NORTHWEST FOREST PLAN
THE FIRST TEN YEARS (1994–2003)

Interagency Resource Information Management: Issues, Vision, and Strategies

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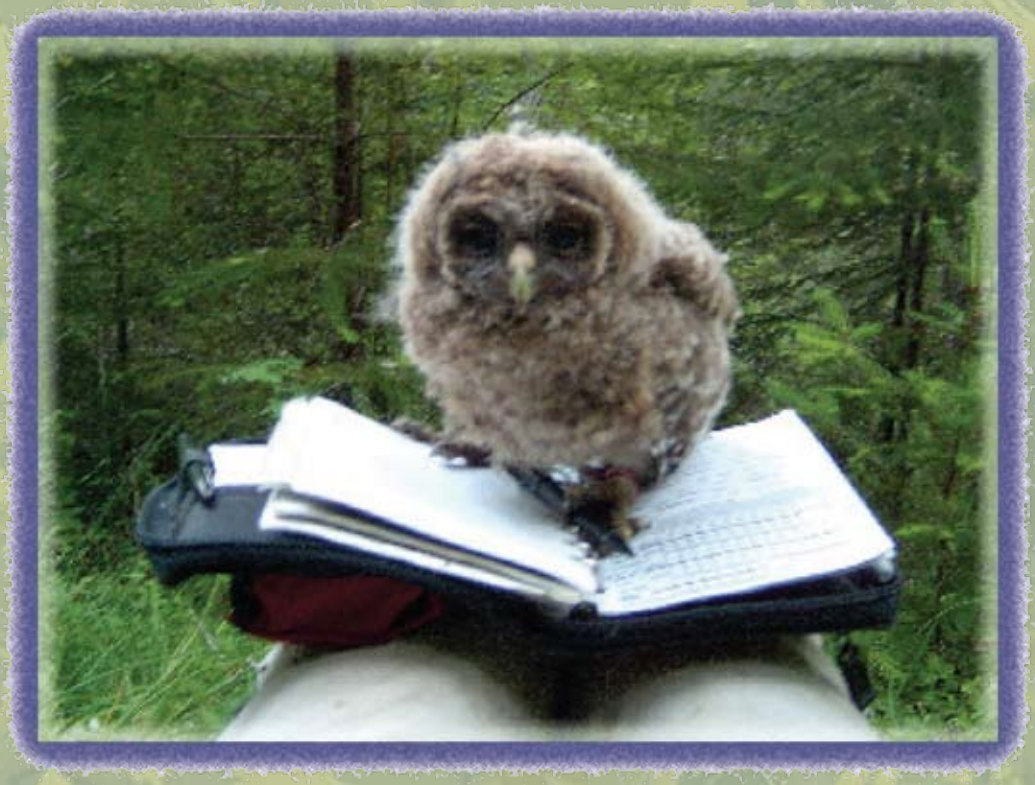

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Abstract

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This report documents important information management issues encountered during the preparation of seven status and trend reports evaluating the effectiveness of the Northwest Forest Plan. The top issues identified included deficient reporting of surface disturbance activities; absence of riparian reserve spatial data; incomplete hydro/stream spatial data; un-maintained land use allocation data; and road data disparities. Other top ten data issues were the need to recalibrate vegetation change detection data; spatial resolution differences in vegetation model data; fish passage and barrier information incompatibilities; validity (legal defensibility) of potential natural vegetation maps; and, procurement and contracting data inconsistencies. Key barriers to information gathering were a lack of consistency between and within agencies and a lack of data compilation to the regional scale. The solution to these issues will require an interagency approach to executive oversight, standardization, data stewardship, issue prioritization, and enterprise data models.

Key words: Northwest Forest Plan, effectiveness monitoring, data stewardship, data consistency, information management issues, enterprise data models

Cover Photograph by Amy Price. The Northern Spotted Owl module monitors status and trends in populations and habitat for this species. In this photograph, data is recorded for a fledgling spotted owl.

Preface

This report is one of a set of reports produced on this 10-year anniversary of the Northwest Forest Plan. The collection of reports attempts to answer questions about the effectiveness of the Plan from new monitoring and research results. The set includes a series of status and trends reports, a synthesis of all regional monitoring and research results, a report on interagency information management and summary report.

The status and trends reports focus on establishing new baselines of information from 1994, when the Plan was approved, and reporting change over the 10-year period. The status and trends series includes reports on late-successional and old growth forests, northern spotted owl population and habitat, marbled murrelet population and habitat, watershed condition, government-to-government tribal relationships, socio-economic conditions, and monitoring of project implementation under Plan standards and guidelines.

The synthesis report addresses questions about the effectiveness of the Plan by using the status and trends results and new research. It focuses on the validity of the Plan assumptions, differences between expectations and what actually happened, the certainty of the findings, and, finally, considerations for the future. The synthesis report is organized in two parts: Part I – introduction, context, synthesis and summary and Part II - socioeconomic implications, older forests, species conservation, the aquatic conservation strategy, and adaptive management and monitoring.

The report on interagency information management identifies issues and recommends solutions for resolving data and mapping problems encountered during the preparation of the set of monitoring reports. Information management issues inevitably surface during analyses that require data from multiple agencies covering large geographic areas. The goal of this report is to improve the integration and acquisition of interagency data for the next comprehensive report.

Executive Summary

A regional, interagency, monitoring team prepared seven status and trend reports to evaluate the effectiveness of the Northwest Forest Plan over its first ten years. A synthesis report is also being prepared by an expert team. Several significant information-management issues were encountered during the preparation of these reports. In the hope of resolving these issues in the near future, an effort was undertaken to document the issues, assess their relative effects on the 10-year reports, characterize common barriers encountered during information gathering, identify a vision for the future, and suggest steps to achieve that vision.

The regional monitoring team recognized that data from other agency programs would be essential for their reports. In 2003, these essential datasets were identified and agency programs contacted to determine data availability. Unfortunately, some of the critical data sources turned out to be unavailable, incomplete, inaccessible, or inadequate to meet analysis and reporting needs. A database was developed to document theses issues with the hope that they might be resolved before the next interpretive reporting cycles in 5 or 10 years.

Six barriers to information gathering were identified, including existence, access, consistency, compilation, maintenance, and documentation. The primary barrier encountered was a lack of consistency between or within agencies, such as how they mapped intermittent streams or collected road data. The lack of compiling and maintaining data at a regional scale were also important barriers.

Thirty data-specific issues were documented and ranked according to the degree of negative effects to text or maps in the reports. The top issues identified include:

- Activities - A comprehensive interagency geospatial database of ground disturbing activities does not exist for the Plan area.
- Riparian reserves - A geospatial data set showing the location and extent of the riparian reserves does not exist for the Plan area.
- Hydro and stream data - A lack of data standardization such as differences in approaches to mapping intermittent streams between agencies has inhibited the development of a comprehensive interagency hydrologic geospatial database.
- Land-use allocation – Lack of maintenance and updating of land-use allocation map information compromises the utility of these data over time.
- Road data – Information on roads were often incomplete, inconsistent, or lacking in spatial registration

- Vegetation change detection – Different methods were used in California when estimating the location and extend of stand-replacing events such as timber sales or wildfire.
- Vegetation modeling – Differences between vegetation mapping projects in Oregon/Washington and California hindered efforts to map spotted owl and marbled murrelet habitats in a consistent and repeatable manner.
- Culvert, fish passage and barrier information - No easy way exists to share fish passage or barrier information between agencies.
- Potential Natural Vegetation – Maps of potential vegetation communities across the Plan area require peer review to establish their validity but the field scientists working on them are generally not given sufficient time or other resources to accomplish peer review.
- Procurement and contracting data – The locations of contracted work needs to be identified with higher resolution and cross-referenced with project data.

The regional team developed a vision for an information system for the regional monitoring program. Subsequent discussions with the regional data-management staff showed that this vision might not resolve the underlying causes of the information issues encountered. They explained that a traditional approach to information management in the agencies is to develop project or "stovepipe" data systems. What is needed is a corporate interagency or "enterprise" data system that encourages data access and availability. This system would require a substantial effort, including developing enterprise data models, data standards, and regional data stewardship within the framework of national data systems.

Several specific recommendations are provided as a means to address the information issues in the near future. Executive oversight should be continued, including involving the interagency information-management board and the regional geospatial information council. Interagency standardization must be encouraged to develop compatible data standards and information hardware, software, and security policies. Interagency data stewardship needs to be initiated by selecting regional data stewardship teams who would be responsible for collating, quality assuring, maintaining, and archiving important data layers. These efforts will need to be prioritized and implemented gradually because the agencies have limited experience with stewardship-related interagency corporate datasets. A first step is to encourage programs to adopt an enterprise view to data management and data sharing by identifying multiple client needs. The efforts are expected to provide numerous benefits to the agencies.

Contents

Status and trends in old-growth forest is reported by the late successional and old growth monitoring module. Photograph by Rocky Pankratz of moss covered logs and complex canopy layering in an old-growth western hemlock and Douglas-fir stand**.**

Chapter 1: Introduction

Under the direction of the Regional Interagency Executive Committee (RIEC) that oversees implementing and managing the Northwest Forest Plan (the Plan), a regional interagency monitoring team developed and implemented a monitoring program to evaluate the Plan success. During the past two years, this team devoted significant effort to preparing a 10-year interpretive report. This report is meant to provide an integrated, cross-disciplinary analysis of the Plan's implementation and effectiveness by using the best available research, monitoring, and management experience. The 2004 interpretive report represents the first comprehensive evaluation of monitoring data and research since the 1994 record of decision was implemented.

The 2004 interpretive report includes seven status and trend reports: implementing standards and guides, late-successional and old-growth forests, northern spotted owls, marbled murrelets, watershed condition, social and economic, and tribal monitoring. Additionally, a synthesis report is being prepared by an expert team to provide the RIEC with an understanding of the management implications of the status and trend reports, as well as other ongoing research activities.

While these reports were being prepared, the regional monitoring team encountered significant information-management issues. Often, these issues could not be overcome quickly, therefore limiting the scope and content of the reports. Unless these issues are resolved, the interpretive report next planned for 2009 will likely be subject to the same limitations. In addition, many of these issues have been longstanding and affecting more than just the interpretive reports. With these issues in mind, the RIEC directed the regional monitoring team to prepare a synthesis of these issues and suggest methods for resolving them.

Objectives

The objectives of this report are to:

- Document the information management issues encountered by the regional monitoring team in preparing their reports;
- Set priorities among these issues to identify those that most impacted the monitoring reports;
- Characterize the common barriers encountered during information gathering;
- Provide a vision of desired attributes of a information system for the regional monitoring program; and,
- Recommend a strategy for achieving that vision and overcoming the common information-management barriers encountered by the team.

Over the long term, this report will be most effective if it serves to enable resolving key information-management issues. Given that many of these issues are highly complex, additional detailed information on the issues is documented in Appendix A. Our goal is to provide an overview and recommendations to those who will be given the responsibility of resolving these issues.

Background and History

This section is intended to provide some understanding of why some of the basic data sets needed for completing the 10-year interpretive report were not available when the regional monitoring team's report preparation was initiated. The adoption of the Plan in 1994 instigated interagency organizational structures and staffing necessary to implement and monitor the Plan (MOU, 1993; MOU, 2003):

- The Regional Interagency Executive Committee (RIEC) became the senior regional group charged with coordinating Plan implementation and the principal forum for communications between

regional and national groups. The RIEC consists of regional executives from cooperating land management and regulatory agencies.

- The Intergovernmental Advisory Committee (IAC) was established to provide consultation on coordinating Plan implementation among state, tribal, and county governments. The IAC provided advice and recommendations to promote integrating and coordinating forest management activities among federal and nonfederal groups.
- The Regional Ecosystem Office (REO) was established to support the RIEC and the IAC. The REO included a geographic information (GIS) staff charged with archiving data relevant to the Plan, serving it up to those who needed the data, and communicating data requirements and priorities to the RIEC.
- The Interorganizational Resource Information Coordinating Council (IRICC) was established as a subcommittee to the IAC. The IRICC was charged with coordinating the development of a seamless, current, and accessible information network to support the Plan. At the time of its origin, the IRICC was primarily an advisory group of agency representatives with knowledge and experience in information management standards, technology, and architecture. The IRICC was to help identify strategies for meeting Plan information needs.

Although the RIEC holds executive decision authority, in concept, the Regional Ecosystem Office and the Interagency Regional Information Coordinating Council played critical roles for monitoring the effectiveness of the Plan. The REO GIS staff had responsibility for acquiring or producing geospatial layers and other data related to monitoring the Plan. The IRICC was to facilitate coordination with partner agencies in establishing and adopting interagency data standards for geospatial layers and related data, and gaining access to existing data. Coordination, through REO GIS and IRICC, was expected to help the regional monitoring program gain access to the best available information while avoiding duplication of existing data. Where new data were required, coordination through IRICC was to increase the value of new data-gathering efforts to agencies by addressing shared business needs, and ensuring adherence to interagency standards for metadata, data quality, and data maintenance. The main challenge with the conceptual relations among the REO GIS, the IRICC, and the interagency regional monitoring program was that the REO GIS staff and the IRICC were established some five years before the interagency regional monitoring program was fully staffed. Several successful regional data efforts were undertaken before the regional monitoring team was formed. But without the regional monitoring program, no staff was devoted to determining the information needs for monitoring the effectiveness of the Plan. Consequently, the RIEC lacked critical information on the information needs of the Plan's monitoring program. These information needs were first identified in planning documents published in 1995-2004 (Implementation Monitoring Work Group, 1995; Hemstrom et al., 1999; Lint et al., 1999; Madsen et al., 1999; Mulder et al., 1999; Reeves, et al., 2004). By the time the regional monitoring program was funded and fully staffed (1999 to 2001), many of the basic data sets needed for completing the 10-year interpretive report were still undefined, making the timely acquisition or production of several key data sets impossible. A complicating factor was that the REO-GIS team, a key support group, was disbanded in late 2003, just when it was needed the most.

Description of Data Types

The regional monitoring team required several types of data in preparing their reports. The four different data types were originally described by Palmer and Mulder (1999) while developing a strategy for effectiveness monitoring for the Plan. The different data types are shown in Figure 1.

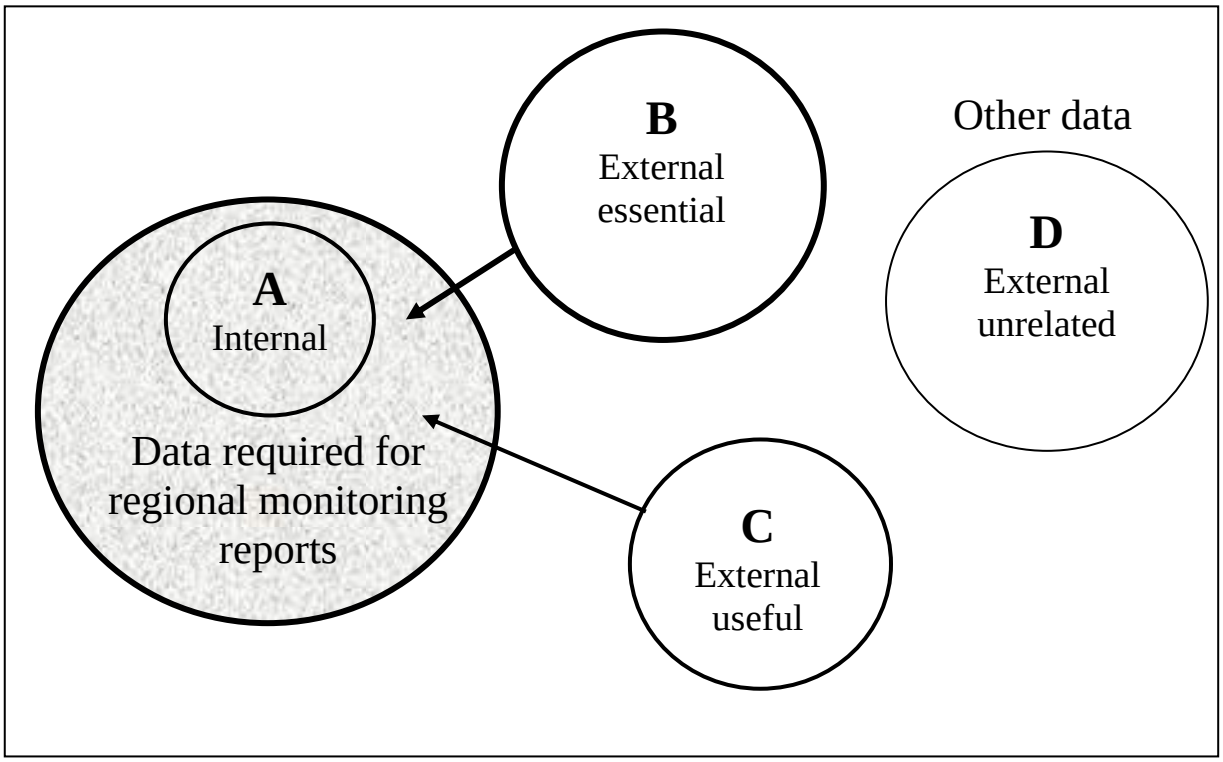

Figure 1. Data types associated with the regional monitoring program

The first data type (type A, called internal data) are those data collected during the field monitoring efforts of the regional monitoring program. Examples include the population data collected by the northern spotted owl and marbled murrelet modules or stream data collected by the watershed condition module. A second type (type B, called external essential) is collected by agencies, primarily for other purposes, but critical to the regional monitoring program. An example is forest inventory information, collected by the Forest Inventory and Analysis (FIA) program. These data are external in the sense that the data are not managed by the regional monitoring team. A detailed listing of the types A and B data used in the interpretive reports is provided in Appendix B.

