEET

BY: _______________________ DATE: ___________________

OBJECTIVE/ISSUE: #__

DECISION TO BE MADE/LEGAL MANDATE:

Priority (H, M, L): ______

ENVIRONMENTAL COMPONENT: ___________________________ GROUP PRIORITY RATING: ______

INFO NEEDED: (Past ___ Present ___)

Priority (H, M, L): ______ Format: __________________________

DATA NEEDS:
<table>
<thead>
<tr>
<th>Attribute</th>
<th>Kind</th>
<th>Qual.</th>
<th>Quant.</th>
<th>Bounds</th>
<th>Accuracy</th>
</tr>
</thead>
</table>

HOW WILL THE INFO BE USED IN DECISION MAKING (NFMA/NEPA) PROCESS:

AVAILABILITY OF INFO:

SOURCE OR RESPONSIBILITY FOR PROVIDING INFO:

District ____ Forest ____ Sub Regional ____ UCRB ____ Research ____
Literature ___________ Other (specify) ___________
DIRECTIONS FOR COMPLETING WORKSHEET

These directions are designed to provide focus and context for identifying information needs and inventory attributes needed for PA assessments.

Attachment 5 has examples of filled out worksheets.

BY: Person to contact for clarification or additional information.

DATE: Date prepared.

OBJECTIVE/ISSUE: Most inventory and assessment work should link to a specific ecosystem or management issue. Identifying the objective/issue as narrowly as possible will allow a more focused answer in other parts of this worksheet. Consecutively number your issues for later summarization.

DECISION TO BE MADE/LEGAL MANDATES: What decisions are expected to come from the assessment and inventory work proposed. It will be important to link the decisions and work that are required legally, when evaluating priorities and accuracy under budget and time constraints.

Priority: Relative ranking of objective/issue (high, medium, low) in relation to other issues in your resource field. This can be helpful in identifying what information and attributes will need more detailed and accurate information. (Later - As a group we will rate all resource needs pertinent to PA assessment process).

INVENTORY/ASSESSMENT ANALYSIS - It is important to clearly identify and display the needs, rational & alternative methods of addressing issues, to determine the best way to combine current information and inventory needs.

An objective/issue may require more than one type of information or assessment. When more than one type of info is needed reference the objective/issue number and fill out worksheet from the inventory/assessment analysis section on.

ENVIRONMENTAL COMPONENT: Identify the general environmental group this needed information pertains to (e.g., physical, biological, social, landscape). See list-attachment 1. This will be used to organize, summarize & prioritize the info needs we identify.

GROUP PRIORITY RATING: After all the worksheets are completed & summarized, then the task group will rank priorities within each environmental component. This should provide a picture of long term vs short term (current) data and information needs.

INFO NEEDED: Address the specific information or assessment that is needed to address the objective or issue. Most info needs should have environmental or social importance which will be used to diagnose ecosystem condition/health &/or is required by FP standards & guides. Remember with EM assessments we want to look at structure, composition, and function of the various environmental components. These info needs should generally fit into a diagnosis matrix similar to one for ELU Table of Attributes/Characteristics - attachment 2. Indicate if past and/or existing condition info is needed and track thru with attribute kind and accuracy needed, since it may not be the same.

Priority: Relative ranking of information (H,M,L) based how important the info needs are to diagnosing ecosystem condition & or addressing the issue.

Format: If known specify desired way to display, such as map, table, narrative, combinations (map & tables), or other.
DATA NEEDS: This part of the worksheet will be used to determine specific inventory objectives. It also give basis for determining the resolution of data appropriate for the original objective/issue. Be as specific as possible.

List the specific attribute(s) or data which need to be measured or described to provide the information.
Identify the kind of data (field collected, map derived, interpreted -ie from photos, queries or analysis like GIS).
List the unit of measure under qualitative or quantitative categories.
Identify the bounds or how the data will be summarized (PA, ELU, drainage, stream channel, ect- more than one may be appropriate).
Assign a relative accuracy (H,M,L) based on the relative risk of making an incorrect decision based on the measurement of this attribute.
Assign a priority (H,M,L) to the attribute in relation to the other attributes.

HOW WILL THE DATA/INFO BE USED IN THE DECISION MAKING (NFMA/NEPA) PROCESS: If not fully addressed above, this section will specifically identify how and why this work will be used in the PA assessment process. It is critical we understand how the information specifically relates to the desired outcome. We can not afford to collect data or summarize information that is not essential to the decision process.

AVAILABILITY OF INFO: Is the data or information available today in a useable form? If not what must be done to acquire it. Examples may be data from UCRB or other sources that don't require a lot of energy to acquire. Identify existing source(s) for this info & whether you think they are adequate (if you can). You may know of more than one source for the desired info or attribute. If so indicate your preference and reasons. Keep in mind the resolution appropriate for PA assessment vs project work.

SOURCE OR RESPONSIBILITY FOR PROVIDING INFO: If the info is not adequate or available now, how or where do you think the info can/could be most efficiently obtained. EXPLAIN BRIEFLY.
KNF PHYSIOGRAPHIC AREA ASSESSMENT
INFORMATION NEEDS/ INVENTORY WORKSHEET

BY: ___________________________ DATE: 7/17/95

OBJECTIVE/ISSUE: # 1

Describe the important characteristics of the terrestrial environment which affect ecological functions and process.

DECISION TO BE MADE/LEGAL MANDATE:
Suitability of land uses/activities.

Priority (H,M,L): ___H___

ENVIRONMENTAL COMPONENT: Physical - Terrestrial GROUP PRIORITY RATING: ____

INFO NEEDED: (Past X Present __X__)
Landtype, important soil factors.

Priority (H,M,L): ___H___ Format: Maps & descriptions

TA NEEDS:

<table>
<thead>
<tr>
<th>tribute</th>
<th>Kind</th>
<th>Qual.</th>
<th>Quant.</th>
<th>Bounds</th>
<th>Accuracy</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>Landtype</td>
<td>Map</td>
<td>X</td>
<td></td>
<td>PA</td>
<td>M</td>
<td>H</td>
</tr>
<tr>
<td>Soil ash com</td>
<td>Field</td>
<td>presence</td>
<td>Avg depth</td>
<td>Landtype</td>
<td>M</td>
<td>L</td>
</tr>
<tr>
<td>H Lg woody debris</td>
<td></td>
<td>X</td>
<td></td>
<td>ELU</td>
<td>M</td>
<td>M</td>
</tr>
</tbody>
</table>

HOW WILL THE INFO BE USED IN DECISION MAKING (NFMA/NEPA) PROCESS:
Landtype important in describing affected environment. Used to guide what management activities are appropriate for the area. Landtype is correlated with general productivity and management activities. Insure the DFC is biologically sound. Historic woody debris to determine range for DFC. Soil ash to provide more specific info on site productivity, nutrient cycling and sensitive soils.

AVAILABILITY OF INFO:
Land type (KNF LSI) completed. Landtype info has some ash component info but more site specific data would be desirable for ____. Historic woody debris info not available but could be inferred from habitat type and fire regime info.

SOURCE OR RESPONSIBILITY FOR PROVIDING INFO:

District ___ Forest _X_ Sub-Regional ____ UCRB ____ Research ____ Literature ____X ?____
Other (specify): ___
Appendix D.