A third type of data (type C, called external useful) is collected by agencies and might be useful to supplement information required for the regional monitoring program. A fourth data type (type D) is called external unrelated.

Palmer and Mulder (1999) encouraged the regional monitoring team to consider the implications of these different data types to the monitoring program. They emphasized that the program would need a data management system to steward their internal data. They also emphasized that the regional monitoring team would need to be actively involved with the agencies collecting the external essential data to ensure that these data would meet the needs of the regional monitoring team.

During the first few years of the monitoring program, the regional monitoring team emphasized collecting, summarizing and synthesizing their internal data. The preparation of the 10-year interpretive reports has forced the team to identify and then gather the external essential data. This first attempt by the team to obtain these data encountered many challenges. One goal of this report is

to document these challenges and provide suggestions for addressing them in the near future.

Requirements analysis for regional monitoring information

The regional monitoring program followed relatively standard practices in the information management and technology community for identifying data needs (Inmon et al., 1997; Mimno 1997; Kimball et al., 1998). Generally, the process focuses on analyzing the strategic business and functional needs of the program. The process should produce a clear understanding of the required data, data models, analysis applications, software, hardware, connectivity, and standard operating procedures for information management. Because of time and resource constraints, however, most of the effort focused on documenting the functional needs of the monitoring program in the context of the 2004 interpretive report.

A significant initial step in the process was to organize a workshop for the interagency monitoring program managers (MPM) comprising the directors from the cooperating agencies. The intent of the workshop was to gain an understanding of business needs and success metrics for the monitoring program, the existing agency information-management environments, and the potential costs of implementing business-driven information-management architecture for the monitoring program. Another key objective was to gain executive support for proceeding with a needs analysis.

After the workshop, the monitoring program embarked on an analysis of our data needs. The procedure included documenting the information needs; identifying required data attributes, including scale and resolution; describing the summarization or analysis of the data; and the discovery of existing data sources. The specific steps followed were

- Document the questions that need to be answered:
  - What are the monitoring questions asked by each module?
  - What other questions will be addressed by the monitoring program (for example, questions about implementation, resource outputs, and expectations)?
- Determine the scope, scale, and resolution requirements of the analysis:
  - What are the required temporal and spatial scales of the analyses?
  - What are the required temporal and spatial resolutions of the data?
- Identify attribute-specific information or data needs:
  - What types of data are needed to answer the questions?
  - What are required attributes of the data?
- Estimate the effort required to acquire the data:
  - Where is that information?
  - How can we obtain the required information?
  - How can we get the data to the people that need it?
- Understand the data processing and analysis needs:
  - What new data models are required?
  - What analysis applications are required?

The data-needs analysis generated an issue-management form that documented the data issues, data characteristics, and actions for acquiring the data (Appendix C). The forms were collated and tracked in a data-issues log (Appendix D).

Determining the effort to acquire the data presented the greatest challenge in the process. Once a potential data source was discovered, it had to be evaluated for meeting the scope, scale, and resolution requirements, the attribute requirements, and requirements for other characteristics such as accessibility, consistency, and documentation. When required data were not available, a plan for scheduling the resources needed to complete the data development work was to be developed. By February 2003, the regional monitoring team had

identified 110 data sources needed by six of the seven monitoring program modules. Fifty-four of these data sets were determined to be critical to producing the 2004 interpretive report. Coordination in the acquisition of existing data and developing new data was through the REO and IRICC.

Initial meetings with the REO GIS program manager and the IRICC led the regional monitoring team to believe that about 75 percent of all the needed data sources existed in some form, but many of them would require careful evaluation and updating. The remaining 25 percent would need to be expanded or developed from very limited existing data – either through new data collection or the aggregation of numerous smaller data sets of yet-undetermined extent, content, and quality. The regional monitoring team began to develop work plans for acquiring or developing the critical data sources. Planning was coordinated with REO GIS and IRICC. The REO GIS was already working on some of these data, including the land-use allocation layer, watershed boundaries, and restoration projects, and they were scheduled to deliver final products by October 2003. The monitoring program bought a server (NT) and hired staff to manage the system and the very large volume of anticipated data. By May 2003, it was apparent that some of the critical data sources would be unavailable, incomplete, inaccessible, or generally inadequate to meet the analysis and reporting needs for producing the 2004 interpretive report.

Data on activities such as timber sales are required by many of the Northwest Forest Plan monitoring modules. Photograph by John Hutmacher

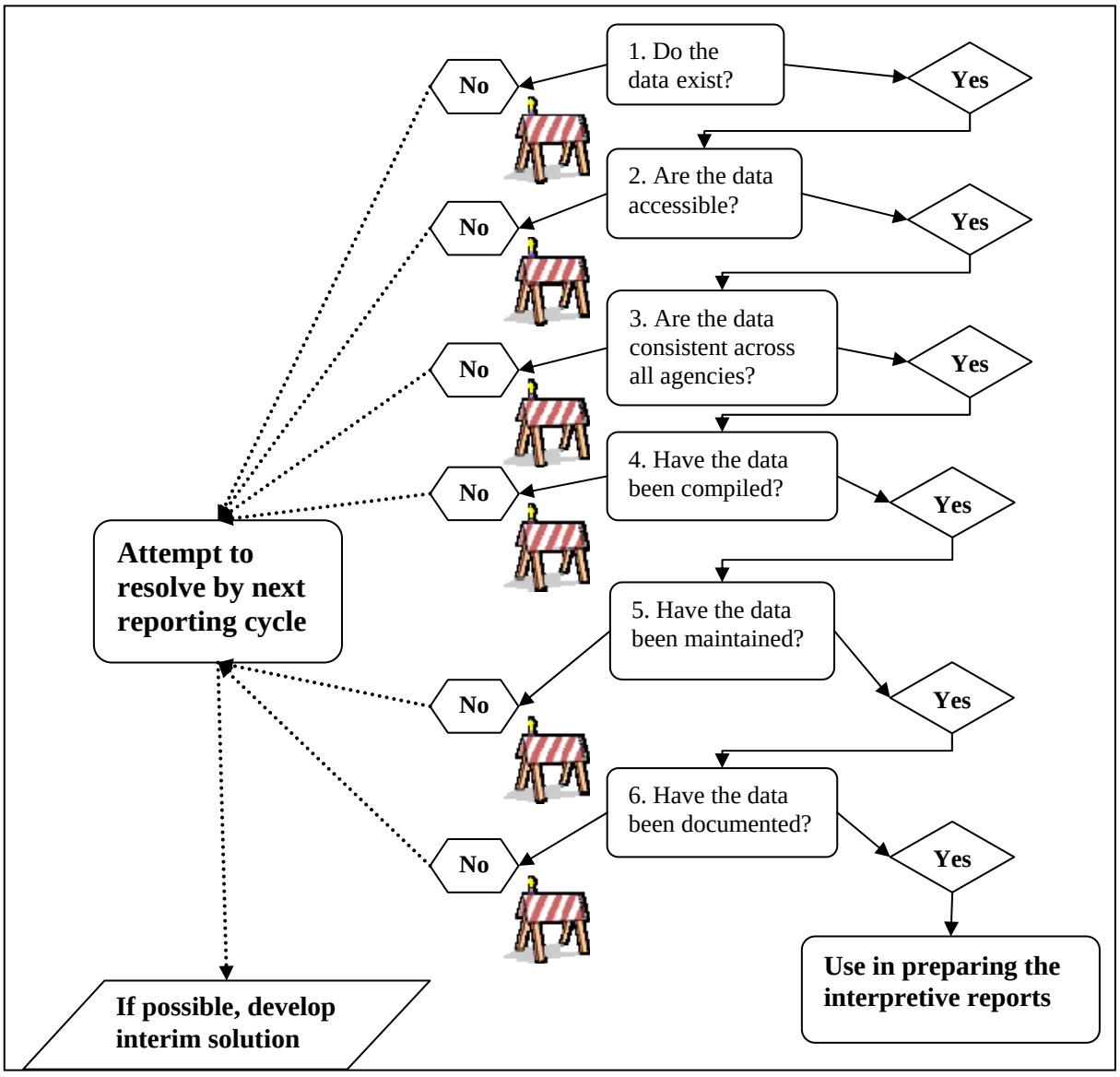

Figure 2. Conceptual model of barriers to information gathering.

Chapter 2: Barriers to information gathering

The monitoring program often encountered barriers to acquiring data. Although the main issue in many instances was simply nonexistent data, existing data posed some problems not easy to anticipate. Simply gaining timely access to existing data was a common problem. Many spatial and tabular data sets suffered symptoms of neglect or other poor data management practices. Data sets were often inconsistent, not at the required scale or resolution, incomplete, not to existing standards, or lacked basic documentation or metadata. Sometimes, either the technology or the needed basic data, such as hydrology or roads, was not available to produce the required information at the necessary scale or resolution. Documenting these issues and others involved completing an issue form, which contained a statement of the issue, the affected staffs and operations, and recommendations for addressing the issues. Once documented, the issue statement was assigned a number, and the issue was logged for tracking and resolution.

While the focus of this report is to document these data issues, it is important to note that frequently essential data were readily available from programs in agencies. For example, forest inventory data from the Forest Inventory and Analysis (http://www.fs.fed.us/ne/fia/spatial/index_ss.html) and the Current Vegetation Survey (http://www.fs.fed.us/r6/survey/) were readily accessible and very useful for regional analysis of status and trends in old-growth forests. Our work benefited greatly from investments by these programs in data management systems to support multiple-client requirements.

A Conceptual Model for Gathering Information

In an effort to identify the factors that contributed to the data management issues, a conceptual model was developed (Figure 2—see previous page). The objective of this model was to identify and categorize the different barriers encountered by monitoring staff when attempting to collect information for the 10-year interpretive reports.

The conceptual model suggests that a sequential set of questions must be answered when identifying data for the interpretive reports. If an answer of "yes" can be given to any sequential question, then one can continue to the next question. If an answer of "no" is encountered, then a barrier exists to information gathering.

The first question is whether the data required to answer a monitoring question had been collected. Regional staff at the BLM and FS offices were contacted by the monitoring team to identify if data had been collected to answer the monitoring questions. If the data did not exist, this lack was identified as a barrier to information gathering. If only partial data existed, then this was considered as a contributing factor. An example of partial data collection was when one agency had collected the data but not the other, or when data had been collected in only certain years.

If data could be found, then the next question asked was whether the data were accessible and readily available. To be considered readily available, data needed to be in electronic format. Given the scope of the Plan area, the monitoring team could not consider collating information from all or parts of 30 FS and BLM administrative units in the Plan area unless the data could be provided in an electronic format.

The third question asked was whether the data from the agencies were consistent. If contributing agencies had available data for a given topic, but these data were not comparable, then the monitoring team faced a significant barrier when trying to collate this information into one view of the Plan area. Without a pressing requirement for

consistency, data systems have historically been developed by agencies to meet only their own requirements and standards.

The fourth question was whether the data had been compiled for the Plan area. If data existed and were available and consistent, a possible barrier to information gathering existed if these data had not been compiled. To overcome this barrier, the monitoring team would need to issue a data call to all Plan units and hope they responded in a timely manner. Fortunately, many regional datasets had been developed and were available.

Once a regional dataset was identified, the next question was whether or not that dataset was current. Unless the dataset had been maintained and updated, its value to the regional monitoring team could be very limited. Significant effort was often needed to update data layers that had not been maintained for several years. Unless resources were available to make this effort, a new barrier existed to information gathering.

If data had been collected, were readily available, were consistent, had been compiled at a regional scale, and had been maintained, no additional barriers should be expected. But one barrier remained, whether the datasets had been adequately documented in how data had been collected and summarized.

Categories of barriers

In an attempt to summarize the challenges to meeting the information needs for producing the 2004 interpretive report, the following categories of data-specific problems are suggested.

- Existence: The data did not exist or were so incomplete that for all practical purposes, they were nonexistent. Collecting or producing the data was considered cost-prohibitive or impractical because of limited time.
- Access: Data existed but could not be acquired in a timely manner. Often, no stewards or point of contacts were there, or the contacts were not responsive. Funding limitations may have prevented programs from responding to major data requests from the monitoring team.
- Consistency: Data were often distributed among multiple sources, such as agencies, districts in an agency, or cooperators, and they were inconsistent across sources. Even if the data were well documented, their utility was severely limited because of inconsistencies. Inconsistencies applied to many characteristics such as data definitions, standards, quality, extent of documentation, and so on.
- Compilation: Data may have been accessible, documented, and even consistent across sources, but substantial resources were needed to compile the information to the necessary scale.
- Maintenance: Data had not been managed or stewarded over time and required updating or migrating to current standards. Resources were often committed to collect data but no commitment was made to maintain the information. Because of the substantial costs of maintaining data, inventories -- and other sources of land management information often used in planning -- suffer from neglect. In the short tem, re-collecting data according to the planning cycle can seem more cost effective than using existing data. But this strategy ignores long-term needs for maximum use of existing data to include maintaining historical baselines.
- Documentation: Metadata (information about the data) were often missing. Even if metadata did exist, it was so incomplete or inadequate that evaluating the qualities and utility of the data was impossible. Creating or recreating the documentation years after the data had been produced was often impossible because of attrition in institutional knowledge.

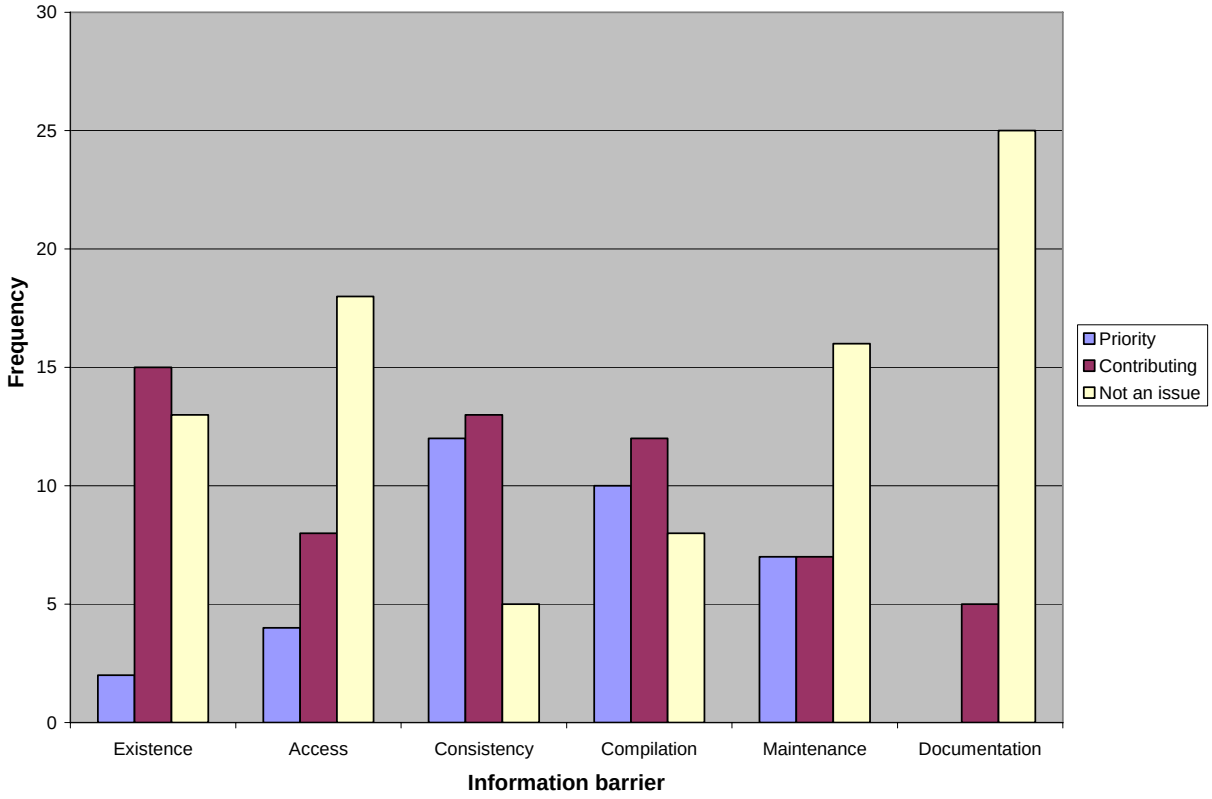

Figure 3. Frequency of occurrence and priority of information barriers for the thirty information issues documented in the information management issues database (see Appendix A).