Source Evaluation

Source Evaluation and Comparison ....................... 98

Decision-Maker’s Evaluation ................................. 100

Completed Example Forms ..................................... 101
### SOURCE EVALUATION & COMPARISON

**PROJECT:** ____________________________________________  
**INFO ELEMENT:** ____________________________________________  
**BY:** __________________________________________________  
**INFO NEEDS:** ____________________________________________  
**DATE:** __________________________;_____________________  
**ISSUE/OBJECTIVES:** ____________________________________________  

<table>
<thead>
<tr>
<th>CRITERIA*</th>
<th>SOURCE 1:</th>
<th>SOURCE 2:</th>
<th>SOURCE 3:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 DOES SOURCE EXIST?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>2 REFLECT CONDITIONS?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>3 USABLE FORMAT?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>3a CAN BE REFORMATTED?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>4 MATCHES TEMPORAL BOUNDS?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>5 MATCHES SPATIAL BOUNDS?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>5a CAN BE DERIVED?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>6 COVERAGE COMPLETE?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>6a GET FROM ADJACENT AREA?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>7 RELIABLE?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>8 YES/NO TALLY</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>9 RECOMMENDATION &amp; COSTS</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>10 REMARKS &amp; NOTES</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
</tbody>
</table>

* See back of form for detailed criteria explanations

---

98
<table>
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<tr>
<th>Source Evaluation Criteria</th>
<th>Input Data Needed - Reference (Form - Field #)</th>
</tr>
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<tbody>
<tr>
<td>1</td>
<td>Does the identified source presently exist? If NO, estimate time &amp; cost.</td>
</tr>
<tr>
<td>2</td>
<td>If existing condition information is needed, have conditions changed significantly since the data was collected or will conditions change significantly during the analysis period? Analysis Period; Source Date (4-F5)</td>
</tr>
<tr>
<td>3</td>
<td>Is the source of the information element in a usable format? Information Kind (2-F6); Source Kind (4-F9); Source Type (4-F10); Source Format (4-F11)</td>
</tr>
<tr>
<td>3a</td>
<td>IF 2 is NO, is it feasible to format/summarize the data/info? IF YES, estimate time &amp; cost.</td>
</tr>
<tr>
<td>4</td>
<td>Do the temporal bounds of the data/info match the identified time period? Temporal Bounds (3-F7); Temporal Bounds (4-F7)</td>
</tr>
<tr>
<td>5</td>
<td>Do the spatial bounds of the data match the unidentified spatial area? Spatial Bounds (3-F6); Spatial Bounds (4-F6)</td>
</tr>
<tr>
<td>5a</td>
<td>IF 4 is NO, is it feasible to derive the data/info (by aggregating or degenerating data) from another scale? IF YES, estimate time &amp; cost.</td>
</tr>
<tr>
<td>6</td>
<td>Is the &quot;coverage&quot; complete? Status (3-F10) or Source Status (4-F8)</td>
</tr>
<tr>
<td>6a</td>
<td>IF 5 is NO, is it feasible to complete coverage by deriving (inferring or extrapolating) data/info from a similar or adjacent area? IF YES, estimate time &amp; cost.</td>
</tr>
<tr>
<td>7</td>
<td>Is the reliability of the source satisfactory? (quality assurance by the data steward) IF NO, explain in remarks. Stewardship (3-F9) or Source Steward (4-F4); Source Reliability/Quality Rating (4-F14)</td>
</tr>
<tr>
<td>8</td>
<td>TALLY of YES/NO RESPONSES</td>
</tr>
<tr>
<td>9</td>
<td>DO you recommend using this source? IF source does not fully satisfy needs (any no responses), estimate the total time &amp; cost of reformatting, summarizing &amp;/or collecting new or additional data.</td>
</tr>
<tr>
<td>10</td>
<td>Use this space for remarks &amp; notes about criteria responses.</td>
</tr>
<tr>
<td>DECISION CRITERIA</td>
<td>INPUT INFO</td>
</tr>
<tr>
<td>----------------------------------------------------------------------------------</td>
<td>--------------------------</td>
</tr>
<tr>
<td>1 Does the significance or importance of the issue/objective indicate collecting new data?</td>
<td>Issue/Objective; Priority</td>
</tr>
<tr>
<td>2 Does the political sensitivity of the issue or the legal mandate require new data?</td>
<td>Issue/Objective; Mandate</td>
</tr>
<tr>
<td>3 Does the risk or implication of making a wrong decision based on inadequate information indicate collecting new data?</td>
<td>Issue/Objective; Information Need &amp; Importance</td>
</tr>
<tr>
<td>4 Will monetary constraints allow or prohibit collection of new data?</td>
<td>Cost Estimate</td>
</tr>
<tr>
<td>5 Will time constraints (project time lines) allow collection of new data?</td>
<td>Time Estimate</td>
</tr>
<tr>
<td>6 Will work force constraints (expertise &amp; people available) allow collection of new data?</td>
<td>Work Force Alternatives</td>
</tr>
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</table>

**DECISION**

BY: ___________________________ DATE: ________________

100
**SOURCE EVALUATION & COMPARISON (5/96)**

**PROJECT:** Green Hills IRA  
**INFO ELEMENT:** Canopy Cover (Existing)  
**BY:** Biological-Flora IDT Subgroup  
**INFO NEEDS:** Community Diversity, Habitat Suitability & Veg Texture  
**DATE:** 6/21/96  
**ISSUE/OBJECTIVES:** #64, 77, 80, 82 & 84

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>1 DOES SOURCE EXIST?</td>
<td>YES</td>
<td>NO</td>
<td>DAYS</td>
</tr>
<tr>
<td>2 REFLECT CONDITIONS?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 USABLE FORMAT?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3a CAN BE REFORMATTED?</td>
<td></td>
<td>5</td>
<td>$500</td>
</tr>
<tr>
<td>4 MATCHES TEMPORAL BOUNDS?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 MATCHES SPATIAL BOUNDS?</td>
<td>X</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5a CAN BE DERIVED?</td>
<td></td>
<td></td>
<td></td>
</tr>
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<td>6 COVERAGE COMPLETE?</td>
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<tr>
<td>6a GET FROM ADJACENT AREA?</td>
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</tr>
<tr>
<td>7 RELIABLE?</td>
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<td></td>
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</tr>
<tr>
<td>8 YES/NO TALLY</td>
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<td>9 RECOMMENDATION &amp; COSTS</td>
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<td>45</td>
<td>$5500</td>
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</table>

**REMARKS & NOTES**

1. Will need to process, summarize and map.
2. 1993 scene from UCRB.
3. Need to summarize for project area & map.
4. Estimate 70% accuracy.
5. 80% of the data is current (some harvest & blowdown changes).
6. Non-suitable lands estimated from adjacent areas.
## DECISION MAKER'S EVALUATION

**PROJECT:** Green Hills IRA

**INFO ELEMENT:** Canopy Cover (Existing)

**INFO SOURCE (S):** 1) new field survey, 2) remote sensing & classification, 3) TSMRS Database

<table>
<thead>
<tr>
<th>DECISION CRITERIA</th>
<th>INPUT INFO</th>
<th>NO - USE EXISTING DATA SOURCE</th>
<th>YES - NEW DATA</th>
<th>REMARKS</th>
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</thead>
<tbody>
<tr>
<td>1. Does the significance or importance of the issue/objective indicate collecting new data?</td>
<td>Issue/Objective; Priority</td>
<td>X</td>
<td></td>
<td>X Could reprioritize work program $5500 / $300 /$700</td>
</tr>
<tr>
<td>2. Does the political sensitivity of the issue or the legal mandate require new data?</td>
<td>Issue/Objective: Mandate</td>
<td>X</td>
<td></td>
<td>X Complete IRA by Sept. 1 60 days to contract &amp; 45 days of FS work</td>
</tr>
<tr>
<td>3. Does the risk or implication of making a wrong decision based on inadequate information indicate collecting new data?</td>
<td>Issue/Objective; Information Need &amp; Importance</td>
<td>X</td>
<td></td>
<td>X Contract Exam OK, but no personnel to summarize data</td>
</tr>
<tr>
<td>4. Will monetary constraints allow or prohibit collection of new data?</td>
<td>Cost Estimate</td>
<td></td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>5. Will time constraints (project time lines) allow collection of new data?</td>
<td>Time Estimate</td>
<td>X</td>
<td></td>
<td>X</td>
</tr>
</tbody>
</table>

**DECISION:** Use existing data from TSMRS database

**USE EXISTING DATA & EXTRAPOLATE**

7 days / $700

**BY:** DISTRICT RANGER  **DATE:** 6/25/96
Appendix E.

Proposed Source Table

INA Database Data Dictionary - Proposed ........ 104
Uses of Source Fields .............................................. 109
A source is the place from which an information element can be obtained. The Source Form is intended to answer the following questions about information element sources:

1. What is available?
2. Where is it found?
3. Is it usable? (Source table contains criteria for determining adequacy/suitability and reliability.)

Table 4: INFORMATION ELEMENT SOURCES

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Format</th>
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</thead>
<tbody>
<tr>
<td>F1</td>
<td>SOURCE ID</td>
<td>(6 digit number)</td>
</tr>
<tr>
<td>F2</td>
<td>SOURCE CATEGORY</td>
<td>(3 digit numeric code)</td>
</tr>
<tr>
<td>F4</td>
<td>SOURCE STEWARD</td>
<td>(20 characters)</td>
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<tr>
<td>F5</td>
<td>SOURCE DATE</td>
<td>(10 digit numeric value)</td>
</tr>
<tr>
<td>F6</td>
<td>SOURCE SPATIAL BOUNDS</td>
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<td>F7</td>
<td>SOURCE TEMPORAL BOUNDS</td>
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<tr>
<td>F8</td>
<td>SOURCE STATUS</td>
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<td>F9</td>
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<td>SOURCE TYPE</td>
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<td>F11</td>
<td>SOURCE FORMAT</td>
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<td>SOURCE METHOD</td>
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<tr>
<td>F13</td>
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<td>(1 character numeric code)</td>
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<td>F14</td>
<td>SOURCE RELIABILITY/QUALITY RATING</td>
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<tr>
<td>F15</td>
<td>SOURCE MAP SCALE/RESOLUTION</td>
<td>(12 character numeric code)</td>
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</tbody>
</table>
Table 4: *INFORMATION ELEMENT SOURCES*

**F1 SOURCE ID.** - Program assigned number.

**F2 SOURCE CATEGORY** - Category of the existing or most likely source(s) for obtaining the desired information element. More than one source may be identified for an information element.

<table>
<thead>
<tr>
<th>Source Category</th>
<th>Source Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Field Survey/Inventory</td>
</tr>
<tr>
<td>2</td>
<td>Aerial Photography</td>
</tr>
<tr>
<td>3</td>
<td>Remote Sensing &amp; Classification</td>
</tr>
<tr>
<td>4</td>
<td>Data Base</td>
</tr>
<tr>
<td>5</td>
<td>Map</td>
</tr>
<tr>
<td>6</td>
<td>Special Project Report or Summary/Files</td>
</tr>
<tr>
<td>7</td>
<td>Published literature/reference</td>
</tr>
<tr>
<td>8</td>
<td>Research</td>
</tr>
<tr>
<td>9</td>
<td>Model</td>
</tr>
<tr>
<td>10</td>
<td>No known source (new need)</td>
</tr>
<tr>
<td>999</td>
<td>Source unknown or not identified</td>
</tr>
</tbody>
</table>

**F3 SOURCE NAME** - Specific name of the source. More than one source may be identified for an information element.

Examples: Source Category(F2)  Source Name

<table>
<thead>
<tr>
<th>Source Category</th>
<th>Source Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Oldgrowth Survey</td>
</tr>
<tr>
<td>2</td>
<td>Dry Creek KV Photo Flight</td>
</tr>
<tr>
<td>3</td>
<td>Gap Analysis (Rolly Redmond's Project)</td>
</tr>
<tr>
<td>4</td>
<td>TSMRS (Timber Stand Management Record System)</td>
</tr>
<tr>
<td>5</td>
<td>USGS Quad (Base Map)</td>
</tr>
<tr>
<td>6</td>
<td>Roads Map (Theme Map)</td>
</tr>
<tr>
<td>7</td>
<td>KNF Social Assessment</td>
</tr>
<tr>
<td>8</td>
<td>Forest Stand Dynamics, Oliver &amp; Larson</td>
</tr>
<tr>
<td>9</td>
<td>Gradient Analysis (U of I)</td>
</tr>
</tbody>
</table>

**F4 SOURCE STEWARD** - Administrative unit/Sub-unit responsible for collecting, managing, storing the information element. The Sponsor/Steward should be the most knowledgeable about the status & reliability source of the information element.

Examples: SO-FF  Supervisor’s Office - Fire/Fuels  
RD-VEG  Ranger District - Veg. Mgmt.  
D4-HR  3-Rivers RD - Heritage Resources  
R1-PLAN  Regional Office - Planning  
UM-FOR  University of Mt. - Forestry  
FS-INT  Forest Service - Intermountain Research Station  
LC-LIB  Lincoln County - Library
**F5 SOURCE DATE** - Date of data collection, classification, summary or report. Enter the date or a range of years to indicate the currency of the source. The source date give an indication of the reliability of the source and the data/info collection & processing methods.

<table>
<thead>
<tr>
<th>Format</th>
<th>Date</th>
<th>Source Examples</th>
</tr>
</thead>
<tbody>
<tr>
<td>Year-month</td>
<td>1993-03</td>
<td>Project report, remotely sensed scene</td>
</tr>
<tr>
<td>Year</td>
<td>1975</td>
<td>1975 Photo flight, a map</td>
</tr>
<tr>
<td>Year-Year</td>
<td>1990-1995</td>
<td>Field Surveys, theme maps (roads)</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**F6 SOURCE SPATIAL BOUNDS** - Spatial area that the source describes. Record the primary or intended description/sampling area that applies to the source. Record only one spatial area.

- ELU Ecological Land Unit
- PA Physiographic Area
- GA Geographic Area
- S Stand
- C Community
- SR Sub-region
- WS Watershed
- R Reach
- KNF Kootenai National Forest
- MA Forest Plan Management Area
- G Gradient Analysis
- SL Specific Location (noxious weeds or TES plants)
- LC Lincoln County
- AC Adjacent County(s)
- ? Not Identified (specified)

**F7 SOURCE TEMPORAL BOUNDS** - Time period the source describes. Record the primary or intended time period, if more than one temporal bound applies to the source. Record only 1 time period.

- P Prehistoric
- H Historic
- E Existing
- B Baseline (biophysical template)
- F Future
- ? Not identified (specified)
**F8 SOURCE STATUS** - Completeness or percent of the spatial bounds the source describes or covers.

XXX - estimate of percent complete
85 = 85% complete

Example: 85% of the roads are identified on road layer. 85% of the stands have cover type coded in TSMRS.

**F9 SOURCE KIND** - General category of the kind of data the source contains. Record the primary or intended data type of the source.

QL Qualitative (Descriptive attribute information)
QT Quantitative (Numeric attribute information)
M Map (Spatial information)
? Not Identified

**F10 SOURCE TYPE** - Data type of the source.

B Basic - obtained from a field survey - measurements or direct observations
I Interpreted - subjective classification or delineation based on indirect observations (examples: stand layer, cover class from photo interpretation)
D Derived - interpreted from other basic data, usually using a mathematical process (example: cover class based on remote sensed spectral class)
P Product - combination of basic, interpreted &/or derived data (example: TSMRS database)

**F11 SOURCE FORMAT** - How the information element is "captured" or formatted.

1 Paper - field notes & unsummarized reports
2 Report/Document - summarized records & studies
3 Automated - digital format (in a computer)
   3a Data table or spread sheet
   3b Integrated data base (IDB) structure
   3c Other data base structure - example INFOS
F12 SOURCE METHOD - Method used to collect the data or information element. Quality is usually higher with standard and documented methods. Unique and undocumented methods are assumed to be of lower quality or reliability. (Code 1 being most reliable & 4 least reliable.)

1 Standard & Documented
2 Standard & Undocumented
3 Unique & Documented
4 Unique & Undocumented

Standardized & documented methods are professionally accepted. They include publications or reports which have been peer reviewed. Unique or undocumented methods have not been tested.

F13 SOURCE PROCEDURES - Optional field with Quality factors for maps & field data.

1 Sampling units readily identifiable
2 Map units same over analysis/summary area
3 Sample/survey done at scale of analysis

F14 SOURCE RELIABILITY/QUALITY RATING - Rating of the quality and reliability of the source for the intended use.