Analysis of information barriers

For each of the information issues in the database, the priority and contributing barriers to information gathering were evaluated. The barriers are defined as existence, access, compilation, maintenance, consistency, and documentation in accordance with the conceptual model (Figure 2).

The frequency of each of these barriers to the Plan monitoring data is shown in Figure 3. The factors that were most often barriers to information gathering were consistency, compilation, and maintenance. Existence and access were not often the priority barriers but were important contributing factors, which reflects the fact that some data were available to answer most monitoring questions, but other barriers were encountered in attempts to collate this information into a regional dataset for the Plan area. A primary barrier encountered by the monitoring team was the lack of consistency between agencies for important information they are collecting. Examples are the differences between agencies in how they mapped intermittent streams or how they collected road data. Another example is the difference in approach to vegetation modeling between California (CALVEG) and Washington-Oregon (IVMP).

Another information barrier of importance was compilation. An example is the difficulty encountered in trying to develop a regional data layer of riparian reserves

on matrix lands from the numerous watershed analyses. Another example is the inability to compile spatial data from ground-disturbing activities across the Plan area.

The lack of maintaining or upkeep of regional datasets was also an important barrier. An example was the effort required to obtain an updated land-use allocation layer for the monitoring team. The original layer from the establishing of the Plan had not been updated to reflect changes over the years.

The lack of existing data was a priority obstacle for two issues: the lack of digital orthophotoquad coverage for the whole Plan area and the lack of data for determining the cost associated with the Plan's planning requirements. The lack of data was a significant contributing factor to many issues, including the identification of riparian reserves and streams.

The inability to access data was a priority obstacle for several issues, including the location of activities and the identification of contracting data. The lack of documentation or metadata was a contributing factor to several issues including ground-disturbing activities and data compilation.

Information on riparian areas is required by many of the Northwest Forest Plan monitoring modules. Photogragh by David Baker of a riparian area rehabilitation and abatement of a fish passage problem in the SW Oregon Province.

Chapter 3: Effects on the 2004 Report

Information management issues database

Recently, the data issue log was moved to a more thorough database designed in MS ACCESS to capture documentation and track issues, and also to prioritize data needs, generate reports, and manage metadata related to specific data sets (see Appendix A). Module leaders were also encouraged to identify any additional data issues not previously identified. A total of 30 issues have now been identified and included in the database.

Ranking of dataset-specific issues

In addition to describing the issues, an important purpose of the information issues database was to collect information that would allow for a ranking of the issues. The ranking was requested by the monitoring program leader to encourage follow-up activities to be focused on the priority issues. Ranking was based on the relative effects of the issues on the reports and maps prepared by the monitoring modules. A table was developed to provide a basis for ranking the relative effects of an issue to the text in a specific report (Table 1). The purpose of assigning an effects value was to allow for a numerical calculation of the relative effects to the monitoring team reports. In a similar way, a table was developed to estimate the effects to maps produced for the reports (Table 2).

A preliminary set of rankings was identified based on information provided to the database. These rankings were then sent to the monitoring module leads for confirmation or revision.

Table 1—Description of effects of an issue on the text in module reports

Effects	Description of effects	Effect value to text
Very High	Could not complete section in report	4
High	Section completed with limitations	3
Moderate	Delayed completion of section of report	2
Low	Section completed on time, but with significant effort	1
None	No effects to this module's report	0

Table 2—Description of the effects of an issue to maps in module reports

Effects	Description of effects	Effects value to maps
Very High	Could not complete a map or maps for the report	4
High	Map(s) completed with limitations	3
Moderate	Delayed completion of map(s) for report	2
Low	Map(s) completed on time, but with significant effort	1
None	No effects to this module's report	0

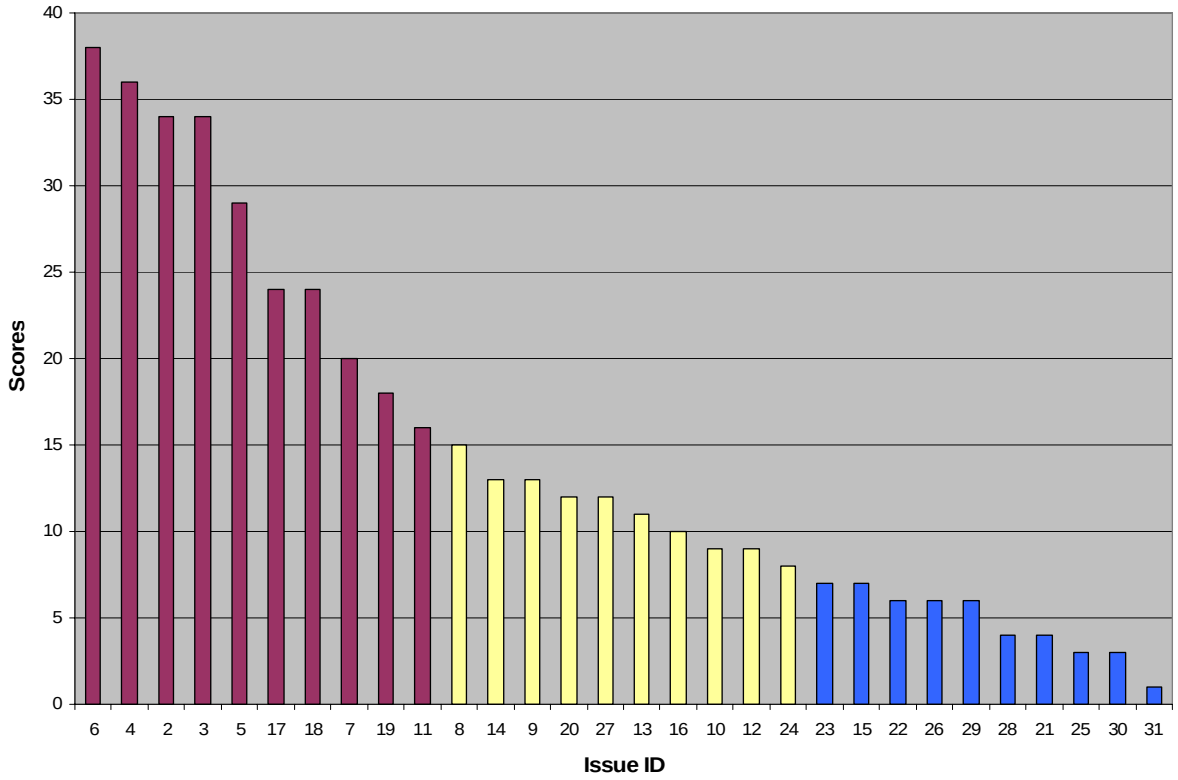

Figure 4. Ranking of dataset-specific issues. Issue ID identifies issues in the information management issues database (see Appendix A).

The scores were arbitrarily divided into three groups of ten for further examination. These three groups have been given different colors in Figure 1. The first group of issues with the highest scores had significant (very high or high) effects on the reports for several modules. The second group of scores tended to be those with significant effects on a few modules. The last groups tended to be those issues specific to certain module reports or the synthesis team. The following table provides a prioritized list of the issues along with their score and issue identification (for ease of referral to the Issues Database)

The following issues significantly affected the preparation of reports for the regional monitoring team. This information is also included with additional details in the accompanying Appendix A for this report.

Effects of issues to text alone or maps alone were also ranked. The top ten issues essentially remained the same as for the combined rankings except that special forest products (Issue ID 14) and collaborative forest stewardship data (activities) (Issue ID 12) tied for ninth spot for effects to text. The top ten issues remained the same for effects to maps, although the order of the top ten rankings changed slightly. From this analysis, most major issues apparently affected both text and maps for the interpretive reports.

Description of top ten issues

Each of the top ten issues is discussed beginning with the issue with the highest score and therefore the highest ranking. An explanatory description is provided for each

Table 3—Ranking of information issues. Issue ID identifies issues in the information management issues database (see Appendix A). Issues with the highest scores had the most effects on reports and maps prepared by the monitoring modules

Rank	Title	Issue ID	Score
1	Activities	6	38
2	Riparian reserve spatial data (resource)	4	36
3	Hydro and stream spatial data (resource)	3	34
3	Land use allocation & ownership	2	34
5	Road data (resource and activities)	5	29
6	Vegetation change detection data	17	24
6	Vegetation modeling (IVMP & CALVEG)	18	24
8	Culvert, fish passage, & fish barrier information (activities & resources)	7	20
9	Potential natural vegetation (PNV)	19	18
10	Procurement contracting data for ecosystem management work (activities)	11	16
11	Restoration projects (activities)	8	15
12	Special forest product (activities & resources)	14	13
12	Recreation (activities &resources)	9	13
14	Scenery: spatial data (resource)	20	12
14	Digital orthophotoquad coverage did not describe the whole Plan area	27	12
16	Grazing (activities)	13	11
17	Watershed analysis (activities)	16	10
18	Local unit implementation monitoring data (activities)	10	9
18	Collaborative forest stewardship data (activities)	12	9
20	Vegetation inventory and monitoring analysis tool (VIM)	24	8
21	Lack of common data distribution platform	23	7
21	Watershed boundaries changing (resource)	15	7
23	Workforce composition data	22	6
23	Physiographic province boundary	26	6
23	Community economic assistance data	29	6
26	Agency budget data	28	4
26	Marbled murrelet habitat data (occupancy, platforms)	21	4
28	Cost of implementing planning requirements of the Plan cannot be determined	25	3
28	Measurement methods for timber volumes	30	3
30	Total maximum daily load	31	1

issue. The priority and contributing barriers to information gathering (see Chapter 2) are then listed for the issue. Explanatory comments are provided along with a specific suggestion of what is needed to revolve the issue.

Activities - ground disturbing (Rank 1; Score: 38; Issue ID 6)

Description: Activities data is a very broad category of management data that includes timber sales; road and trail building and decommissioning; recreation facility building and removal; stream channel restoration; prescribed fire; culvert repairs and water bars; dam and other fish barrier construction or removal; mining and mineral extraction; stream restoration activities; and so on. Tabular data often exists, but may have no spatial component, which is necessary for monitoring. Several data sets were examined because of the various kinds of data necessary to describe all activities.

Barriers: Access, compilation (priority); maintenance, consistency, documentation (contributing)

Comments:

- Assembling data to answer the monitoring questions about the full array of activities across the Plan area was extremely challenging. Activity data were not standardized among the agencies or in the units. Problems with existing attributes and data sources made regional compilation difficult, but the greatest problem was the lack of a comprehensive interagency activities spatial database for the Plan area.
- No interagency standards existed for data describing the full range of activities accomplished in the region. Existing data standards varied by unit and type of activity; data were often incomplete and may contain little or no information about location, extent, or effects of the activity to sensitive resources. Most units created GIS data describing ground-disturbing activities, but the data were not in a standardized format, not included in upward reporting requirements, and not consistent between agencies or units. Hence, projects and cumulative effects could not be described consistently across the region by using current technology.

What is needed: A comprehensive centralized interagency spatial database describing all activities for the Plan area without regard to boundaries.

Riparian reserve spatial data (Rank: 2; Score: 36; Issue ID 4)

Description: A spatial data set with attributes showing the location and extent of the riparian reserves specified by the Plan. This data set should be a part of the land use allocation coverage but does not currently exist.

Barriers: Compilation (priority); existence, access, consistency (contributing)

Comments:

- In addition to defining the extent of riparian communities, the riparian reserves were designated to serve as habitat-connectivity corridors between the late-successional reserves for dependent species, and they function as part of the dispersal habitat network. Thus, the inability to fully describe riparian reserves precludes discussing connectivity between late-successional reserves and dispersal habitat for late-successional-dependent species, such as spotted owls.
- The team could not evaluate the potential contribution of riparian reserves to marbled murrelet habitat without knowing the reserve locations.

- Lack of riparian-reserve data resulted in arbitrary assumptions about riparian reserve widths for modeling the effects of riparian-reserve status on watershed health.
- Implementation monitoring could not verify whether a project was inside or outside a riparian reserve without knowing the riparian reserve location.
- Data on riparian reserves exists at the local administrative level (districts or forests).
- Lack of interagency hydrologic coverage for the Plan area precluded modeling of interim riparian reserves.

What is needed: An annual regional compilation of riparian reserve coverages.

Hydro and stream spatial data (Rank 3; Score: 34; Issue ID 3)

Description: Hydrologic data set of perennial and intermittent streams and other water features.

Barriers: Consistency (priority); existence, access, compilation (contributing)

Comments:

- A comprehensive interagency spatial layer representing all perennial and intermittent streams, lakes, springs, wetlands, and other hydrological resources in the Plan area is critical to many monitoring modules. Road and stream interactions, riparian reserves, fish passage, tribal uses, implementation, and other analyses are all based in part on knowing the exact location and extent of riparian resources and their relations to other resources, such as roads, fisheries, or property boundaries.
- Available data were incomplete because of the large amount of detailed data needed to fully describe these resources across all agencies and a lack of data standardization between agencies and units. For example, differences in approaches to mapping intermittent streams between agencies have resulted in different stream densities for adjacent land areas.
- Hydrological coverage was only partially fulfilled with the data supplied by the hydro clearinghouse.
- Agencies are currently devoting significant resources in an effort to develop a consistent stream layer including perennial and intermittent streams.

What is needed: The ideal hydrological coverage would be a wall-to-wall point, line, and polygon coverages consistently showing all perennial and intermittent streams, lakes, wetlands, and other water features in the scale of 1:24 K or better.

Land-use allocation and ownership (Rank 3; Score: 34; Issue ID 2)

Description: The land-use allocation coverage describes the division of land use on federally managed lands in the Plan area and is critical to answering several monitoring questions. Ownership is a separate but closely related coverage describing federal administrative boundaries and state ownership/zoning combined.

Barriers: Maintenance (priority); existence, compilation, consistency (contributing)

Comments:

- Issues include the need to identify riparian reserves, lack of data attributes for the largest lakes in at least two national parks, lack of California state park boundaries wholly contained in Redwood National Park, absence of recreation facilities smaller than 40 acres, sliver

polygons and mismatched edges, and a lack of sub-unit (Ranger District or Resource Area) identification. When combined, these issues present many challenges to data analysts. An example is the potential of underestimating the size of Crater Lake National Park since the polygon for the 13,000 acres of Crater Lake had no attributes.

- Lack of maintaining and archiving data compromises the utility of the land-use allocation data over time. Under the current processes, once the "official" map has been created and approved by the RIEC, it cannot be modified or edited [because that would make it a different map than the one accepted by the RIEC.]

What is needed: Updated land-use allocation and ownership maps with regular maintenance and archiving schedules (at least every five years).

Road data (Rank 5; Score: 29; Issue ID 5)

Description: The regional road coverage consists of line and attribute data describing the extent, location, classification, condition, and changes in all system and nonsystem roads across all agencies and owners in the Plan area.

Barriers: Compilation, consistency (priority); existence, access, maintenance (contributing)

Comments:

- The current data set represented most federal system roads, but non-system spur roads were not consistently represented even though they can affect watershed health. The data for nonfederal lands is very incomplete.
- The FS does not compile spatial information on built roads to the regional level.
- No information was collected on road building, decommissioning or restoration for nonfederal lands.
- Some tabular data on road building and decommissioning exists since the implementation of the Plan in 1994, but these data have little or no spatial registration and therefore cannot be used to answer the monitoring questions.
- The current coverage identified decommissioned federal roads, but supplied no year of decommissioning for FS lands. Often, different interpretations for decommissioning exist. The road coverage needs to identify which roads have been built or decommissioned by year.
- Road attributes such as culvert data, road surface type, or slope position needed to assess the effects of roads on delivering sediment to streams are not required in the agency database.
- The large amount of time and work needed to answer the road-related questions was not anticipated, so monitoring questions about increases or decreases in roads in key watersheds or inventoried roadless areas were not thoroughly addressed.
- Road and stream interaction data were not fully available.
- Each agency interpreted road categories somewhat differently; thus, questions about the amount of roads occurring, built or decommissioned could not be addressed.

What is needed: Consistent roads layer for the Plan area including attributes such as culvert data, road surface type, or slope position is needed. These require frequent updates through an interagency geospatial roads-data clearinghouse. Spatial data and dates for construction and decommissioning of roads need to be recorded in regional roads databases (e.g. Infra) at the regional level from this point forward.

Vegetation change detection data (Rank 6; Score: 24; Issue ID 17)

Description: The Oregon/Washington vegetation-change-detection data are a raster-based estimate of the location and extent of stand-replacing events, such as timber sales and wildfire in the Plan area by using LANDSAT TM data. Stand-replacing events are shown in 5-year increments from 1972 though 2002. The CALVEG change-detection layer for northern California was also created to vegetation strike team standards but using different methods, so it was somewhat different than the OR/WA portion of the Plan area.

Barriers: Consistency (priority)

Comments:

- A vegetation-change-detection data layer was required because of the absence of an activities map (previously described) or a fire map.
- A raster-based change detection layer was created from satellite data to estimate the cumulative effects of stand-replacing vegetation management and disturbance events across the Plan area since 1994.
- The vegetation strike team laid out the business needs for modeling vegetation and changes in vegetation. Change detection was accomplished in two parts by two separate units – the monitoring program contracted with the Forestry Sciences Laboratory and Oregon State University to create the Oregon/Washington change detection layer and used the CalVeg estimate for northern California. The CalVeg data were difficult to use in the Biomapper model selected by the habitat modules because it was in a polygon format rather than raster, and conversion to raster by resampling created inaccuracies in the data. This business need was identified several years after the data were created.

What is needed: Uniform vegetation change-detection approach across entire Plan area.

Vegetation modeling - IVMP & CALVEG (Rank 6; Score: 24; Issue ID 18)

Description: Late-successional and old-growth forest mapping is derived data describing vegetation conditions based on remotely sensed tree size, canopy structure, and species composition (life form) data combined to create 22 late-successional and old-growth classes. Two data sets were used, the interagency vegetation mapping project (IVMP) mapping in Oregon and Washington, and the California vegetation mapping project (CALVEG) for northern California.

Barriers: Consistency (priority); existence, compilation (contributing)

Comments:

- The IVMP and CALVEG vegetation models were not directly comparable, although both data sets met the original vegetation strike team standards. The IVMP map is based on the classification of individual pixels, but the CALVEG map has aggregated pixels into polygons. The differences between these data sets hindered efforts to map spotted owl and marbled murrelet habitats in a consistent and repeatable manner between the Washington-Oregon and California portions of the Plan area.
- Note: The business need for both IVMP and CALVEG to be compatible with the model used for habitat modeling (Biomapper) was not known when the data were created.

What is needed: A consistent approach across the Plan area for future vegetation modeling efforts.

Culvert, fish passage and barrier information (activities and resources) (Rank 8; Score: 20; Issue ID 7)

Description: Spatial and tabular data describing barriers and passage information for fish, related to culverts and other water crossings.

Barriers: Consistency (priority); existence, compilation, maintenance (contributing)

Comments:

- Currently, no easy way exists to share fish passage or barrier information between the FS and BLM (and with state agencies), which results in:
  - Difficulty ranking the priority of solving culvert fish-passage problems.
  - Agencies are unable to show how much fish habitat is being made accessible through culvert restoration efforts or dam relicensing agreements.
- A reliable fish species/habitat spatial layer is not currently available. Attempts to identify and solve blockage points with a tabular solution resulted in inconsistent success.
- Responding to policy makers asking how the millions of dollars being spent on culvert inventories and improvements are directly benefiting fish is difficult.
- Fish-habitat accessibility cannot be used as part of determining watershed condition (and getting credit for improving fish passage).
- Data from the FS consist of a point layer of culverts based on a road map. The database was never designed to be input at a regional scale, so the data are aggregated and the spatial registration is inadequate.

What is needed: Interagency data-collection standards that allow for regional compilation and spatial registration of culvert, fish passage and barrier information. Annual updates and archiving of these data.

Potential Natural Vegetation (Rank 9; Score: 18; Issue ID 19)

Description: Mapping of potential vegetation communities across the Plan area developed by Jan Henderson. Based on moisture and topography.

Barriers: Consistency (priority); maintenance, documentation (contributing)

Comments: These data are considered good, though not peer reviewed. The effect is twofold: reduced scientific credibility and greater risk for the vegetation, spotted owl, and marbled murrelet modules should litigation arise related to our monitoring report or the conclusions derived from it.

What is needed: Peer review of the potential natural vegetation map.

Procurement contracting data ecosystem management work (activities) (Rank 10; Score: 16; Issue ID 11)

Description: Procurement contracting data describes the value and number of contracts and distances between contractor headquarters and the location where the work is accomplished, recorded by county. The data for the regional analysis are drawn from the Federal Procurement Data Center's database that includes information from all federal agencies compiled from the SF-279 form that each federal agency must fill out for contracts with an estimated value above $25,000. Our data set includes contracts from FS and BLM in western Oregon and Washington and northwestern California awarded between fiscal years

1990 and 2002. All data are reported by federal fiscal year.

Barriers: Access (priority); existence, consistency (contributing)

Comments: The dataset includes contracts for land management work in the Plan's affected counties, as defined in the jobs-in-the-woods program. The dataset includes product service codes that were related to land management, broadly defined, using the same criteria as Moseley and Shankle (2001) and Moseley and Toth (under review). That is, the dataset includes contracts related to forestry and watershed management, such as thinning, brushing, piling, noxious weed control, biological surveying, riparian restoration, and for road building and maintenance. Contracts for fire suppression are reported separately because they are procured differently from other forestry services. Prescribed burning, however, is reported in the same product service code as fire suppression, and therefore cannot be distinguished from the regional portion of the study.

What is needed: Linking of contract to activities data.

The purpose of the socioeconomic monitoring module is to evaluate progress in meeting the Northwest Forest Plan's socioeconomic goals. Photograph by Susan Charnley of downtown Happy Camp, CA.

The tribal monitoring module evaluates the unique government-to-government relationship between federal land managers and tribal governments in the Northwest Forest Plan area. Photograph by Bruce Crespin of traditional forest materials and products including cedar, hazel, willow and fern basketry material, scale-version fish trap and baby basket, biscuit root and bitterroot.

Chapter 4: Developing a Vision for the Regional Monitoring Program

In addition to identifying data issues and associated barriers to information gathering, the regional monitoring team recognized a need to develop a vision for an information management system for the program. On September 17, 2003, representatives from each of the monitoring program modules met to begin developing this vision. The workshop and the responses of workshop participants is summarized in Appendix E.

A remarkably clear vision of what the regional monitoring team desired in an information management system was expressed at the workshop (see Appendix F). The scope or focus of the system should be primarily to support data collection by the regional monitoring team. The system should establish links to other essential monitoring data currently collected by agencies in the region, but it should not be responsible for these data. A data clearinghouse should be established to encourage the access and use of team data by others. Legacy data should be incorporated into this system, once it has been quality-assured to meet team standards.

The information management system should be designed to foster several attributes. Data in the system should be safe, secure, accessible, current, permanent, maintained (in most current technology), documented (accurate and complete metadata), and quality-assured. An important goal is to make the data useful for land management decision-making by making the data accessible in user-friendly formats and having searchable access.

Evaluation of regional databases

A review of regional interagency databases was undertaken to identify keys to the successful implementation of databases at the regional level. The need for the collection of regional data has resulted in the development of several databases. The three databases examined were the interagency restoration database (IRDA), the Northwest Forest Plan implementation monitoring database, and the interagency species management system (ISMS) database. A summary of information related to background, organization, information barriers and lessons learned is provided in Appendix H.

The first key was the establishment of support and oversight by mid-level managers. With this support, staff were able to solicit interagency involvement to develop and implement their projects.

All projects relied on information collected at the local unit level. In all cases, it was determined that databases must meet local as well as the regional needs. Each of the databases was therefore developed with the assistance of local unit staff.

The goal for each of the projects was to identify core data sets that met both local and regional needs. This proved to be a very challenging and time-consuming process. However, with persistence, all groups were able to identify certain regional standards and minimum core data sets. Once these requirements had been established through interagency teams, programmers were assigned the task of developing prototypes for testing and implementation. These programmers could be federal staff or contractors.

A key component for success for each of the projects was the identification of local and regional data stewards. The local data stewards are responsible for data entry. This is often done during the winter when the demands

for field work are lower. Regional data stewards have a very important role in checking the data, collating it, and then reporting the information. They also coordinate the training of new local data stewards and assist with the reevaluation of the core data standards. All three data projects recognized the need for additional programming support after the initial development had taken place to ensure that the databases were maintained.

Developing an Interagency Information-Management Vision

Information management leads for the Bureau of Land Management (BLM) and National Forest Service (FS) in the Pacific Northwest, Dr. Duane Dippon (BLM) and Kim Rivard (FS), reviewed this report and expressed strong support for an enterprise approach to information management. They pointed out that the vision for an information management system for the Regional Interagency Monitoring Program must attempt to address the failures of project level approaches to data modeling and management. Many of the issues faced by the Regional Monitoring Team in meeting the information needs of the program are directly related to the program's dependency on data collected and managed externally to the Regional Interagency Monitoring Program. While some of the external data comes from programs that advocate or use enterprise approaches to information management, such as the Forest Inventory and Analysis Program, much of the required external data is managed with projects in mind, such as a local or district level inventory of roads or streams. Project- or program-driven approaches to information management perpetuate and encourage the kinds of information barriers described previously in this report rather than removing them. What is needed for the monitoring program is an alternative coordinated interagency information management vision that includes all the agencies contributing to managing and regulating the natural resources in the Northwest Forest Plan area. This vision includes an enterprise information management approach and is supported by comments from the synthesis team on the information management issues they identified (see Appendix G). The vision for an information management system described by the Regional Monitoring Team (Appendix F) includes qualities characteristic of an enterprise architecture for information management.

Project driven data models (an example might be a district level database for invasive species) that are designed without expectations of supporting a larger enterprise, such as the Regional Interagency Monitoring Program, result in information "stovepipes." "Stovepipe" or project driven data models are readily found in land management agencies with decision authorities broadly distributed at the local levels (i.e. the National Forest and District, BLM District, and National Park levels). While there may be times when project driven models are appropriate, long-term mission critical programs, such as the monitoring program for the Northwest Forest Plan, should never use data models that generate "stovepipe" solutions.

Designing and adopting enterprise information management solutions that serve agency missions and avoid information stovepipes requires strong guidance and direction at the National level (i.e. Departmental and Agency levels), and strong commitments to collaboration and coordination at the local level (i.e. Region, Forest, District and Park levels). The need for enterprise approaches to information management in federal government is recognized and supported at the National, Departmental and Agency levels. At the national level, the federal Enterprise Architecture Program (http://www.whitehouse.gov/omb/egov/a-1-fea.html) promotes a business driven approach to budget allocation, performance management, cross-agency collaboration and a number of other program areas. At the Departmental level, the Department of Interior (Interior Enterprise Architecture- http://www.doi.gov/ocio/architecture /index.html) and Department of Agriculture (USDA

Enterprise Architecture Program – (http://www.ocio.usda.gov/e_arch/e_programs.html) have made commitments to supporting enterprise architectures. Specific examples of enterprise approaches to Agency natural resources programs include the Forest Service Natural Resources Information System (NRIS - http://www.fs.fed.us/emc/nris), the BLM Enterprise Geographic Information System (EGIS) Project (http://www.blm.gov/ba/spotlights/spotlight1_05.htm), and the National Park Service PRIDE (Protecting Resources through Informed Decision-making and Education) project.

The Electronic Government or E-Government Act of 2002 defines enterprise architecture as: "A strategic information asset base, which defines the business, the information necessary to operate the business, the technologies necessary to support the business operations, and the transitional processes necessary for implementing new technologies in response to the changing business needs. It is a representation or blueprint." The first step in modeling an enterprise architecture is to define the enterprise. But being realistic and pragmatic in how the enterprise is defined is critical to the successful design and implementation of enterprise information architectures. In the case of the Regional Interagency Monitoring Program, the enterprise can be defined as the Northwest Forest Plan and the information assets and other resources required to meet the business of monitoring the effectiveness of the "Plan" at achieving the goals and objectives.

Defining the entire "enterprise architecture" required to meet the business needs of the Regional Interagency Monitoring Program for the Northwest Forest Plan is beyond the scope of this report. However, this report reviews the information asset base required to meet the needs of the Regional Interagency Monitoring Program and related information management issues, and thus provides a sense of the complexity and challenges faced by the Interagency Monitoring Team. Revisiting Figure 1 in the first chapter of this report clearly shows that the Regional Interagency Monitoring Program relies heavily on external information assets (type B; external essential data) that are collected and managed by agencies and programs external to the immediate influence of the Regional Monitoring Team. Many of the external data assets are managed using project or program -driven "stovepipe" solutions. For the Regional Interagency Monitoring Program to be successful at developing and implementing an enterprise information management solution, the owners and managers of the "external essential data" must be brought into the process of defining the requirements of the enterprise architecture. Consideration must be given not only to the various business requirements of Regional Interagency Monitoring Program and the contributing external programs, but also to the varying technologies (hardware, software, connectivity), information management processes, and support resources. The whole process will require commitment by the cooperating programs and strong support from Agency Directors and Managers. The effort will also require the expertise and support from experienced enterprise information architects. There are programs within the agencies, such as the US Department of Agriculture, National Information Technology Center (NITC; http://www.ocio.usda.gov/nitc/index.html), that specialize in providing information technology services and enterprise solutions for meeting agency missions.

The vision of an enterprise information system needs to include a discussion of some of the efforts needed to achieve that vision. The agencies involved in the Plan have only limited experience in maintaining data at a regional scale. In addition, security systems in the agencies have developed "firewalls" that tend to limit rather than encourage the sharing and accessing of data. For this reason, consideration needs to be given to developing enterprise data models, data standards, regional data stewardship, rewards, and management oversight.

An enterprise data system begins with developing requirements for a regional data model that identifies common elements required for regional assessments, who is responsible for each piece of data, who requires access, and how data from separate programs can be integrated to address joint issues. Each individual agency will then need to work to incorporate common elements of the regional data model into their own agency data model. Common data elements are accomplished by building multi-agency regional data standards for measured attributes. Building these standards takes time, committed teams, and additional funding as individual programs face competing needs for available resources. Progress on regional standards should not violate national standards.

Inherent in both stovepipe and enterprise data models is the need for good data stewardship. The difference is that an enterprise data model requires two types of data stewardship: the first is at the program scale, where data are being collected. But a regional interagency scale is also required to ensure that the data are consistent, have been collated, and have been kept as current as possible. Data stewards across agencies are responsible for updating those portions of the data for which they have responsibility to maintain. Any potential user can then automatically enjoy the data-maintenance investments by all agencies involved.

Maintaining consistent data across all the 24 million acres under the Plan is a challenging task that takes time, planning, collaborative effort, and funding. To encourage good data stewardship, data stewards need to be rewarded for their efforts and their contributions to the regional data system. Management oversight is important to guide, encourage, and reward successes in developing a regional data system.

The function of the information technology support staff in each agency is to provide an electronic work environment that efficiently supports data access, updates, maintenance, and use for all of the programs it views as its customers. This overall function is a departure from the past of supporting a series of individual programmatic data management efforts. The staff will also need to develop recommendations for maintaining security while allowing regional multi-agency access to data for all participating agencies.

Recent Developments

An important step has been taken in Oregon and Washington by the Bureau of Land Management OR/WA and the Forest Service Region 6 to establish an interagency information management board (IIMB). This board is a shared leadership team comprised of directors/branch chiefs and line officers to guide the development, use and maintenance of information resources by both agencies. Special areas of interest to the board include data stewardship, implementation of national initiatives, regional inventory and monitoring activities, inventory protocol development, policy guidance on data management, and review of regional expenditures related to joint inventory and resource information activities.

A major challenge of the IIMB team will be to develop an interagency approach to data management within a framework of different agency-level directions regarding data management. For example, FS-wide direction for data systems in certain programs is often different from BLM-wide direction. Each of these data issues will need to be resolved on an individual basis in an organized manner.

Organizing the data for resolving the issues

By arranging the information management issues into categories, significant efficiencies can be achieved in resolving issues together because subtle relations can be more clearly seen.

For the tracking priorities through the discussion, the issues discussed above are moved into one of three priority ranking groups, priorities 1, 2, and 3 based on simply grouping the issues into three sets (Table 4). Several modules were affected by most data priorities 1 and 2. Priority 3 data may only be needed by one module, as discussed above.

Issues not related to information management

The Vegetation inventory and monitoring analysis tool (VIM) issue is an application development issue, not an information management issue, and thus its solution is independent of the solution to the information management issues.

Table 4—Future data priorities grouped into three sets. Several monitoring modules were affected by data priorities 1 and 2, whereas priority 3 data may only be needed by one module.