S Satisfactory
U Unsatisfactory

F15 SOURCE MAP SCALE & RESOLUTION - This field needs more research and may need to be expanded to several fields. Metadata Issues. Some ideas of what to include:

Scale of the aerial photography or base map 1:24000
Minimum Mapping Unit 5 acres
Imagery size (resolution) 25m pixels
# USES OF DATABASE FIELDS

for

PROPOSED SOURCES TABLE

<table>
<thead>
<tr>
<th>TABLE</th>
<th>POSSIBLE USES</th>
</tr>
</thead>
<tbody>
<tr>
<td>FIELD NUMBER &amp; NAME</td>
<td>ID NEEDS &amp; PRODUCTS</td>
</tr>
<tr>
<td>SOURCES</td>
<td></td>
</tr>
<tr>
<td>F2 S. Category</td>
<td>X</td>
</tr>
<tr>
<td>F3 S. Name</td>
<td>X</td>
</tr>
<tr>
<td>F4 Stewardship</td>
<td></td>
</tr>
<tr>
<td>F5 S. Date/Age</td>
<td></td>
</tr>
<tr>
<td>F6 S. Temporal Bounds</td>
<td></td>
</tr>
<tr>
<td>F7 S. Spatial Bounds</td>
<td></td>
</tr>
<tr>
<td>F8 S. Status</td>
<td></td>
</tr>
<tr>
<td>F9 S. Kind</td>
<td>X</td>
</tr>
<tr>
<td>F10 S. Type</td>
<td></td>
</tr>
<tr>
<td>F11 S. Format</td>
<td></td>
</tr>
<tr>
<td>F12 S. Method</td>
<td></td>
</tr>
<tr>
<td>F13 S. Procedures</td>
<td></td>
</tr>
<tr>
<td>F14 S. Reliability /Quality Rating</td>
<td></td>
</tr>
<tr>
<td>F15 S. Map Scale/Resolution</td>
<td></td>
</tr>
</tbody>
</table>

X - Factor to Use ? - Possible Factor to Use

ID - Identify Specs. - Specifications

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Appendix F.

INA Database Data Dictionary
## INA DATABASE DATA DICTIONARY

### Table 1: ISSUES and OBJECTIVES

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Issue/Objective ID</td>
<td>(6 digit number)</td>
</tr>
<tr>
<td>F2</td>
<td>Issue/Objective Description</td>
<td>(80 characters)</td>
</tr>
<tr>
<td>F3</td>
<td>Comments</td>
<td>(80 characters)</td>
</tr>
<tr>
<td>F4</td>
<td>Priority</td>
<td>(3 character alpha code)</td>
</tr>
<tr>
<td>F5</td>
<td>Reason</td>
<td>(1 digit numeric code)</td>
</tr>
<tr>
<td>F6</td>
<td>Operator ID</td>
<td>(20 characters)</td>
</tr>
<tr>
<td>F7</td>
<td>Update Date</td>
<td>(date)</td>
</tr>
</tbody>
</table>

### Table 2: INFORMATION NEEDS

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Info Needs ID</td>
<td>(6 digit number)</td>
</tr>
<tr>
<td>F2</td>
<td>Info Description</td>
<td>(80 characters)</td>
</tr>
<tr>
<td>F3</td>
<td>Comments</td>
<td>(80 characters)</td>
</tr>
<tr>
<td>F4</td>
<td>Importance</td>
<td>(1 character alpha code)</td>
</tr>
<tr>
<td>F5</td>
<td>Resource Area</td>
<td>(5 character alpha code)</td>
</tr>
<tr>
<td>F6</td>
<td>Information Kind</td>
<td>(5 character alpha code)</td>
</tr>
<tr>
<td>F7</td>
<td>Mandate</td>
<td>(2 digit numeric)</td>
</tr>
<tr>
<td>F8</td>
<td>Operator ID</td>
<td>(20 characters)</td>
</tr>
<tr>
<td>F9</td>
<td>Update Date</td>
<td>(date)</td>
</tr>
</tbody>
</table>

### Table 3: INFORMATION ELEMENTS

<table>
<thead>
<tr>
<th>Field</th>
<th>Description</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1</td>
<td>Info Element ID</td>
<td>(6 digit number)</td>
</tr>
<tr>
<td>F2</td>
<td>Information Element Description</td>
<td>(80 characters)</td>
</tr>
<tr>
<td>F3</td>
<td>Comments</td>
<td>(80 characters)</td>
</tr>
<tr>
<td>F4</td>
<td>Importance</td>
<td>(1 character alpha code)</td>
</tr>
<tr>
<td>F5</td>
<td>Steward</td>
<td>(20 characters)</td>
</tr>
<tr>
<td>F6</td>
<td>Status</td>
<td>(20 characters)</td>
</tr>
<tr>
<td>F7</td>
<td>Spatial Bounds</td>
<td>(5 character alpha code)</td>
</tr>
<tr>
<td>F8</td>
<td>Temporal Bounds</td>
<td>(1 character alpha code)</td>
</tr>
<tr>
<td>F9</td>
<td>Source</td>
<td>(3 digit numeric code)</td>
</tr>
<tr>
<td>F10</td>
<td>Variable</td>
<td>(3 digit numeric code)</td>
</tr>
<tr>
<td>F11</td>
<td>Unit Of Measure</td>
<td>(3 digit numeric code)</td>
</tr>
<tr>
<td>F12</td>
<td>EM Class</td>
<td>(1 character alpha code)</td>
</tr>
<tr>
<td>F13</td>
<td>Strata</td>
<td>(6 character alpha code)</td>
</tr>
<tr>
<td>F14</td>
<td>Operator ID</td>
<td>(20 characters)</td>
</tr>
<tr>
<td>F15</td>
<td>Update Date</td>
<td>(date)</td>
</tr>
</tbody>
</table>

* These fields have reference tables associated with them, so they have established "acceptable" values (which can be added to or changed as necessary).

X Source and Variable Fields and fields closely associated with them may be developed (expanded) into separate database tables at a later date.
FIELD DEFINITIONS & EXAMPLES

Table 1: ISSUES/OBJECTIVES

F1 ISSUE/OBJECTIVE ID - Program assigned number.

F2 ISSUE/OBJECTIVE DESCRIPTION - A statement of the issue or objective to be addressed.

F3 COMMENTS - Comments related to issue/objective.

F4 PRIORITY - The management priority assigned to issue/objective. Priority is based on the relative importance in accomplishing the area assessment or project objectives.

<table>
<thead>
<tr>
<th>Code</th>
<th>Priority</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>High</td>
</tr>
<tr>
<td>M</td>
<td>Medium</td>
</tr>
<tr>
<td>L</td>
<td>Low</td>
</tr>
<tr>
<td>O</td>
<td>Optional</td>
</tr>
</tbody>
</table>

(My thought is: if F5 Reason = Required then Priority would be High. Optional might apply to issues or objectives that are specific to a landscape, like grizzly bear issue.)

F5 REASON - Category of the purpose or goal associated with the stated issue or objective. One or more reasons are required. (These reasons fit into steps of the assessment process.)

1 - CHARACTERIZE - Describe the area, landscape or resource. This includes: 1) defining the analysis area - spatial/physical boundary determination (PA, Watershed, VRU(ELU) criteria; 2) determining & describing natural ranges or reference conditions; & 3) determining & describing existing conditions.

2 - DIAGNOSE/EVALUATE - Identify conditions which may warrant management actions. Compare & analyze ecosystem conditions & capabilities with desired conditions to identify opportunities/strategies to maintain or restore productive, sustainable, healthy ecosystems & socially desirable conditions.

3 - RISK/EFFECT - Identify the risks or probable effects and feasibility of alternative & no treat scenarios. Risk & effects may need to be evaluated prior to fully determining management actions.

4 - REQUIRED - Mandated by a law, regulation, policy or agreement. If issue/objective is required, the specific requirement needs to be coded in Table 2 Field 4.
5 - PUBLIC ISSUE - A current public or social issue which needs to be addressed in the assessment.

6 - MONITOR - Identify & appraise changes or trends in resource conditions.

9 - NOT IDENTIFIED (categorized)

**F6 OPERATOR ID** - Person last accessing the record.

**F7 UPDATE DATE** - Date of last access of the record.

---

Table 2: **INFORMATION NEEDS**

<table>
<thead>
<tr>
<th><strong>F1 INFORMATION NEED ID</strong></th>
<th>Program assigned number.</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>F2 INFORMATION NEED DESCRIPTION</strong></td>
<td>A statement of the information needed to address the associated issue/objective.</td>
</tr>
<tr>
<td><strong>F3 COMMENTS</strong></td>
<td>Comments related to information need.</td>
</tr>
<tr>
<td><strong>F4 IMPORTANCE</strong></td>
<td>Relative importance of this information in addressing the related issue/objective.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>High</td>
</tr>
<tr>
<td>M</td>
<td>Moderate</td>
</tr>
<tr>
<td>L</td>
<td>Low</td>
</tr>
</tbody>
</table>

(Which information needs are the most critical to addressing the issue or meeting the objective?)

**F5 RESOURCE AREA** - Resource area(s) that identified the information need.

<table>
<thead>
<tr>
<th>Code</th>
<th>Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>AQ</td>
<td>Aquatics/Hydrology/Fisheries</td>
</tr>
<tr>
<td>EC</td>
<td>Ecology</td>
</tr>
<tr>
<td>ENG</td>
<td>Engineering</td>
</tr>
<tr>
<td>FF</td>
<td>Fire/Fuels</td>
</tr>
<tr>
<td>HR</td>
<td>Human &amp; Heritage Resources (social sciences)</td>
</tr>
<tr>
<td>PL</td>
<td>Planning</td>
</tr>
<tr>
<td>S</td>
<td>Soils &amp; Minerals</td>
</tr>
<tr>
<td>VEG</td>
<td>Vegetation/Silviculture &amp; Range</td>
</tr>
<tr>
<td>VIS</td>
<td>Visuals &amp; Recreation</td>
</tr>
<tr>
<td>WL</td>
<td>Wildlife</td>
</tr>
<tr>
<td>?</td>
<td>Not Identified</td>
</tr>
</tbody>
</table>
**F6 INFORMATION KIND** - General category of the kind of information needed. One or more kinds may be required or desired.

- **QL** - Qualitative (Descriptive attribute information)
- **QT** - Quantitative (Numeric attribute information)
- **M** - Map (Spatial information)
- **?** - Not Identified (specified)

(This field is intended to provide an indication of the accuracy or precision of the information needed. For historic or baseline information a quantitative range may apply, or only qualitative may be feasible.)

**F7 MANDATE** - If applicable, the specific law, regulation, or policy requiring the information be evaluated/presented. More than one mandate may be identified.

1. INFISH Inland Native Fish Strategy
2. WA Clean Water Act
3. WQA Water Quality Act
4. ESA Endangered Species Act
5. NHPA National Heritage Protection Act
6. SHPO State Historic Preservation Office Agreement
7. CAA Clean Air Act
8. NEPA National Environmental Protection Act
9. FP (KNF) Forest Plan Standards
10. MEMP Montana Elk Management Plan
11. MWQR Montana Water Quality Regulations
12. EPA Environmental Protection Agency
13. MCSMP Montana Cooperative Smoke Management Plan
14. MAQB Montana Air Quality Bureau
15. ARFA American Indian Religious Freedom Act
16. Treaty Hellgate Treaty

**OTHER EXAMPLES:**
- FSM # - Forest Service Manual Reference Number
- Interagency or Memorandum of Agreement - specify
- Lincoln County Noxious Weed Plan
- Roadless Area Policy
- Federal Register

**F8 OPERATOR ID** - Person last accessing the record.

**F9 UPDATE DATE** - Date of last access of the record.
Table 3: *INFORMATION ELEMENTS*

**F1 INFORMATION ELEMENT ID** - Program assigned number.

**F2 INFORMATION ELEMENT DESCRIPTION** - A key characteristic, attribute or component of an information need.

**F3 COMMENTS** - Comments related to information element.

**F4 IMPORTANCE** - Relative importance of the element in addressing the related information need.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>H</td>
<td>High</td>
</tr>
<tr>
<td>M</td>
<td>Moderate</td>
</tr>
<tr>
<td>L</td>
<td>Low</td>
</tr>
</tbody>
</table>

(Which element(s) are most critical to satisfying the information need?)

**F5 STEWARD** - The administrative unit/subunit or the primary organizational level and resource area responsible for collecting, managing and storing the information element.

Examples:  
- SO-FF Supervisors Office - Fire/Fuels  
- RD-WL Ranger District - Wildlife  
- RO-PL Regional Office - Planning  
- UM-For University of Mt. -Forestry  
- FS-INT Forest Service - Intermountain Research Station  
- MF-Lib Mansfield Library  
- USGS US Geological Survey

(This field may be more beneficial as part of the "Source Form" to be developed. It identifies who knows the status of the data or information element.)

**F6 STATUS** - Description of the state or condition of the information element.

An estimate made by the "Steward" as to the coverage & adequacy of the information.

Example: ____% complete/acceptable (usable) 0-100%

(This field will probably be more developed with the "Source Table" to help assess the adequacy or reliability of the data source.)
F7 SPATIAL BOUNDS - The spatial area to be evaluated in order to address the related information need. An information element may need to be summarized or evaluated on more than one hierarchical scale to adequately meet the information need.

- VRU Vegetative Response Unit (ELU- Ecological Land Unit)
- GA Geographic Area
- S Stand
- C Community (social)
- SR Sub-region
- WS Watershed
- R Reach (stream segment)
- KNF Kootenai National Forest
- RD Ranger District
- MA Forest Plan Management Area
- G Gradient Analysis
- SL Specific Location (for noxious weeds or TES plants)
- LC Lincoln County
- AC Adjacent County(s)
- ? Not Identified (or specified)

F8 TEMPORAL BOUNDS - Time frame to be evaluated in order to address the related information need. More than one may be applicable.

- P Prehistoric (Pre-European Contact - before 1800)
- H Historic (Post European Contact - 1800 - 1946?)
- E Existing
- B Baseline (biophysical template)
- F Future
- ? Not Identified (or specified)
**F9 SOURCE** - General category for the existing or most likely source(s) for obtaining the information element.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Field Survey/Inventory</td>
</tr>
<tr>
<td>2</td>
<td>Aerial Photography</td>
</tr>
<tr>
<td>3</td>
<td>Remote Sensing &amp; Classification</td>
</tr>
<tr>
<td>4</td>
<td>Data Base</td>
</tr>
<tr>
<td>5</td>
<td>Maps [Base (USGS Quads) &amp; Theme (Roads, Stands, etc.)]</td>
</tr>
<tr>
<td>6</td>
<td>Special Project Report or Summary/Files (UCRB)</td>
</tr>
<tr>
<td>7</td>
<td>Published Literature/Reference</td>
</tr>
<tr>
<td>8</td>
<td>Research</td>
</tr>
<tr>
<td>9</td>
<td>Model</td>
</tr>
<tr>
<td>10</td>
<td>No Known Source (new need)</td>
</tr>
<tr>
<td>999</td>
<td>Unknown Source or not identified</td>
</tr>
</tbody>
</table>

(If the "Source Form" is developed a field which will specifically identify the data/information sources (i.e., TSMRS data base, LSI Handbook) will be linked to this field.)

**F10 VARIABLE** - The data or information items which, when summarized, will result in the information element desired. A variable of an information element is often an amount (area or volume), type (species, age, quality) and a location.

<table>
<thead>
<tr>
<th></th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Species</td>
</tr>
<tr>
<td>2</td>
<td>Size</td>
</tr>
<tr>
<td>3</td>
<td>Height</td>
</tr>
<tr>
<td>4</td>
<td>Amount</td>
</tr>
<tr>
<td>5</td>
<td>Productivity</td>
</tr>
<tr>
<td>6</td>
<td>Area</td>
</tr>
<tr>
<td>7</td>
<td>Density</td>
</tr>
<tr>
<td>8</td>
<td>Type/Kind</td>
</tr>
<tr>
<td>9</td>
<td>Group/Classification</td>
</tr>
<tr>
<td>10</td>
<td>Location</td>
</tr>
<tr>
<td>11</td>
<td>Width</td>
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<td>Shape</td>
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</tr>
<tr>
<td>15</td>
<td>Intensity</td>
</tr>
<tr>
<td>16</td>
<td>Interval</td>
</tr>
<tr>
<td>17</td>
<td>Abundance</td>
</tr>
<tr>
<td>18</td>
<td>Distribution</td>
</tr>
<tr>
<td>19</td>
<td>Composition</td>
</tr>
<tr>
<td>20</td>
<td>Age/Time of</td>
</tr>
<tr>
<td>21</td>
<td>Continuity</td>
</tr>
<tr>
<td>22</td>
<td>Depth</td>
</tr>
</tbody>
</table>

(If someone said "I need road information", this field clarifies the data needed. This field will track the more detailed responses included in the initial survey. A "Variable Table" may be developed to more specifically identify the field survey data needs.)
**F11 UNIT OF MEASURE** - The measurement method to quantify or describe the variable. Some possible units are:

1. Acres
2. Number/acre
3. Basal area/acre
4. Tons/acre
5. MBF (thousand board feet)
6. Miles
7. Days
8. Number of individuals
9. Dollars/decade
10. Feet
11. Percent
12. Index
13. Fractals
999. Not Identified

(This field should be part of the "Variable Table" if it is developed.)