Priority	Title	Issue ID
1	Activities	6
1	Riparian reserve spatial data (resource)	4
1	Hydro and stream spatial data (resource)	3
1	Land-use allocation and ownership	2
1	Road data (resource and activities)	5
1	Vegetation change detection data	17
1	Vegetation modeling (IVMP & CALVEG)	18
1	Culvert, fish passage and barrier information (activities and resources)	7
1	Potential natural vegetation (PNV)	19
1	Procurement contracting data for ecosystem management work (activities)	11
2	Restoration projects (activities)	8
2	Special forest products (activities and resources)	14
2	Recreation (activities and resources)	9
2	Scenery: spatial data (resource)	20
2	Digital orthophotoquad coverage did not describe the whole Plan area	27
2	Grazing (activities)	13
2	Watershed analysis (activities)	16
2	Local unit implementation monitoring data (activities)	10
2	Collaborative forest stewardship data (activities)	12
2	Lack of common data distribution platform	23
2	Watershed boundaries changing (resource)	15
3	Workforce composition data	22
3	Physiographic province boundary	26
3	Community economic assistance data	29
3	Agency budget data	28
3	Marbled murrelet habitat data (occupancy, platforms)	21
3	Cost of implementing planning requirements of the Plan cannot be determined	25
3	Measurement methods for timber volumes	30
3	Total maximum daily load	31

Road data is important to several of the monitoring modules. Photograph by David Baker of a decommissioned road in the California Coast Province roadless area.

Culvert, fish passage and barrier information was ranked as the 8th most important data issue. Photograph by David Baker of an in-stream structure (culvert) to abate seasonal instream passage problem, Olympic Province

Chapter 5: Strategy for the Future

Challenges faced by the regional monitoring program are complicated because they rely on information from multiple agencies. The cooperating agencies are at various stages of maturity with their respective information management strategies, and interagency coordination on information management is limited – and often avoided in the past. The fact that the agencies use different technologies, software, hardware, and intranets (with firewalls), and have different information-management organizations, produces information environments and "cultures" that not only present obstacles to information sharing, but to basic communication as well. Cooperating agencies will need to provide people with the appropriate authority to overcome the data roadblocks and information-management issues plaguing the regional monitoring program. Support staffs with an understanding of natural resources business needs, information technology, agency-specific information environments, data stewardship, and data collection and production are required. Key elements of a proactive strategy to facilitate interagency cooperation on meeting the information needs of the regional monitoring program include

- **Executive oversight** – by interagency directors with authority to approve information needs and projects, commit resources, and require accountability. *Key to resolving all issues described above.*
- **Interagency standardization** – effort for defining and documenting required interagency information standards, metadata, and stewardship needs. Needs to include defining enterprise software and hardware requirements for interagency data structures and information processes. Group must have knowledge of existing agency information environments, IT regulations, and cultures. *Key to solving issues around documentation, consistency, and maintenance.*
- **Interagency stewardship** – staff with knowledge of interagency programs (monitoring, EIS, planning, and so on) and their business needs. Requires skill to articulate information content, standards and maintenance requirements, and ability to work with production staff in developing work plans and budgets. *Key to solving issues around data documentation, compilation, and maintenance.*
- **Organizing the data more effectively** – begin with selecting priority datasets and then provide the support staff, software, hardware, and financial resources necessary to complete production and maintenance work. *Key to solving issues around information production, compilation, and maintenance.*
- **Adopt an enterprise approach to data management** – encourage interactions between programs so that multiple client needs can be identified and taken into account as data are collected and shared. Technologies that are not tied to one agency's data architecture need to be pursued. *Key to resolving all issues described above*.

Executive oversight

In this chapter, we provide ten recommendations as a strategy for the future. The first two recommendations address executive oversight.

Recommendation 1: Continue Interagency Information Management Board oversight.

Many barriers to effective information management exist and will continue to plague the monitoring program for

several more years. As an organization chartered by the FS Regional Forester and the BLM State Director, the interagency information management board (IIMB) is positioned to provide executive oversight for efforts directed at addressing issues discussed in this report. This team is beginning to set priorities and affect change; executive oversight is especially needed for the next phases of monitoring because effort will be directed at fixing the issues discussed in this report. Each selected priority will need to be followed up by the development of an implementation plan, with accomplishment targets, budgets, and timeframes.

Recommendation 2: Continue supporting the IRICC as it grows into the RGIC.

In addition to a need to have management support through the IIMB, there is also a need for a forum of technical experts across agencies to develop a workable strategy. This forum is the interorganizational resource information coordinating council (IRICC). This council is currently expanding its purview to include the salmon-recovery areas in the Columbia Basin at the request of several agency partners. In the process, it will rename itself the Pacific Northwest regional geospatial information council (RGIC). The information required for the salmon-recovery efforts is similar to that collected for the Plan area. The monitoring program stands to benefit from the participation of an increasing number of partners. As costs for data management are shared, data development costs for each individual agency or unit should be reduced. The IRICC is also moving toward a solution similar to the vision presented in this report.

Interagency standardization

The highest ranked barrier to information gathering was the lack of consistency between agencies in data standards and attributes, sample designs, data-collection protocols, and other information-gathering processes. The issues identifying data consistency between or in agencies as a primary barrier are detailed in Table 5.

The federal agencies have received and spent many millions of dollars on anadramous fish habitat-restoration projects in the Plan area, yet the data for telling us how effective those efforts have been at restoring habitat is inadequate because various agencies were not collecting data to a standard protocol and many did not use a probabilistic sample design. Fish barrier data were often collected, but the attributes or descriptions differed so the various data sets were not usable together [S. Lanigan].

Recommendation 3: Compatible interagency data standards.

More clearly defined standards or other data-quality issues would, if resolved, contribute to efficient information compilation across agency boundaries. Unified standards could be developed for attributes, sample designs, data-collection protocols, and compilation methods. The challenge is to develop and support interagency forums that will further these efforts. The development of unified standards can be a difficult and time-consuming activity. However, it should be recognized that the time devoted to these efforts will provide significant long-term benefits to all participating agencies, and therefore deserve management support.

Recommendation 4: Standardization of information hardware, software, and security policies.

In addition to the development of interagency data collection standards, agencies need to identify opportunities for standardization of their information systems. The overall goal would be the creation of a fully compatible set of hardware, software, and security policies, procedures, and equipment between the cooperating agencies. A benefit of this goal would be that every monitoring team member would have secure access to the program's servers regardless of the agency

Table 5—Information issues where data consistency is a primary barrier

Priority	Title	Issue ID
1	Activities (ground disturbing)	6
1	Land-use allocation and ownership (or zoning)	2
1	Road data (resources and activities)	5
1	Change detection data	17
1	Culvert, fish passage and fish barrier information (activities & resources)	7
2	Restoration projects (activities)	8
2	Special forest products (activities & resources)	14
2	Recreation (activities & resources)	9
2	Scenery: spatial data (resource)	20
2	Grazing (activities)	13
2	Local unit implementation monitoring data (activities)	10
2	Lack of common data-distribution platform	23
3	Marbled murrelet habitat data (occupancy, platforms)	21
3	Measurement methods for timber volumes	30

hosting the data system. This approach could include compatibility of hardware and software along with internet and intranet firewalls allowing every participating agency to seamlessly access the information they need during monitoring analyses.

Interagency stewardship

Recommendation 5: Designated interagency data stewardship teams for each data layer.

One designated interagency data stewardship team needs sole responsibility for overseeing the producing and managing of each interagency data set at all levels of each agency. The team would be responsible for determining attributes needed by all partners, negotiating common data standards and defensible data collection protocols, QA/QC planning, production, maintenance, and archiving of the data layer. This designated data stewardship team would need to have expertise in the specific natural or cultural resource or activity described by the data and in data management.

The interagency data stewardship team would need access to adequate data producing resources, as well as authority to approve edits and interpret standards on the whole data set without regard to agency, whose data are being edited, or where it was created. This authority may require stewardship or maintenance agreements with the RIEC, but is critically needed as an effective means of getting quality data in a cost-effective manner. Management engagement is always very important when implementing a stewardship model.

Consider how the land-use allocation layer was produced. A data call was issued by the REO in early 2002 and the finished product was expected by December 2002. The data were delivered to monitoring in April of 2004, 16 months after it was due. As the data passed from agency to agency for editing, the National Park Service had no representative and their data were never edited even though it had easily correctible errors, such as the polygon representing Crater Lake in Crater Lake National Park having no attributes. Also, numerous edge-matching errors along the park service boundaries were found. And each agency had labeled its lakes in a different way. These errors were not discovered until after the RIEC had

formally approved the coverage, so the required edits were not done because of potential legal issues involved in modifying the formally designated coverage. This process was not efficient.

Designated data stewards for each agency could work closely with the monitoring program, or be employed by it, because monitoring has the resources to help define standards in a rigorous way that will hold up to peer review or court scrutiny. Peer-reviewed monitoring data might be useful for other purposes, such as land management planning because of its nature and relations to the resources.

Recommendation 6: Create and follow maintenance schedules.

Each data set in the interagency data collection must be regularly maintained including updating any changes and correcting any errors found in the data. Some data sets like roads would require frequent maintaining because of frequent changes in the resource. Some data, like a regional scenic-viewshed coverage, which would be fairly static, would need maintaining only as needed when viewsheds are added or changed.

Recommendation 7: Archive annually.

All agency data need annual archiving because monitoring status and trend requires knowing how resources change over time. Had road data for each agency been archived annually, for example, monitoring analyses might have avoided the substantial cost of rebuilding the 1994 road data.

Data related to activities needs to be archived each year so that activities can be registered to the correct timeframe. Changes in land allocations, watershed boundaries, roads, and other resources needs to be archived by their dates of entry, or annually, as appropriate. Not archiving these data annually will lead to problems similar to some the monitoring program faces currently, or could lead to confusion about allocations or other administrative data when things change.

The current stovepipe processes normally update data as needed (if needed), but rarely does anyone keep data from before the edits. This appears to be a systemic problem across agencies.

Recommendation 8: Multi-scale QA/QC planning

Quality assurance (QA) and quality control (QC) planning are crucial parts of improving data quality; they could be undertaken for each data set produced for the monitoring program (Palmer 2003). These plans would apply at any level of any agency, so a QA plan might specify data-collection protocols at the local units in 3 agencies and interagency compilation methods at the regional scale.

Conversely, data-collection protocols at the local units already determine usability of the data at the regional scale. Because no one standard is applied at all localities across the region, a lot of data are not usable at the regional scale, which describes a stovepipe process very well.

The monitoring program produces significant information regionally that might be useful at the local units if its accuracy at that scale could be demonstrated scientifically. For example, the spotted owl habitat maps are produced regionally by the monitoring program, using the same 25-meter resolution LANDSAT TM data that the local units commonly use for their local assessments. Monitoring can verify the validity of the habitat mapping at the physiographic province scale using CVS (current vegetation survey) and FIA (forest inventory and analysis) plot data and statistical techniques, but the validity of the data cannot be verified for smaller areas of land because of the number of plots available [Moeur pc 2004]. Thus, each unit will make its own habitat layer, based on professional judgment, with little or no formal

Table 6—Setting priorities for resource issues

Priority	Title	Issue ID
1	Riparian reserve spatial data	4
1	Hydro and stream spatial data	3
1	Land use allocation and ownership	2
1	Road data for system and non-system roads	5
1	Vegetation change detection data	17
1	Vegetation modeling (IVMP & CALVEG)	18
1	Potential natural vegetation	19
1	Culvert, fish passage and barrier information	7
2	Special forest products – resource distribution	14
2	Recreation facilities – roads, trails, campgrounds, ski areas, viewpoints	9
2	Scenery: spatial data about scenic highways and viewsheds	20
2	Watershed boundaries	15
3	Physiographic province boundary	26
3	Marbled murrelet habitat data (occupancy, platforms)	21

accuracy assessment other than a biologist's approval. Comprehensive multiscale accuracy assessment could result in significant cost savings by making use of good regional data that cannot currently be validated at the local scale.

A lot of data is also created in watershed analyses and land management planning at local units that could be useful for monitoring if its accuracy were known and if standards were uniform across the region. A consistent accuracy assessment for areas of land where CVS/FIA plot data are not sufficient for statistical significance could add value to locally created data and make regionally generated data more useful at the local unit.

Significant cost savings might be generated if regionally standardized local accuracy assessment were a part of every watershed analysis or land-use planning data set.

Organizing the data more effectively

Natural and cultural resources

Resource data describe the natural and cultural resources that are important to federal land managers, as shown in Table 6. Most of the natural and cultural resource data are basic data and usable for management or monitoring, although most need standardization. Each set needs an interagency data stewardship team with full authority to develop standards, to create, and to maintain these data.

Ground-Disturbing Activities

The federal land management agencies engage in many kinds of activities. Some activities are ground disturbing, some are survey or planning projects, and some are administrative and may relate to the other activity types. Some activity data are tabular, such as total timber volumes in the region, and some are spatial, such as describing activity boundaries. All of them need a spatial component.

Following are some types of ground-disturbing activity issues that came up during monitoring:

Table 7—Prioritization of activity issues

Priority	Title	Issue ID
1	Consumptive activities - timber sales, mines, and so on	6
1	Road building, deconstruction, decommissioning	5
1	Culvert, fish passage and barrier information	7
2	Aquatic restoration projects	8
2	Special forest products	14
2	Recreation maintenance and usage	9
2	Grazing	13

Other kinds of ground-disturbing activities also occur in the Plan area but did not show up as monitoring issues. These activities will need standardization and other work similar to the formal issues, but are of a lower priority. They are:

- Terrestrial restoration projects
- Watershed restoration projects
- Wildlife enhancement projects
- Projects accomplished through procurement contracting for ecosystem management work [Issue ID 11]
- Project accomplished through collaborative forest stewardship agreements [Issue ID 12]
- Prescribed fires
- Wildfires, project fires
- Fire camps, helispots, retardant drops

Survey and Planning Activities

Some activities do not disturb the ground and therefore do not require NEPA analysis but may require monitoring. They are generally survey, inventory, or planning activities like watershed analysis.

Other survey, inventory, and monitoring activities that do not disturb the ground will need standardization or other remedies recommended in this paper:

- Late-successional reserve assessment
- Inventory plot data collection (CVS & FIA) [Issue ID 24]

Administrative Activities

Administrative data are associated with administering project activity and resource management programs with spatial components, even if that component is not commonly recognized in the data. These issues need to draw a relation between the administrative data and the project data related to it (Table 8).

Many of the administrative issues arising from monitoring are activity issues in disguise. For example, the collaborative forest stewardship issue describes tabular administrative data related to multiple ground-disturbing activities accomplished with a certain kind of funding. Its purpose is accountability, but relating the numbers for the program to specific project costs is difficult for the monitoring program as is summarizing the total costs of the program because the data sets are not cross-referenced.

Recommendation 9: Consider project indexing and cross-referencing.

Create an interagency numbering system (that is, an indexing system) to identify activities by type, location, and date. Using that index as a key to relating tabular and geospatial data together could facilitate better cross-referencing between administrative and other activity types and, therefore, better accounting for activities, contracts, and costs. Activities would be easier to identify and evaluate or track by category (such as, watershed

Table 8—Prioritization of administrative group issues

Priority	Title	Issue ID
2	Procurement contracting data for ecosystem management work	11
3	Local unit implementation monitoring data	10
3	Collaborative forest stewardship data	12
3	Cost of implementing planning requirements of the Plan	25
3	Agency budget data	28
3	Community economic assistance data	29
3	Workforce composition data	22
3	Measurement methods for timber volumes	30

analysis), and their costs and funding sources could be identified and summarized as the data are compiled.

Most of the priority 3 issues could clearly benefit from some kind of numbering system that relates administrative tabular data to the projects they describe or account for. Many of the priority 1 and 2 and most of the priority 3 issues can be mitigated with indexing and cross-referencing of activities. Specifically, issues 5, 7, 10, 11, 12, 13, 14, 16, 22, 25, 28, 29, and 30 will benefit. Standardization will also be required for many of these data sets.

Looking beyond current data management situation, we see other data sets that would benefit from activity indexing. They are listed by the data with issues so they will not be forgotten.

Adopt an enterprise approach to data management

Recommendation 10: Encourage programs to adopt a corporate interagency or "enterprise" view to data management and data sharing.

The underlying cause of information barriers is a general lack of awareness that data collected by one program or agency might be of use to others. In a 'stovepipe' data model, each program or agency develops a data system that meets their own internal requirements without thought to the numerous potential uses of these data by others. An enterprise data model, in contrast, identifies and facilitates the use of data by multiple programs among the partner agencies.

Agencies need to encourage interactions between programs so that these data requirements can be taken into account as data are collected and shared. A good example of this type of activity is the annual client meeting held by the Pacific Northwest Forest Inventory and Analysis program where multiple client needs are identified. In a similar manner, the regional monitoring program needs to develop a mechanism, such as a client meeting, for determining how its monitoring information might be of more use to others.

An enterprise approach is also most effective when technologies are selected to encourage the delivery and sharing of data. Technologies that are not tied to one agency's architecture, that use open systems across networks, and that exploit the advantages of new powerful tools in the world of web-based applications need to be pursued.

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The watershed monitoring module uses laser levels to map the morphological characteristics of sampled stream sites. Photograph by Steve Lanigan

The marbled murrelet monitoring module reports on the status and trends in populations and habitat for this species. Photograph by Rick MacIntosh

Appendix A: Information Management Issues Database

Database Index:

Issue ID ***2***

Data topic **Land-use allocation and ownership**

Data description:

The land-use allocation (the allocation) coverage describes the manner in which the Plan divided land use on federally managed lands in the Plan area; it is critical to answering several monitoring questions. Ownership is a separate but closely related coverage describing federal administrative boundaries and state ownership and zoning combined.

The allocation classes for federal lands in the map were as follows:
·CR – Congressionally reserved
·LSR – Late-successional reserves
·LSR 3 – Marbled murrelet reserved areas
·LSR 4 – Spotted owl cores
·AMA – Adaptive management areas
·AMR – Late-succesional reserves in adaptive management areas
·MLSA – Managed late-successional areas
·AW – Administratively withdrawn
·Matrix/RR – Matrix (which contains riparian reserves that were not mapped)
·ND – Not designated; land that has no plan land-allocation designation.

National Park Service lands were mapped as Congressionally reserved. The current allocation map also includes Department of Defense and Fish and Wildlife Service lands not subject to the plan; but Bonneville Power Administration, Corps of Engineers, State and private industrial lands, and other federal lands not assigned an allocation in the Plan are not represented. The allocation layer currently confounds riparian reserves and matrix lands, which is a significant issue to several monitoring functions. Ownership coverage could be combined with an allocation layer because they are very similar attributes over different land areas.

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☑	☑	☑	☑	☑	☑	☑	☑

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	High	High
Late-successional and old growth (LSOG)	High	High
Marbled murrelet (MaMu)	Very high	Very high
Northern spotted owl (NSO)	Very high	Very high
Socioeconomic	Moderate	None
Tribal	None	None
Watersheds	Moderate	Moderate

Comments:

Lack of maintenance and annual archiving compromises the utility of the land-use allocation data over time. Under the current processes, once the "official" map has been created and approved by the

RIEC (Regional Interagency Executive Committee), it cannot be modified or edited because it would then be a different map than the RIEC-approved one, a process that virtually guarantees the data are of marginal quality because land uses and boundaries can change over time.

The most recent allocation coverage created from a 2002 data call confounds riparian reserve and matrix allocations, a major problem for several modules because it mixes reserved and nonreserved lands with significantly different habitat and vegetation management objectives. One result is a conservative estimate of older forests in the reserve allocations because the extent of riparian reserves cannot be determined. It also confounds estimating the contribution of the riparian reserves to dispersal habitat for spotted owls and other species.

Lack of attributes in the existing data coverage for the largest lakes in at least two national parks can skew administrative and habitat acreage calculations (one of the missing lakes covers more than 13,000 acres). Inconsistent coding of other water features compounds the problem, so extra work was necessary for several modules to verify acreages and explain procedures. This issue is related to IssueID 3 (hydro andstream) and IssueID 4 (riparian reserves).

A similar issue arose with Fish and Wildlife Service lands in the Columbia River. Some refuge lands were described as being in Oregon when they were, in fact, wholly in Washington. The appropriate polygons were mislabeled. Some other wildlife refuge lands were missing from the data.

The absence of spatial attributes for recreation facilities smaller than 40 acres obscures potential monitoring issues in those areas and makes evaluating the contribution of recreation opportunities to the economy more difficult. Some monitoring questions could not be answered because this information was not included in the allocation data call.

Numerous sliver polygons and mismatched edges confound unit and allocation boundary identification and make overlays using the data more difficult and less accurate than anticipated. Acreage calculation might be affected by the cumulative effect of these errors across the Plan area.

Missing subunit (Ranger District or Resource Area) identification makes responsible authority difficult to identify.

Missing boundaries for the California state parks wholly contained in Redwood National Park also misrepresents land-administration and management responsibilities in those areas.

In the words of one module leader, “To knowingly include significant mistakes that can be readily fixed, if given sufficient time, does not meet the standards enacted in the Data Quality Act. For the monitoring program to produce calculations that misrepresent commonly available data such as the total size of a major national park calls into question the validity of any calculations made by the monitoring program. This problem substantially obscures the reader's ability to "independently" interpret results about reserves, and places all of the effectiveness monitoring papers at risk of being marginalized by those who wish to sway political opinion" [Mark Huff, pers. comm., 2004].

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	Readily available	**FS R6**	Readily available
BLM OR,WA	Readily available	**Other**	
FS R5	Readily available	**Description of other:**	

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐
BLM-OR,WA	☐	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R5	☐	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R6	☐	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐

Spatial data availability (by agency)

BLM CA	Available after significant effort	**FS R6**	Available after significant effort
BLM OR,WA	Available after significant effort	**Other**	
FS R5	Available after significant effort	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

Issue classification:

Access	Not an issue
Production	Contributing issue
Maintenance	Priority issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

Revision of the Plan's land-use allocation layer to support monitoring was initiated in 2002 (REO memo August 23, 2002). This effort was intended to update the legacy coarse-scale (40-acre resolution) allocation map to correct inconsistencies in interpreting certain allocations among administrative units and also incorporate changes and adjustments to allocations since the Plan was implemented. Although the accuracy of allocation mapping had improved, including representing

allocations at a finer resolution, the map product still had some limitations. The final product was regarded as a “display map” rather than a “control map” [Connelly 2004], although it is still the best available data.

Examples of the outstanding issues are as follows:

· The most significant limitation of the allocations map was its inability to display the riparian reserves. The current allocation data coverage confounds riparian reserve and matrix land allocations, a major problem for several modules. Riparian reserve data are collected and kept at the local units, but these data are difficult to compile because no common data standard exists between units or agencies.
· Water is not coded consistently across the Plan area, and some water is not even mapped. For example, the 13,000 acres of Crater Lake in Crater Lake National Park is represented by a polygon with no attributes, so it is not counted when a query is made for park acreage. Other large bodies of water are mapped with whatever underlying allocation designation is, such as adminstratively withdrawn or congressional reserve. Additional water polygons were labeled not designated, but not all nondesignated polygons are water and not all water is labeled not designated [P.Eldred, pers. comm.]. Therefore, the habitat analysts needed to check all other water bodies on federal land to make sure they had an allocation attribute, which not all did [J. Lint, pers. comm.]. Time and the data compilation ability of the monitoring agencies did not allow for correcting the data in time for the 2004 reports. The monitoring program did not have authority to edit a data layer already approved by the RIEC.
· The lack of subunit (Ranger District or Resource Area) attributes and boundary lines make responsible authority for lands, projects, or issues difficult to identify, which was a problem for the socioeconomic module.
· A lack of nonfederal industrial ownership boundaries and attributes prevented range-wide assessment of habitat for spotted owl and marbled murrelet populations because areas on nonfederal land that contribute to the habitat could not be identified or evaluated [Lint, pers. comm.].
· The variability in size and classification criteria for administratively withdrawn lands resulted in inconsistent mapping of these areas across the range of the marbled murrelet [Huff, pers. comm.] and northern spotted owl [Lint, pers. comm.] and underestimation of the amount of reserved lands in the Plan area.
· Other mapping-related issues included inconsistent edge matching of allocation between some adjacent administrative units like national parks and national forests, creating sliver-sized gaps in the map along with the inconsistent attributing of large bodies of water. Sliver gaps still exist in the allocation data and are problematic from a technical viewpoint.
· Another significant issue was the existence of California lands wholly contained in Redwood National Park that were not recorded in the allocation layer. National park lands are considered “Congressionally Withdrawn” but state park lands are not, thus this error misrepresents the amount of withdrawn land in the plan area.
· Tualatin National Wildlife Refige in the northern Willamette Valley isn not represented on the allocation layer. Ridgefield National Wildlife Refuge on the Columbia north of Vancouver is misrepresented. The refuge is shown as being in Oregon, but it is wholly in Washington. Furthermore, the layer incorrectly names some polygons as "Ridgefield National Wildlife Refuge" in the UNIT attribute field; however, this field is empty for the orange (valid) refuge polygons. They are all coded with the allocation "CR" and AGENCY="FW". The area represented by the allocation coverage polygons is more than double the size of the actual refuge (48.4 sq. km. Vs 20.9 sq. km.). Several

other discrepancies were between the refuge shapefile and the allocation layer.

Metadata about search for data

How data were requested	Formal data call was sent to Plan units in the spring of 2002; data were not completed and released until the spring of 2004 and, then, with limitations and missing elements (like riparian reserves).
Data contacts-program leads	Bill Connelly, FS; Chris Cadwell, BLM.
Data standards	Standards were defined in the data call but not fully met.
Where data were found	Contacting individual units
Data quality	data are still of marginal quality as it contains known errors like missing lake data in the National Parks, a large amount of sliver polygons, poor edge matching, etc. Lack of maintenance compromises data quality over time.

Recommendations

Land-use allocation and ownership coverages could be combined into a single coverage because they are similar in purpose, with both showing administrative boundaries and types of land-use zoning. Private industrial land boundaries could be included in the allocation data set for analysis of habitat conditions across the range of sensitive species, which implies that the ownership information could be included in the same data layer as the federal land-use allocations.

Although interagency standards for spatial land-use allocation data exist and were specified in the 2002 data call, the current allocation coverage needs to be upgraded by adding missing data, correcting attributes, deslivering boundaries, and unifying this coverage with other related data such as nonfederal ownership and zoning. Annual archiving is needed because of the boundary changes each year from land exchanges, sales, purchases, donations, and changes in allocation.

Riparian reserve boundaries need to be added to the alloction data so they can be distinguished from matrix lands. Understanding the location, extent, and condition of the riparian reserves is critical for several monitoring modules. Two possible routes exist for collecting this information: one is modeling from the hydrography layer, which is problematic because of the state of this layer; the second is a data call to the units, followed by regional compilation.

Lack of maintenance and archiving will compromise the utility of land-use allocation data over time as federal administrative boundaries or land management allocations change, unless formal maintenance and archiving schedules are set and followed. Under the current management scenario, once the "official" map has been created, it cannot be edited. This process virtually guarantees that the data are of marginal quality.

Designated data stewards with the authority to change the data once it has been approved by the RIEC could be assigned to all data coverages. Tracking the changes in allocations needs to be connected to the decision documents authorizing those changes.

An interagency maintenance plan and formal agreement with the RIEC will be required because no single agency has authority over all the data or the whole land area. The data needs to be consistent among the agencies, none of which have complete control over the data or its attributes. Maintaining the allocation coverage will require substantial interagency coordination, perhaps via the IRICC in order to achieve a quality data product.

Tabular data alone cannot be used to describe whether any activity or resource in any particular allocation because it relies on the problematic assumptions that the activity occurred in only one allocation and that no mistakes were made in entering the GPS or other coordinates. Tabular descriptions of land use allocation for projects need independent verification because they could accidentally (or intentionally) misrepresent the data. Accurate spatial registration of activities data overlaid with accurate and sufficiently detailed spatial allocation data could solve the problem.

Issue ID ***3***

Data topic **Hydro and stream spatial data (resource)**

Data description:

The ideal hydrological coverage would be a comprehensive set of point, line, and polygon coverages accurately and consistently showing all perennial and intermittent streams, lakes, wetlands, springs, seeps, and other water features at 1:24,000 or better. These data are critical to several monitoring modules because water-body data are necessary for understanding road and stream interactions, riparian reserves, fish passage, tribal uses, and correct application of standards and guides. Many other analyses can be based on knowing the exact location and extent of hydrologic or riparian resources. This ideal has only been partially fulfilled with the data supplied by the hydro clearinghouse.

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☑	☑	☑	☑	☐	☑	☑	☑

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	High	High
Late-successional and old growth (LSOG)	High	High
Marbled murrelet (MaMu)	High	High
Northern spotted owl (NSO)	Very high	Very high
Socioeconomic	None	None
Tribal	None	None
Watersheds	Very high	Very high

Comments:

A comprehensive interagency spatial layer representing all perennial and intermittent streams, lakes, springs, wetlands, and other hydrological resources in the Plan area is critical to many monitoring modules. But the data delivered were incomplete because the large amount of detailed editing needed to fully describe these resources across all agencies over a vast area was not complete, and the lack of data standardization between agencies and units confounded the problem. Hence, certain road and stream interaction, riparian reserve, and spotted owl dispersal habitat analyses based on knowing stream locations were not completed, or were completed with limitations.

The stream layer delivered for the program did not meet the need for modeling the riparian reserve network [Lint, pers. comm. 6/23/03] because:

· The current process to capture the hydrography data layer does not address densification (that is, digital representation of stream locations using a digital elevation model) of the intermittent stream network. It accepts whatever amount of densification is available from the administrative units, which was sometimes inadequate and not consistent across the agencies. No way was found to describe all streams consistently.

· Where densification of intermittents was done, it was without a standard, common approach; therefore, a consistent and accurate representation of the intermittent stream network across all agencies did not occur. As such, the current hydro layer did not provide the defensible baseline needed to model the riparian reserve network as envisioned under the Plan.

· One of the analyses planned for the spotted owl module about owl dispersal habitat required knowledge of how many acres of a given watershed were in riparian reserve. Without an acceptably accurate stream layer with correctly densified intermittents, a riparian reserve layer could not be created for this purpose. No solution was found in time for the 10-year interpretive report. This issue is related to Issue ID 4 (riparian reserves) and Issue ID 2 (land use allocation).

Completing these data to a common standard will be a large, interagency undertaking because many thousands of miles of perennial and intermittent streams and other water features must be represented accurately at 1:24,000. To be useful, any resulting data needs to be comprehensive, seamless, and relate well to watershed boundary, road, culvert, fish presence and barriers, and other data.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	Available with modest effort	**FS R6**	Available after significant effort
BLM OR,WA	Available with modest effort	**Other**	
FS R5	Available after significant effort	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
FS R5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Issue classification:

Access	Contributing issue
Production	Contributing issue

Maintenance	Not an issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

Accurately representing the amount of highly detailed data needed to fully describe hydrographic resources across all agencies for the whole 57 million acre Plan area (including all the land between the 24.5 million acres of federally managed lands) has presented a formidable challenge. Although most units of most state and federal land management agencies keep their own local unit hydrographic data, the water feature coverage from the interagency hydro clearinghouse based on these data were delivered incomplete because no interagency standards exist, and a huge workload is involved in compiling so many disparate data sets.

Because the recently produced hydrography (hydro) layer does not fully meet the need for regional consistency of both perennial and intermittent streams water features, it also did not meet the monitoring program's need for modeling the riparian reserve network. Without an acceptably accurate riparian reserve layer, one of the broad-scale analyses planned for spotted owl dispersal habitat requiring knowledge of how many acres of a given watershed are in riparian reserve was not possible. [Lint, pers. comm., 6/23/03]:

Without an accurate riparian reserve layer, effects of management activities cannot be related to riparian reserve boundaries or riparian reserve functionality, so certain aspects of compliance with aquatic conservation strategy (ACS) guidelines cannot be monitored.

In the absence of an accurate hydro layer, road-stream interaction data such as sedimentation, culvert condition, and fish habitat and presence cannot be related to the appropriate streams and the locations of survey points used during monitoring.

Tribes in the Plan area cannot determine whether their treaty and other interests are being met without the ability to describe streams in relation to special forest products or fisheries. Hence, effects of management restrictions from the Plan on certain treaty rights cannot be fully described.

Completing this comprehensive hydrologic data set will be a large interagency undertaking because many thousands of miles of perennial and intermittent streams and other water features must be represented accurately at 1:24,000 across the whole Plan area. The resulting data, to have utility must be comprehensive and seamless across all ownerships and mesh with HUC6, road, culvert, and fish presence and barrier data.

Metadata about search for data

How data were requested	From the interagency hydro clearinghouse for FS Regions 5 and 6, BLM Oregon, and BLM California offices.
Data contacts-program leads	Ken Adee (FS), Dan Wickwire (BLM), Ralph Warbington (FS R5)

Data standards	The data standard has been determined for locating streams but not for densification of intermittents across the Plan area.
Where data were found	Corporate database
Data quality	A 1:24 k resolution (or better) is necessary to describe the resource, but many thousands of miles of streams exist and, because both intermittant and perennial water features must be accurately described, thework load would be huge. Data need to be of sufficient quality to assess road-stream interactions, such as culverts and stream crossings, and to model riparian reserves.

Recommendations

The interagency hydro clearinghouse effort (also called the national hydrography data set) in progress to complete a 1:24,000 stream layer needs more resources because it is not yet completed for the Plan area. The final hydro coverage must be comprehensive and seamless across all ownerships and needs to include all perennial and intermittent streams and lakes to be useful.

Achieving absolute accuracy for the existing intermittent-stream network on the ground may not be feasible in the next 5 years, so a consistent process for estimating stream density (densification) needs to be established and followed for the whole plan area. This densification process should include some ability to approximate reality in each watershed area or group of watersheds, not simply to model all watersheds at the same density without regard to reality. This effort will involve expert hydrological advice as well as modeling expertise.