**F12 EM CLASS** - Classification of the ecosystem management characterization descriptor(s) that the element provides.

- C Composition
- S Structure
- F Function
- P Process
- ? Not Identified (classified)

(This field can be used to identify which descriptors are numerous or lacking, especially in combination with a strata or resource area. For example, if we have identified 8 ways to describe floral composition, maybe only 1-3 ways would be enough.)
F13 STRATA - Classification of the environmental components of an assessment. More than one category may apply to an information element.

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>B-FLO</td>
<td>Biological Environment - Flora</td>
</tr>
<tr>
<td>B-FAU</td>
<td>Biological Environment - Fauna</td>
</tr>
<tr>
<td>E-DIV</td>
<td>Ecological/Landscape - Diversity</td>
</tr>
<tr>
<td>E-PRO</td>
<td>Ecological/Landscape - Process/Disturbance</td>
</tr>
<tr>
<td>P-AQU</td>
<td>Physical Environment - Aquatic</td>
</tr>
<tr>
<td>P-TER</td>
<td>Physical Environment - Terrestrial</td>
</tr>
<tr>
<td>P-ATM</td>
<td>Physical Environment - Atmospheric</td>
</tr>
<tr>
<td>S-SOC</td>
<td>Social Environment - Social</td>
</tr>
<tr>
<td>S-ECO</td>
<td>Social Environment - Economic</td>
</tr>
<tr>
<td>?</td>
<td>Not Identified (classified)</td>
</tr>
</tbody>
</table>

(The primary purpose of this field is to stratify or group elements into common environments. Inventory needs & methods are often different between strata, so it will probably serve as a basis for integrating inventories. This field can be used as a basis for organizing information and data elements in the assessment document.)

(Strata groups tie to UCRB Assessment.)

F14 OPERATOR ID - Person last accessing the record.

F15 UPDATE DATE - Date of last access of the record.
Appendix G.

Database Operations:

INA File Structure ..................................................... 121
INA Database Structure ............................................ 123
SQL Table Descriptions ........................................... 124
Database Operations ............................................... 130
Data Entry Forms ....................................................... 140
INA DATABASE FILE STRUCTURE

INA Database, on the Kootenai National Forest IBM system, is comprised of 27 ORACLE tables. Supporting files are in the directory ina_renee (currently under /fsapps/fsother/). There are 4 sub-directories under the ina_renee directory. Below is a detailed list and description of the INA database & file structure as of 2/27/97.

1. **ORACLE Tables** - Tables listed in alphabetical order are:

   ele_class_matches  
   ele_source_matches  
   ele_spb_matches  
   ele_strata_matches  
   ele_teb_matches  
   ele_um_matches  
   ele_var_matches  
   em_class_references  
   information_elements  
   information_needs  
   io_need_matches  
   io_reason_matches  
   issue_objectives  
   kind_references  
   mandate_need_matches  
   mandate_references  
   need_area_matches  
   need_kind_matches  
   reason_references  
   resource_area_references  
   source_references  
   spatial_bounds_references  
   strata_references  
   temporal_bounds_references  
   um_references  
   variable_references

2. **Admin Sub_directory** - Admin contains original files from DG with indexes, grants and synonyms.

3. **Forms Sub_directory** - Forms contains the forms for input and editing of database tables.
   The .fmx files are the executable forms and the .fmb files are the source files for the forms which containing the instructions used in creating or for modifying the forms.

   **Data Input/Edit Forms:**
   - iss_obj.fmx  issue and objectives and related fields and tables
   - info_need.fmx  information needs and related fields and tables
   - info_elem.fmx  information elements and related fields and tables

   **Reference Forms:**
   - em_class_ref.fmx  ecosystem classes reference list
   - kind_ref.fmx  kinds of information reference list
   - mand_ref.fmx  mandate reference list
   - reas_ref.fmx  reason reference list
   - res_area_ref.fmx  resource area reference list
   - sp_bnd_ref.fmx  spatial bounds reference list
   - scr_ref.fmx  source reference list
   - tmp_bnds_ref.fmx  temporal bounds reference list
   - um_ref.fmx  unit of measure reference list
   - var_ref.fmx  variable reference list
3. **Sql Sub-directory** - Sql contains a number of executable queries to aid in editing and summarizing data. The .sql files the executable queries.

4. **Reports Sub-directory** - Reports contains the reports designed for summarizing and displaying the data in the INA database. The .rdf files are the source files for the reports which containing the instructions used in creating or for modifying the reports.
The symbols (boxes) below represent the three types of tables in the database:

- Primary Tables
- Match Tables
- Reference Tables

Relationships are expressed by lines between the table boxes. Solid lines represent mandatory relationships. Dashed lines represent optional relationships.

A crow's foot (—) indicates that each occurrence of the first entity is related to one or more occurrences of the second entity.

Each issue/objective must have one or more information needs and one or more reasons. These relations are stored in the match tables. The reference tables store lists of acceptable values.
### SQL TABLE DESCRIPTIONS

The SQL Descriptions show the specifications for the tables and field values. The descriptions are used in writing queries and designing reports.

**SQL> DESC ELE_CLASS_MATCHES**

<table>
<thead>
<tr>
<th>Name</th>
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<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
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SQL> DESC INFORMATION_ELEMENTS

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SQL> DESC **MANDATE_NEED_MATCHES**

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SQL> DESC **MANDATE_REFERENCES**

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SQL> DESC **NEED_ELEMENT_MATCHES**

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SQL> DESC **NEED_KING_MATCHES**

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### SQL> DESC SPATIAL_BOUNDS_REFERENCES

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### SQL> DESC STRATA_REFERENCES

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### SQL> DESC TEMPORAL_BOUNDS_REFERENCES

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### SQL> DESC UM_REFERENCES

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<th>Type</th>
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</thead>
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SQL> DESC VARIABLE_REFERENCES

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</table>
DATABASE OPERATIONS

INA Database is an Oracle application and uses SQLPLUS language. File access and execution of forms, reports and queries depends on how database loaded onto user’s IBM system. Future plans for this application include a start-up menu. Directions for using the current prototype are outlined below.

a. Forms - Accessing and Running

- Open SQL+ Menu on the tool bar
- Select RUN FORMS
- At File: type in pathname [/fsapps/fsother/forms/iss_obj.fmx]
- <enter>

To look up the name of a form & insert it at the File:
Select Browse & in the filler block type: path
[/fsapps/fsforms/ina_renee/forms/* fmx] & <enter> to get
the list of forms
Double click on form to put it in the File: block

- Click on Userid: block & enter ID
- Click on Password: block & enter password
- <enter> or click OK button to bring up input/edit screen for the selected form
- Click on EXIT button will close the form

(forms can also be run from a dtterm window in the forms sub-directory using the command go.runforms)

Examples of the data input forms are shown on the next pages.)
1) Issue Objectives Data Entry Screen
2) Information Needs Data Entry Screen
3) Information Elements Data Entry Screen
4) Reason_Area_References Data Entry Screen

![Reason Area References Data Entry Screen](image-url)
b. **Data Entry and Editing**

Note: Use uppercase (capital letters) for all descriptions, comments and field values, because ORACLE and SQLPLUS are case sensitive.

1) **Function Keys**

Function keys may be viewed and selected in a number of ways:
- Primary keys used in editing & inserting records are the buttons at bottom of the forms.
- Some function keys can be selected from the top bar menus.
- HELP in upper right corner views a list of function keys and list of values for selected fields. (You must close help before you can resume editing the form.)

2) **Editing Records**

Records are edited through the *query mode*.
Upon entering the data input form the screen will be in the query mode & will show the first record. (The first IO record is #58.)

- To find record you want to edit do one of the following:
  1. use down & up arrows to move through all the records.
  2. click on *QUERY* button and type in the record ID #, then click on *EXECUTE* button.
  3. click on *QUERY* button, click on Description block, type in full description, then click on *EXECUTE* button.
  4. click on *QUERY* button, click on Description and use wild card symbol % (word)%%, then click on *EXECUTE* button.