The hydrology coverage needs to relate well to road, culvert, fish barrier, fish presence, land use allocation, and other related data [S. Lanigan, pers. comm.]. It needs to be accurate enough to:
· Visually describe the watershed and its hydrologic resources;
· Accurately portray the number of stream-road crossings when juxtaposed with the road layer;
· Be used to determine the probability of road sediment reaching a stream (based on the distance between the road and stream);
· Predict landslide occurrence; and,
· Define riparian areas. [S. Lanigan, pers. comm.]

Issue ID ***4***

Data topic **Riparian reserve spatial data (resource)**

Data description:

An accurate, site-specific (that is, as-built) riparian-reserve data set should be a part of the land use allocation coverage showing the location and extent of the riparian reserves specified in the Plan's watershed analyses. The data set is critically needed, but it does not currently exist. An alternative data set showing the interim riparian reserve widths defined in the ROD until site-specific reserves are created via watershed analysis would be a good stopgap measure, but this, too, does not exist. The interim reserves could be modeled across the Plan area if sufficient hydrographic data were available.

Most of the required watershed analyses have been completed but the data were not compiled to the regional scale because standardization and upward reporting requirements were lacking.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☑	☑	☑	☑	☐	☑	☑	☑

Nature of effects	To text	To maps
Implementation (activities/compliance)	High	High
Late-successional and old growth (LSOG)	High	High
Marbled murrelet (MaMu)	Very high	Very high
Northern spotted owl (NSO)	Very high	Very high
Socioeconomic	None	None
Tribal	None	None
Watersheds	Very high	Very high

Comments:

Absence of riparian reserve data has significantly affected several interpretive reports. In addition to defining the extent of riparian communities, the reserves were designated to serve as habitat connectivity corridors between the late successional reserves, as part of the dispersal habitat network. Thus, the inability to fully describe riparian reserves precludes discussion of species that depend on connectivity and dispersal habitat, such as spotted owls [Lint, pers. comm.]. This issue is related to Issue ID 3 (hydro-stream) and Issue ID 2 (land use allocations).

The team cannot evaluate the potential contribution of riparian reserves to marbled murrelet habitat without knowing where these reserves are. Lack of riparian reserve data also precludes modeling of streamside vegetation, as well as the role of the riparian reserves in watershed health. Implementation monitoring cannot verify whether a project was inside or outside a riparian reserve without knowing its location.

The team cannot evaluate compliance with the standards and guidelines of the Aquatic Conservation Strategy without knowing the location or extent of the riparian reserves. Nor can it estimate the contribution of these reserves to watershed health without knowing their locations.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	Readily available	**FS R6**	Not available
BLM OR,WA	Readily available	**Other**	
FS R5	Readily available	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
FS R5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
FS R6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☑
Other	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Issue classification:

Access	Contributing issue
Production	Priority issue
Maintenance	Not an issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

No comprehensive regional interagency riparian reserve coverage exists. Riparian reserve boundaries identified during watershed analyses (that is, as-built data) do exist at many units, but they cannot be combined into a regional product because of the variance in data standards created independently by the local units. This lack of site-specific data makes describing riparian reserves as they were built

problematic.

Modeling of interim riparian reserves defined in the Plan's ROD was also problematic. It specifies that interim reserve widths would apply until watershed analysis clearly defined the boundaries for that watershed [ROD, B-13]. Lack of interagency hydrologic coverage for the Plan area, however, precluded modeling of the interim reserves. Unstable areas, springs, seeps, and other riparian features also could not be identified at the regional scale because of their site-specific nature, yet such features neeed to be known for final riparian-reserve delineation.

Riparian reserve standards and guides may serve to limit access to tribal interests, but these issues cannot be quantified without knowing the reserve boundaries, the locations of all the streams, and fish presence [Crespin, pers. comm. 2005].

Metadata about search for data

How data were requested	Data were informally requested via experts in each agency. Data calls to collect these data were strongly discouraged because of workload to units. Sufficient data in the hydro layer was assumed to complete this work, but this assumption did not pan out because of inconsistent densification of intermittants between watersheds and agencies.
Data contacts-program leads	Chris Cadwell, BLM Oregon; Bill Connelly, FS R6; Ralph Warbington, FS R5.
Data standards	None exist. The extent and locations of riparian reserves are well defined in the Plan's ROD, but the data created by units and subunits to describe these areas cannot be combined because of differing production standards, data collectiona nd modeling, or reserve layout techniques. The land use allocation layer did define a data standard, but riparian reserves were not included in the data call, hence no standard exists.
Where data were found	Contacting individual units
Data quality	Riparian-reserve boundaries are defined by slope distance from streams and by stream class in the ROD. Unstable areas, wetlands, springs, and other point and polygon water features also are a part of the riparian reserve network defined by the ROD. The process of delineating reserves is therefore open to interpretation by the units; hence, a consistent interagency regional standard does not exist. The concept is easy, but the reality has been very difficult to achieve.

Recommendations

The easiest solution to the problem of mapping riparian reserve boundaries would be a data call to the units to identify and compile existing “as-built” reserves, coupled with consistent modeling of the areas where the reserves were not identified in watershed analyses and approved through NEPA. Most of the required watershed analyses have been completed, and the data exist at the units; it simply needs to be compiled to the regional scale and have the blank areas filled in. The

optimal coverage would be the best description of what is on the ground. Formats and specifications for data could be standardized among all parties and upward reporting needs to be required on a regular basis.

Riparian reserve data will require annual maintenance as new reserve boundaries are identified in updated watershed analyses. Formal archiving of each year's data are needed to track the extent of field-verified reserves as they are created.

Increasing the capacity of the agencies to compile data from numerous sources into a single comprehensive seamless data layer is necessary. Once production of land use allocation and riparian reserve data have occurred, an interagency maintenance plan will be indispensable. The riparian reserve data would be related to the land use allocation coverage and with regular maintenance and periodic, possibly annual, archiving. This data layer also needs to relate well with the interagency hydro, road, and other layers.

Designated interagency data stewards need to be assigned to manage and maintain this data set because the issues involved in its creation cross agency boundaries and jurisdictions. If nobody with the authority to edit all aspects of these data are assigned to the task, the data will languish and become useless as time passes and boundaries change away from the approved mapping.

Issue ID ***5***

Data topic **Road data (resource and activities)**

Data description:

The ideal road coverage for effectiveness monitoring would consist of line and attribute data consistently and seamlessly describing the extent, location, classification, condition, character, and changes in all system and nonsystem roads across all agencies and owners in the Plan region. The current data set has most federal system roads represented, but nonsystem spur roads are not consistently represented even though they can affect watershed health. The data for nonfederal lands is incomplete.

Any interagency road coverage suitable for monitoring needs to identify which roads have been built or decommissioned by year. The current coverage identifies federal roads that have been decommissioned, but has no year of decommissioning for FS lands. The FS also has little spatial information on roads built since the Plan was adopted. Some tabular data on road building and decommissioning exists, but these data have little or no spatial registration and cannot be used to answer the monitoring questions. No information exists on road changes for nonfederal lands.

Data sources include: the 2003 Biological Assessment, Plan,s ROD, Plan,s FEIS, interagency restoration database (IRDA), compliance monitoring database, and agency road databases [Baker, pers. comm.].

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☐	☑	☐	☑	☑	☑	☑	☑

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	High	High
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	High	High
Northern spotted owl (NSO)	None	None
Socioeconomic	Low	None
Tribal	Very high	Very high
Watersheds	Very high	Very high

Comments:

The large amount of time and work needed to answer the road-related questions was not anticipated, so monitoring questions about increases or decreases in roads in key watersheds or inventoried roadless areas were not thoroughly addressed in this report. Road and stream interaction data were also not fully available because neither layer was comprehensive and seamless across all boundaries in the Plan area. Also, the agency databases do not have a reliable way to determine the amount of roads in riparian reserves because spatial data for roads, streams, and riparian reserves were not fully available. Each agency interprets road categories somewhat differently; thus, questions about the amount of existing roads, road building or decommissioning in riparian reserves cannot be addressed. [Baker, pers. comm.]

Comprehensive historical road data were not recoverable, so sampling was used to estimate changes in roads and their density. This question could have been answered by a lengthy process involving regional GIS personnel and a data call to the units and would have required each unit to spend a lot of time and resources conducting an analysis (for example developing GIS coverage and verifying road status) merely to establish a baseline from which to measure future changes [Baker, pers. comm.].

Description of changes in road mileage due to construction or decommissioning of roads since the plan were estimated by sampling, which took DOQs from 1990 or 1994 and 1998 or 2000 and compared the roads found on them with recorded roads from a variety of sources.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	Available after significant eff	**FS R6**	Available after significant effort
BLM OR,WA	Available after significant eff	**Other**	
FS R5	Available after significant eff	**Description of other:**	

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑
BLM-OR,WA	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑
FS R5	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑
FS R6	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☑

Spatial data availability (by agency)

BLM CA	Not available	**FS R6**	Available with modest effort
BLM OR,WA	Available with modest effort	**Other**	
FS R5	Available with modest effort	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☑	☐	☐	☐	☑	☐	☑	☐	☐	☐
BLM-OR,WA	☐	☑	☐	☐	☐	☑	☐	☑	☐	☐	☐
FS R5	☐	☑	☐	☐	☐	☑	☐	☑	☐	☐	☐
FS R6	☐	☑	☐	☐	☐	☑	☐	☑	☐	☐	☐

Issue classification:

Access	Contributing issue
Production	Priority issue
Maintenance	Contributing issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

Assembling a high-quality interagency geospatial road database has been a significant challenge that includes coordination between several federal and state agencies, each of which is wholly responsible for data about roads in their own jurisdiction. To have utility for monitoring, road data must be comprehensive and seamless with standardized attributes across all ownerships in the Plan area, but each agency describes roads in a unique way because sufficient interagency standards do not exist. A national standard for federal lands has been created by the Federal Geographic Data Committee (FGDC), but they are not sufficiently detailed to be used by the monitoring program. Consistency among data sources is important in order to facilitate a discussion of the resource across the ecosystem.

The quality and quantity of road attribute data varies, depending on the source of the data and the ownership of the land. The specific attributes recorded differed across units. One unit might record the frequency of road crossings expressed as number of crossings per mile of road, and another might use the number of crossings per mile of stream [Gallo, pers. comm. 2004]. Some agencies record surface type, some do not. Where road surface data do exist, surface types are not standardized and are hard to compare.

The BLM and FS R6 mapped their "system" roads pretty well, but smaller spur roads not considered part of the official road system are not well mapped even though they may contribute to the hydrological functioning of watersheds. California BLM has not mapped all their roads [P. Eldred, pers. comm.].

Many private timber companies have roads well mapped but would not make this information available for analysis. Ideally, the monitoring program would like to have a comprehensive road coverage for the whole Plan area, including nonfederal lands, with accurate spatial representations for all roads built or decommissioned since 1994 [P. Eldred, pers. comm.].

Road mileage numbers for the national forests partially in the Plan area include system road mileage for the non-Plan areas too. The BLM system-road mileage is only for the Plan area (2003, BA, p. 26). Net BLM changes to road mileage represent time differences from year 2000 to 2003 except for the Arcata and Redding units, which cover changes from 1994 to 2003. The period used to calculate net changes to road mileage by administrative unit for the FS differ by region and administrative unit. The Oregon and Washington administrative units cover differences for a 10-year period, 1993-2002, but the California administrative units vary for the most part by national forest: the Klamath (1993-2002), Six Rivers (1994-2002), Mendocino and Shasta-Trinity (2000-2002) [Baker, pers. comm.]. Quality spatial data for roads would allow accurate measurement of road mileage for any unit, period, or allocation.

Corrections were made to existing FS roads that had incorrect mileages recorded in the database. Several roads-- known as the ghost roads -- were not inventoried because they were not agency-approved roads, although they have entered into the Infra database (2003 BA, p. 27) [Baker, pers. comm.].

Information on road building and decommissioning under the Plan was spotty and incomplete and often available only in tabular form without spatial definition. Although most of the federal road coverages contain attributes that describe whether a specific road segment was decommissioned, dates of decommissioning or information on road building on FS land was not available. Historical road coverages (for example, from 1994, when the Plan was implemented) were also not available. [Gallo, pers. comm.]

Descriptions of changes in road mileage under the Plan were estimated by sampling, which took DOQs from 1990 or 1994 and 1998 or 2000 and compared the roads found on them to recorded roads from a variety of sources. Corrections were made by moving, adding, or deleting roads based on DOQ interpretation. Roads appearing on more recent DOQs, but not on the earlier set, were considered built. Roads added that were on both sets of DOQs were considered omissions from the GIS database. Riparian road densities and frequency of road crossings were then computed in 38 watersheds by using agency road coverages for those watersheds and the update layer developed from the DOQs [P. Eldred, pers. comm.].

To be useful for monitoirng, road data needs to be usable with other point, line, or polygon data about land-use allocations, roadless areas, streams, culverts, fish habitat, and many other resources and activities across several agencies. No centralized interagency data shop exists to tackle this work, and each agency lacks the jurisdiction to accomplish the work alone.

Metadata about search for data

How data were requested	The data were requested by an informal request to the data managers for the agencies. The FS R6 provided FS infra data collected in 2002; BLM in Oregon and Washington provided their road transportation network. A formal data request provided the best available data for FS R5.
Data contacts-program leads	Tom Erkert, FS R6 engineering; Dave Haney, BLM data manager; Ralph Warbington, R5 Remote Sensing Lab; IRICC, for interagency aspects
Data standards	Varied by agency
Where data were found	0
Data quality	The best available data were incomplete. Needed to sample on a watershed basis to answer questions about increase or decrease in road mileage or density, stream crossings, and so on.

Recommendations

The primary recommendation is to create an interagency geospatial road-data clearinghouse with clear authority and sufficient resources to assemble and present a very large, standardized, and highly detailed, comprehensive, seamless, interagency data set. No such clearinghouse exists now and since the demise of the Regional Ecosystem Office's GIS shop, nobody is assembling new road data into a regional interagency data product. Creating detailed and accurate road data are a high priority for the monitoring program.

An interagency data steward could handle producting, compiling, maintaining, editing, and archiving of these data in a "clearinghouse" style because no single agency has authority or resources to produce and maintain this huge data layer alone. To be useful, road data need to relate well with stream, culvert, fish barrier, fish passage, land use allocation, and boundary data sets for all agencies. In whatever form it takes, the interagency GIS function has to be staffed with enough people and resources to produce, maintain, and archive quality interagency spatial data.

National data-quality standards for spatial and attribute road data have been largely defined but need expansion for regional ecosystem management needs. Standardized interagency data-collection protocols, data maintenance, and archiving are also needed between all agencies, including states.

Also, to determine what roads are no longer functioning as roads, we need to know which roads have been decommissioned during the Plan. Decommissioning includes any road taken off the system, as long as it was treated for long-term erosion control. Roads that were already impassible, but treated to remove them, need not be included. Examples of decommissioning efforts include re-contouring, pulling culverts, and re-vegetation to stabilize the road and prevent the flowing of water down the roadbed. If unclassified roads were mapped, they should be included [P. Aldred].

Ideally, we will have a consistent roads layer for the whole Plan area, across all ownerships, by the next series of monitoring reports in five years.