Example of wild card: If you want to find all the records with the word HUMAN, type %HUMAN% and *EXECUTE* button to execute the query. Use up and down arrows to display and edit records with word HUMAN.

- Click on any box you wish to edit (except ID which cannot be changed).
- Change value or enter new values, then click *SAVE* button. (A message at bottom of screen will verify the number of records added or changed.)
- *QUERY* will clear block & allow you to query another record.
- *REVERT* button brings up dialog box that asks if you want to save your change.
- *ADD* button to will put you in the *insert mode*. Also arrow or scroll down to add value to a multiple record field.
- When querying multiple record fields *EXIT* button once will get you out of query mode & allow you to click on another field or enter the insert mode.
3) Adding Records

Records are added through the **insert mode**.

- Click on **ADD** button to put you in the insert mode.
- To enter new record type in a Description, <enter> to move to next field or click on next field.
- **REVERT** will let you start over if you made mistake and want to start over.
- When data entry is complete click **SAVE** button and a new ID # will be assigned to the record.
- When done click on **description block & arrow down** or **ADD** button to input next new record.

4) Deleting Records

Use **caution** especially when deleting primary records (Issue/Objectives, Information Needs or Information Elements) on their input forms. Once deleted the reference # cannot be reinstated. Removing an information need from the issue objective form will cancel the link or match between them but not delete the information need from the database. To delete an Information Need all the Issue/Objectives matches must be removed first and **changes saved**.

- Click on the record you want to remove.
- Then select **Record** on upper menu bar & **Remove**.
- **SAVE** is need to commit the deletion/change.
- To change or delete a non-match table fields (i.e., priority, comments, stewardship, etc.), backspace or use delete key, or highlight the word as with usual word processing.
- Selecting **Record** at upper menu bar & **Clear** will clear or remove a blank record.

5) Reference Tables

Changing or deleting records in a reference table will affect all existing records in the database and should be done only after checking to see how many records will be affected.

- Select **RUN FORMS** & follow steps for accessing & running forms.
- TO Edit - type in change **Exit** and **yes** to save.
- TO Delete - Control delete **Exit** and **yes** to save.
- TO Add - Type in next empty block (arrow to bottom). **Exit** and **yes** to save.
c. Queries - Accessing, Executing, Editing & Printing

1) To access SQL queries:
   - In the sql sub-directory open a dtterm window.
   - Selecting File - Open Terminal and enter bolded responses as shown below:

   ```
   ll1.lincoln.helena.fs.fed.us/fs/fsapps/fsother/ina_renee/sql : sqlplus <
   SQL*Plus: Release 3.2.3.0.0 - Production on Wed Feb 26 16:31:38 1997
   Enter user-name: fsdba
   Enter password: xxxxx
   Connected to:
   Oracle7 Server Release 7.2.3.0.0 - Production Release
   With the distributed and parallel query options
   PL/SQL Release 2.2.3.0.0 - Production
   ```

2) To execute & print a query:
   - SQL> @query_name (@tally_ie) runs the query.
   - An output file query_name.lst (tally_ie.lst) will be created in the sql sub-directory (because existing queries do contain the spool & spool off commands).
   - Click on .lst file & select Selected - Open or Print to view or print the output.
   - At sql > exit or close the open window to stop a query or exit sql.

Note: Queries that need to be printed landscape can be printed by changing the laser printer menu to landscape OR by importing the .lst file into an applix word document using the following steps:
   - Open word document.
   - On upper menu select File - Import & select file from directory (sql).
   - Use Import File Type ASCII lines.
   - If it appears there is no data you need to delete the first 1 or 2 pages from the file
   - Then Format - Page Setup & change to landscape with left & right margins of 0.5 & OK.
   - Print as a regular word document.

3) To edit a query:

Queries can be copied and modified to suit the user.
   - In the sql sub-directory click on the query to copy, then Selected - Copy to & provide a new filename.
   - SQL> ed query_name (tally_ie) will open the EMACS editor for editing the file.
• Edit the query then Files - Exit EMACS & save buffer.
• (A hard copy of the query can be made selecting Tools - Print Buffer in EMACS).
• Or vi query_name.sql at the dtterm prompt to use the VI editor (if you are in SQLPLUS you must exit SQL before accessing the VI editor).

d. Reports - Accessing, Executing, Printing & Editing

1) To access Reports:

• Open SQL+ Menu on the tool bar.
• Select RUN REPORTS (this will bring up the Oracle Reports runtime dialog box).
• Select File - Connect.
• Provide userid & password - click on Connect.
• Select File - Run and change to filter pathname [/fsapps/fsother/reports/*] & <enter>.
• Double click on the report name [iss_obj.rfd] or single click on the report & click OK.
• Enter variables on the Runtime Parameter Form if desired (change Destype to Preview if you plan to print the report), then click on Run Report.

(Note: parameter variables must match database values - use all capital letters & %****% for Description (wildcard value)).

• Select Close to get out of report & run another
• File - Exit will close the report and exit run reports dialog box

2) To print Reports:

• Select File - Page Set up in the open report or prior to running report - Default is portrait.
• Select File - Choose Printer to view or change default printer.
• Select Print & options through print dialog boxes.
• Select Close to get out of report & run another.
• File - Exit will close the Runtime dialog box and exit run reports.

3) To edit Reports:

• Go into the Reports sub-directory.
• Double click on the report to be modified (recommend copying the report to a "test" file before changing a report).
• Connect to fsdba.
• Then report can be edited or run through the Oracle Reports Object Navigator.
New reports can be designed through the Reports sub-directory by opening a new report or through menu bar **SQL - Database - Reports Designer**.

4) To save Reports:

**Currently not working.**

Changing Destype to File In the Runtime Parameter Form will allow you to save the report in a specified directory - BUT it saves it as a postscript file & the viewer is not working. I was told that when GHOSTVIEW is fixed the saved file should be able to print & view the saved report.
### ISSUE/OBJECTIVE Data Entry Form (3/28/97)

**Name:** _______________________________

**Resource:** _______________________________

**Date:** _______________________________

**PROJECT** _______________________________

<table>
<thead>
<tr>
<th>IO ID</th>
<th>ISSUE/OBJECTIVE</th>
<th>COMMENTS</th>
<th>REASON</th>
<th>PRIORITY</th>
<th>IN ID</th>
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### INFORMATION NEEDS Data Entry Form (3/28/97)

#### IN ID INFORMATION NEED COMMENTS IMPORTANCE RESOURCE AREA KIND MAND-DATE IE ID

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<th>IN ID</th>
<th>INFORMATION NEED</th>
<th>COMMENTS</th>
<th>IMPORTANCE</th>
<th>RESOURCE AREA</th>
<th>KIND</th>
<th>MAND-DATE</th>
<th>IE ID</th>
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INFORMATION ELEMENTS Data Entry Form (3/28/97)

Name: _____________________________
Resource: ___________________________
Date: ________________________________

<table>
<thead>
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<th>IE ID</th>
<th>INFORMATION ELEMENT</th>
<th>COMMENTS</th>
<th>IMPORTANCE</th>
<th>STEWARD</th>
<th>STATUS</th>
<th>SPATIAL BOUNDS</th>
<th>TEMPORAL BOUNDS</th>
<th>SOURCE</th>
<th>VARIABLE</th>
<th>UNIT OF MEASURE</th>
<th>IN ID</th>
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Appendix H.

List and Description of Reports and Queries
LIST AND DESCRIPTION  
of  
REPORTS AND QUERIES

This list describes the kind of information that can be obtained from 14 reports and 17 queries available. The report's title is followed by the computer file name. Some of the reports are still in the developmental phase. Example outputs are available in a supplementary notebook.

Reports:

1. Issues and Objectives Report (iss_obj.rdf) - Displays all fields on the Issues and Objectives (IO) table, except operator and update date, and lists the related Information Need identification numbers (IN IDs). It is ordered by the IO ID. It can be run by the IN resource area, IE strata, priority and/or a description (key word).

2. Issues and Objectives Report (iss_obj_short.rdf) - Is a shortened version of report 1. It does not list the related IN IDs.

3. Information Needs Report (info_needs.rdf) - Displays all fields on the IN table, except operator and update date, and lists the related Information Element (IE) IDs. It is ordered by the IN ID. It can be run by resource area, IN importance, IE strata, IE steward and or a description.

4. Information Needs Report (info_needs_short.rdf) - Is a shortened version of report 3. It does not list the related IE IDs.

5. Information Element Report (info_elem.rdf) - Displays all fields on the IE table, except operator and update date. It is ordered by the IE ID and can be run by IN resource area, strata, IE importance, and/or a description.

6. Needs Outline Report (needs_outline.rdf) - Displays the Issue or Objective and ID, the Information Need and ID, and the Information Element and ID in an outline form. It is ordered by the IO ID, IN ID, IE ID. It can be run by IO priority, IN importance, IE importance, IN resource area, IE strata, IE steward and/or a description. It can serve as a crosswalk between the IO, IN, and IE Reports. (Note: report needs work - multiple parameters don't run quite right.)

7. Needs Outline Report (needs_outline2.rdf) - Is a modified version of report 7. The information elements descriptions (IE's) are listed in alphabetical order, so similar names are grouped together. (Note: report needs work - multiple parameters don't run quite right, same as 7.)

8. Needs Outline Report (needs_outline_short.rdf) - Displays the Issue or Objective and ID, and the Information Need and ID in an outline form. It does
not show Information Elements. It is ordered by the IO ID and IN ID. It can be run by IO priority, IN importance, IN resource area and/or a description.

9. **Needs Outline Report** *(needs_outline_dese_pri_imp.rdf)* - Displays the Issue or Objective and ID, the Information Need and ID, and the Information Element and ID in an outline form. It is ordered by the IO ID, IN ID, and IE description (alphabetical order). It can be run by IO priority, IN importance, IE importance, IN resource area, IE strata, IE steward and/or a description. It can serve as a crosswalk between the IO, IN, and IE Reports. It can be run by IO priority, IN importance, IN resource area and/or a description. **This report is recommended over reports 6 & 7.**

10. **Dangling Information Elements Report** *(dang_elem.rdf)* - Displays Information Elements and IDs that are not related to (or matched with) any Information Need. According to the rules, for an IE to be valid it must meet one or more information needs.

11. **Dangling Information Needs Report** *(dang_needs.rdf)* - Displays Information Needs and IDs that are not related to (or matched with) any Issue or Objective. According to the rules, for an IN to be valid it must be required for one or more issues or objectives.

12. **Common Elements Outline Report** *(common_elem.rdf)* - Displays the Information Element and IE ID, and Variable(s), and associated Information Need and ID, and Resource Area. It is alphabetically ordered by IE description with the IN’s ordered by ID number. **It shows which resource areas have common needs and IE’s.** The number of IN’s and IE’s associated with each IE description can be an indication of the importance of the IE. (Note: this report needs to have parameters added for IO priority, IN & IE importance in order to be project specific.)

13. **Common Elements Outline Report** *(common_elem_short.rdf)* - Is a shortened version of report 12. It does not list the IE variables. Like report 12 it **shows which resource areas have common needs and IE’s.** (Note: this report needs to have parameters added for IO priority, IN & IE importance in order to be project specific.)

14. **Common Elements Outline Report** *(common_elem_pri.rdf)* - Is a version of report 13 which lists only IE’s & IN’s with an importance value of H. It does not list the IE variables. Like report 12 it **shows which resource areas have common needs and IE’s.** (Note this report fills the gap until a parameter field is added to the report for project specificity.)
Queries:

1. **EM Class** (em_class.sql) - This query lists the ecosystem management classification assigned to the IE, and shows the IE ID, Description and Comments, and variable(s) of the IE. It is grouped by EM Class and IE description. IE's which provide structure, composition, function and process information could be considered more important and given a higher priority. Variations of this query could be used to identify if one EM class is over- or under-represented.

2. **IE Importance and Status** (imp_status.sql) - This query file has 3 queries; One for each importance value H, M & L. The list of IE's is grouped by status and shows the assigned steward. It can be useful in evaluating and summarizing the IE's which are chosen to be included in the assessment or analysis project, their status and steward.

3. **IE Importance, Status & Resource** (imp_status_res.sql) - This query is similar to query number 2 with the addition of resource area field. The query file has 3 queries; One for each importance value H, M & L. The list of IE's is grouped by status and shows the assigned steward. It can be useful in evaluating and summarizing the IE’s which are chosen to be included in the assessment or analysis project, their status and steward, along with resource area having an IN that requires the IE. The IE’s "steward" can see which resource areas have a need or interest in the IE.

4. **Information Need & Information Elements** (in_ie_list.sql) - This query displays the IE's for the specified IN ID grouped by the IE ID. If you wanted to see which elements are needed for hydrology, stream and water quality, you would edit the file to specify those information needs and query would display what information elements are common among those needs. (Change the title line and the IN IDs to run for your specific question.)

5. **Info Need Kind** - This query lists the kind of information (map, qualitative or quantitative) associated with a given information element. It shows the kind, the IE description and the variables that are associated with the IE. For instance it shows you all the map needs and the variables that need to be shown or calculated.

6. **Info Need and Mandate** (mandate.sql) - This query lists the IN ID, IN description, importance and the mandate that is identified with the IN. It shows what information needs have mandates associated with them (and which do not). If an IN has a mandate, theoretically its importance should be coded high.

7. **Info Need and Mandate by Resource** (mandate_resource.sql) - This query is similar to query number 5 but includes the IO ID. and is run for the specified resource area. It shows the IO ID, IN description, the importance and mandate. Query is to be modified for the desired resource area. You could use this query
to see information needs for VEG/SILV and which ones are mandated and their assigned importance.

8. **Roads** (roads.sql) - This query shows the IN’s and IE’s asking for road information in 2 queries; one for IN’s with %road% and one for IE’s. The IN ID and Description, the IE ID and Description, the Variable and the Resource Area requesting road information is listed. It groups by IE description and is ordered by IN and IE IDs.

9. **Same IN & IE** (same.sql) - This query shows which IE’s & IN’s are worded exactly the same. For instance fire regime could be listed as an information need or as an information element; this query will show if that has occurred.

10. **Sources** (sources.sql) - This query displays the potential information element sources, associated with each IE. It show the IE ID, Description and Comments and the Variable and Source(s). It is ordered by the IE Description. This query can be used in the Source Evaluation and selection process described in the Results, Chapter 4.

11. **Field Sources** (source1.sql) - This query is essentially the same as 9 except that it only lists the IE’s that have source code 1, field survey/inventory identified as a potential data source. It can be used in designing an integrated inventory. A variation of this query which groups by strata would also be helpful in identifying integrated inventory opportunities.

12. **Spatial Bounds** (spatial_bounds.sql) - This query shows which elements are listed for each spatial bounds category. For instance it shows all the IE’s that need to be summarized or analyzed by VRU or by stream reach.

13. **Status** (status.sql) - This query lists each IE with its status, importance and steward. It shows which IE’s have these fields completed and what the field values are.

14. **Strata** (strata.sql) - This query shows the IE’s listed under each strata. It is grouped by strata type and/or ordered by IE Description (so similar elements are listed together). Strata is a general grouping which can be used to organize, summarize and prioritize the information elements. IE’s in the same strata usually require similar data collection methods. Resource area could be added to this query, so it would be useful to identify **resource areas with similar data collection and analysis needs.**
15. **Strata & Resource** (strata_bflo.sql) - This query shows the IE’s listed under the queried strata and the resource area of the associated IN. It is grouped by strata type and ordered by IE Description (so similar elements are listed together) and the resource areas for each IE are listed. Query and title need to be modified for to specify the desired strata. For instance this query will show you the elements in the B-Flora Strata and the resource areas that have an IN requiring that IE. IE’s in the same strata usually require similar data collection methods. This query can be used to identify **resource areas with similar data collection and analysis needs.**

16. **Info Element & Times Used** (tally_ie.sql) - This query lists each IE and show how many times the IE is "matched" with an information need record, and is ordered by frequency. It shows which IE’s are associated with the most IN’s. For instance Activity and use on roads was needed the most. This query can be modified to show which IE’s are needed >10 times or only the IE’s where importance is high (H).

17. **Info Need & Times Used** (tally_in.sql) - This query lists each IN and shows how many times the IN is "matched" with an issue or objective record, and is ordered by frequency. It shows which IN’s are associated with the most IO’s. For instance Activity and use on roads was needed the most. This query can be modified to show which IN’s are needed >10 times or only the IN’s where importance is high (H).