List of attributes needed for a comprehensive road layer [S. Lanigan, pers. comm.]:
· Identify roads decommissioned since the Plan was implemented;
· Identify roads built since the Plan was implemented;
· Identify surface type (not considered critical);
· Report maintenance efforts;
· Describe any point coverages that identify failures, washouts, emergency relief for federally owned roads (ERFO) program sites and similar points, if available;
· Locate bridges and major culvert locations; and,
· Standardize attributes as: scale = 1:24,000; resolution = 20 meters; and accuracy = 20 meters

Issue ID ***6***

Data topic **Activities**

Data description:

Activities data -- a very broad category of disturbance data -- that include ground-disturbing activities like timber sales, road and trail building and decommissioning, recreation facility construction and removal, stream channel restoration, prescribed fire, culvert repairs and water bars; dam and other fish-barrier construction or removal, mining and mineral extraction, stream restoration activities, and so on. Nonground-disturbing activities like inventory and monitoring surveys, watershed analyses, viewshed monitoring, and late-succesional reserve assessments also occur on the landscape. In other words, data about ground disturbing activities can be point, line, polygon, attribute, tabular, image, or raster for any of several different kinds of projects. Tabular data often exist, but they may have no spatial component, which is necessary for monitoring. A complete desciption of activities data may require more than one data set because of the various kinds of data necessary to describe all activities.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☑	☑	☑	☑	☑	☑	☑	☑

Nature of effects	To text	To maps
Implementation (activities/compliance)	High	High
Late-successional and old growth (LSOG)	High	High
Marbled murrelet (MaMu)	High	High
Northern spotted owl (NSO)	High	High
Socioeconomic	High	None
Tribal	Very high	Very high
Watersheds	High	None

Comments:

Adaptive management depends on knowing what was done in the past so the methods used in the present can be adjusted to new knowledge.
The late-successional and old-growth module needs to track ground-disturbing activities that alter the amount and distribution of these older forests.
The synthesis team wants to know how thinning activities in late-succesional reserves relate to rates of regrowth to old- growth characteristics. The recommendation [Spies 2004] to use variable-density thinnings in reserves to improve old-growth characteristics over time has implications for the method of measuring these disturbances. Stand thinning probably needs to be remotely sensed because stand exams cannot describe stand-scale effects.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	Available after significant eff	**FS R6**	Available after significant effort
BLM OR,WA	Available after significant eff	**Other**	

FS R5	Available after significant eff	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
FS R5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
FS R6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Spatial data availability (by agency)

BLM CA	Not available	**FS R6**	Not available
BLM OR,WA	Not available	**Other**	
FS R5	Not available	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
FS R5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
FS R6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Issue classification:

Access	Priority issue
Production	Priority issue
Maintenance	Contributing issue
Data quality	Contributing issue
Metadata	Contributing issue

Issue comments:

Assembling data to answer monitoring questions about the full array of activities across the Plan area has been extremely challenging. Activity data are not standardized among the agencies or in their administrative units, nor is a single kind of activity shared. Some activities, like road building, are linear; some activities, like timber sales, cover areas; and some data, such as well drilling, are best described by point data. Problems with attributes and sources are alos found in existing data, making regional compilation difficult. But the greatest problem is the lack of a comprehensive centralized (and standardized) interagency spatial database describing all activities for the whole Plan area without regard to boundaries.

The monitoring program cannot verify the accuracy of activity locations or estimated effects without spatial data describing those activities. Implementation not only includes meeting the standards and guides but also meeting expected Plan actions. Some members of the public focus on timber and socioeconomic effects like jobs, payments in lieu of taxes, and so on. Other activities were expected too, such as restoration, recreation, mining, grazing, and transportation facilities [Baker, pers. comm.].

Several kinds of activities require spatial data sets. Each of these has unique requirements, but some commonality exists. Examples fall into two major categories and include:

Ground disturbing activities requiring NEPA:
· Timber sales;
· Road and culvert building, decommissioning, and treatments;
· Fire suppression and prescribed fires, including fire camps, helispots, fuels reduction, and so on;
· Building of recreation facilities;
· Grazing;
· Aquatic conservation strategy restoration;
· Terrestrial restoration;
· Mining; and so on.

Survey, inventory, and monitoring activities not requiring NEPA;
· Watershed analyses;
· Late-succesional reserve assessments;
· Current vegetation survey and forest inventory and analysis plots;
· Recreational activities like hiking, off-highway vehicle use, and so on.

Each agency follows standard protocols from data collection to data reporting and use, but the protocols may vary by agency and may not include upward reporting of spatial data. Responsibility for quantitative data collection belongs to the field units, the FS Ranger Districts and BLM Resource Areas. They record standard units of measurement in various ways, including individual field unit records, unit accomplishment reports (BLM), management accomplishment reports (FS), and national or regional tabular databases. Agencies collected all output variables in this way, such as timber volume offered for sale, and activities accomplished, measured in miles or acres [Baker, pers. comm.].

Often, the data collected is tabular without an adequate spatial component, however. The spatial description of an activity may merely be a generalized point location down in scale to the Ranger District or Resource Area, but it is often not sufficient to determine which specific land use allocation (such as matrix or late-succesional reserve) or which management area an activity was in. Describing a specific location requires GIS-based line, polygon, or specific point data, such as GPS points.

No interagency standards exist for data describing the full range of activities accomplished in the Plan area. Existing data standards vary by unit and type of activity; data are often incomplete and may contain little to no information about location, extent, or affects of the activity to sensitive resources. Most units create GIS data describing ground-disturbing activities, but not in any standardized format and not consistently between agencies or units. And these data are not included in upward reporting requirements. Hence, monitoring cannot describe projects or their cumulative effects consistently across the Plan area.

Data aresues influence the completeness and use of activity data in several ways, including:
· The different data reporting standards, protocols, and definitions used by the various agencies;
· The differing periods for which data were available.
· Individual subjectivity in reporting data; and
· Forest and district boundaries split by the Plan boundary; such as not being able to distinguish if reported activities are in or out of the Plan area.

Furthermore, in many instances, data are either unavailable in the format necessary to answer the monitoring questions or does not exist [Baker, pers. comm.]. Changing activities data from a tabular to a standardized GIS centric approach could solve many of these problems.

Recent court rulings, such as the 9th Circuit Court of Appeals case of Lands Council vs. Powell (2004), suggested that the FS does not note past timber harvesting projects and the effects of those projects on the watershed in question in sufficient detail. Information suggested by the court included total acres cut per decade, types and scale of cutting, a catalog of past projects, and how those projects harmed the environment. Thus, activities data should provide information about time, type, place, and scale of activities explained in enough detail for a reader to understand how past projects affected the environment in a required cumulative-effects analysis.

A critical need was identified to increase interagency capacity to compile or produce GIS-based activity data in a way that meets Data Quality Act standards, adequately maintains the data, and archives annually. No single agency has authority or expertise to produce and maintain such a data layer alone.

Metadata about search for data

How data were requested	Tabular data often exist, but without ability to obtain spatial registration or to relate data to any tabular data about the activity such as procurement contracts.
Data contacts-program leads	Unclear
Data standards	No interagency standards exist, except for IRDA restoration data, that is listed separately in this issues database. Project leaders keep their own project data. At the end of a project, data are NOT collected by regional office or unit, although spatial data were usually created, these data are simply kept on project leaders' personal computers without significant upward reporting. When they clean up their pc's, they generally delete the data and the data are lost. The REO does not even collect spatial data for roads in key watersheds, just the tabular data.
Where data were found	Contacting individual units
Data quality	Data quality is generally poor. Standards are rare. Maintenance is rare. Many types of activities take place, including road building, timber sales, restoration, watershed analysis, and so on. But each project needs an indexing number as a key field to track projects through various agency processes. Meeting this

need is conceptually easy, although a lot of work would likely be needed.

Recommendations

The agencies could change the existing tabular database approach for activity data to a more GIS-centric model that ties the existing tabular databases to accurate geospatial data, much of which is already created with each project but not retained at the regional scale. A further recommendation (supported by several monitoring modules) would be to develop and maintain an interagency activities-accomplishment database for the whole array of activity types accomplished by all agencies, not just for aquatic restoration projects in the BLM and FS.

Upward reporting of all components of activities data could be required and the data archived annually. Annual archiving would be beneficial because changes in a watershed boundary might change which watershed a project was thought to be in, for example, and might produce misinformation if not temporally referenced. Also, the vast amount of project work accomplished each year would be overwhelming if archived less frequently.

An interagency project-numbering system (that is, an index) could be used as a key field to link the geospatial, tabular, and other data from a given project. Project (activity) indexing could establish a code for each type of project (logging, road treatment, grazing, watershed analysis, and so on), including the year of its NEPA process or its implementation, the land-use allocation, and a specific project identifier. Every document, table, or map associated with a particular project would contain a data field or entry identifying the project by this predetermined number. Other related data, including tabular data, photographs, satellite imagery, computer applications, funding data, or graphic products, could be linked to the project by that number, and therefore tracked in various enterprise systems.

Because no one agency has the authority or resources to manage data for all federal and nonfederal lands, all production, maintenance, and archiving work on interagency data could be accomplished by assigned an interagency data steward or stewardship team. Spatial data could also describe the estimated effects (if any) of a project to various resources including threatened and endangered species.

To support these recommendations, interagency spatial-data standards, data-collection protocols, and upward reporting requirements need to be fully established for the whole array of activity types. Effective and timely maintenance and orderly archiving of activity data are also needed.

These recommendations are high priority for monitoring because they would allow a detailed look, when coupled with change-detection data, at cumulative effects of projects across the Plan area and significantly improve implementation monitoring. Agency programs would also be more accountable for their accomplishments because contracting and budget information could be tied back to specific projects. This approach would help meet the goals described for the next Plan interpretive report [Baker, pers. comm.].

Issue ID ***7***

Data topic **Culvert, fish passage and barrier information (activities and resources)**

Data description:

Spatial and tabular data describing barriers and passage information for fish is related to culverts and other water crossings.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☑	☐	☐	☑	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	High	High
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	None	None
Tribal	High	High
Watersheds	Very high	Very high

Comments:

Currently, no easy way exists to share fish passage or barrier information between the FS and BLM (and with state agencies), which results in the following:
· Difficulty ranking the priority of solving culvert fish-passage problems;
· Inability of agencies to show how much fish habitat is being made assessable through culvert-restoration efforts or dam-relicensing agreements;
· Difficulty in responding to policy makers asking how the millions being spent on culvert inventories and improvements are directly benefiting fish; and
· Fish-habitat accessibility cannot be used as part of determining watershed condition (and getting credit for improving fish passage).
The FS data consists of a point layer of culverts based on a road map. The database was never designed to be entered at a regional scale, so the data are aggregated and the spatial registration is poor [S. Lanigan, pers. comm., 6/14/04].

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA

BLM OR,WA

FS R5

FS R6

Other

Description of Other:

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Contributing issue
Maintenance	Contributing issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

Currently, no easy way exists to share fish passage or barrier information between the FS and BLM (and with state agencies) because:

· The GIS databases have been registered to different stream layers at different scales, which means that whatever GIS stream data are used, some culverts will always fall on streams, and which stream the culvert belongs to may not be identifiable.

· No effort has been attempted to combine the culvert database. Finding the common elements between the GIS databases, and trying to crosswalk equivalent attributes between the agencies would be ideal.

· The extent of the culvert inventory varies between the agencies [S. Lanigan, pers. comm., 6/14/04].

Tribal monitoring cannot answer questions about treaty rights and other access issues without knowing about the presence of fish or other forest products.

Metadata about search for data

How data were requested

Data contacts-program leads S. Lanigan, Interagency Aquatic & Riparian Effectiveness Monitoring Program team lead.

Data standards	None exist, but they are needed.
Where data were found	Contacting individual units
Data quality	Poor data quality. Data quality and attributes are not standardized among agencies or units. Some units are keyed to point data describing culverts to roads, some to one of several stream layers at various scales, and the specific attributes in the databases vary by unit.

Recommendations

Developing and using interagency standards and common data-collection protocols that allow regional compilation of the data could improve culvert and fish passage information. To be useful, these data need to clearly and accurately relate to road, stream, land-use allocation, and other data. Maintaining and archiving of this data set should be annual because the changes to culvert and stream crossing data are frequent.

An interagency data steward or stewardship team could be assigned to create, maintain, and archive these data because they transcend the jurisdiction and expertise of any single agency. Consensus is needed among FS and BLM and any other interested agencies (for example, FS-R5, NOAA, USFWS, ODOT, OWEB, OWDF, WDFW, CFG) to use a common 1:24,000 stream and a common 1:24,000 road layer for identifying culvert locations and registering the existing data to common bases.

Issue ID *8*

Data topic **Restoration projects (activities)**

Data description:

Spatial data for ground-disturbing activities intended to meet aquatic conservation strategy objectives by the agencies, mostly in aquatic and riparian systems. Could be point, line, polygon, attribute, image, or raster data, but it does NOT currently include all activites, only those directly related to aquatic conservation strategy objectives.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☑	☐	☐	☑	☐	☑	☑	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	High	High
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	None	None
Tribal	Moderate	Low
Watersheds	High	High

Comments:

This data set is part of the activities data bundle. The NOAA is working on restoration activities data related to fish issues. The interagency restoration database (IRDA) was released in December 2003, after final dates for information to be available to the team. Some teams used these data, others did not. This data set is not comprehensive; it just includes activities that are related to aquatic conservation strategy resources.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☐
BLM-OR,WA	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☐

FS R5	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☐
FS R6	☐	☐	☐	☐	☐	☑	☑	☑	☑	☑	☐

Spatial data availability (by agency)

BLM CA Not available

BLM OR,WA Not available

FS R5 Not available

FS R6 Not available

Other

Description of Other:

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access Not an issue

Production Contributing issue

Maintenance Not an issue

Data quality Priority issue

Metadata Not an issue

Issue comments:

Monitoring cannot reliably identify restoration activities in key or other watersheds and cannot verify contribution of activities to improved conditions or aquatic conservation strategy objectives. The activities listed in IRDA represent only a portion of those actually accomplished. Unit participation in providing data to be included in the database was sporadic and spotty, largely because of a lack of time, money, and need. Restoration accomplishments might be available from individual units, but limited time and resources hindered collecting the information [Baker, pers. comm.].

The IRDA was established in 1998. Data from earlier years were not used because the reporting focus was different (for example, jobs instead of accomplishments) and, in 1997, data were not compiled. Informally, agency personnel report concern about the lack of data from spotty field participation in reporting accomplishments, and lack of consistency across administrative units on which units of measure to report. Some units reported acres treated, and others reported miles treated. Also, the following caveat accompanied all data provided from the IRDA database: “Data not available for some administrative units. Others may be incomplete. Most of the data provided is for Oregon and Washington” [Baker, pers. comm.].

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards	Standards need to be developed.
Where data were found	Contacting individual units
Data quality	These data must mesh with road, stream, land-use allocation, and other data sets.

Recommendations

Need interagency standardization and upward reporting for spatial and tabular data.

Need project tracking numbers similar to other activities layers. These data are a subset of the larger activities data issues.

Issue ID ***9***

Data topic **Recreation (activities and resources)**

Data description:

Recreation data can be point, line, polygon, attribute, tabular, image, raster, or other data describing the location, character, extent, and intensity of recreation activities across the Plan area.

Spatial data about recreation facilities and activities might include scenic highways and their viewsheds, recreation opportunity spectrum (ROS) classifications, campgrounds, picnic areas, ski areas, trails, viewpoints, and so on, and they can be point, line, polygon, image, photographic, or raster data.

Tabular and attribute data -- numbers of visitors per unit and facility, numbers of facilities by type (such as a visitor information center, ski area, campground, canoe trail, viewpoint, and so on) and often describes the character or intensity of use.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☑	☐	☑	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	High	Very high
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	High	None
Tribal	High	None
Watersheds	None	None

Comments:

Historical data are not available before 1999. Need both spatial and tabular data; some data maybe available in INFRA for FS lands. Recreational facilities include ski areas, campgrounds, picnic areas, trails, roads, canoe trails, viewpoints, dispersed recreation sites, and so on (that is, they include point, line, polygon, and raster data in the spatial component.) Some data are nonspatial. Tribal monitoring would use dispersed recreation data if it had been available to assess effects to hunting and gathering (such as nontimber forest products). Tribal needs dispersed recreation data, which was not available.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	Available after significant eff	**FS R6**	Available after significant effort
BLM OR,WA	Available after significant eff	**Other**	

FS R5	Available after significant eff	**Description of other:**	

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☑	☑	☑	☑	☐
FS R5	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐
FS R6	☐	☐	☐	☐	☐	☐	☐	☑	☑	☑	☐

Spatial data availability (by agency)

BLM CA	Not available	**FS R6**	Not available
BLM OR,WA	Not available	**Other**	
FS R5	Not available	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

Issue classification:

Access	Contributing issue
Production	Priority issue
Maintenance	Contributing issue
Data quality	Not an issue
Metadata	Contributing issue

Issue comments:

Spatial and tabular data for recreation activities and facilities is not consistently available for years before 1999. Certain recreation data are not available in any form. The interagency land-use allocation coverage contains some facility data, but only for facilities larger than 40 acres.

The FS began keeping recreation data in the national corporate administrative database called INFRA, named for infrastructure, in 1999. Obtaining recreation data for earlier years is difficult [S. Charnley, pers. comm.]. Information in the INFRA "year established" column may be used to indicate the date the record was established rather than the date the facility was established. The data in this column

does not indicate the correct date for establishing a facility because almost all of the sites were established before the year indicated. Thus INFRA data cannot be used to indicate any historical information and the recreation, engineering, lands and minerals (REALM) staff in the FS Regional Office were unable to respond when asked for further information [S. Charnley, pers. comm.].

The FS's data started in FY 2000. The agency began national visitor use monitoring (NVUM), a scientifically defensible protocol, in 2000 to obtain reliable measures of recreation visitation that could be used to support forest planning. Twenty-five percent of the national forests are monitored each year, with a plan to monitor visitor use on each individual forest on a four-year rotation cycle [S. Charnley, pers. comm.].

INFRA in FS went on line in 2000 but with R6 recreation data lost in migration. NVUM data for the national forests in the Northwest Forest Plan area were aggregated in response to a special request by our socioeconomic monitoring team and are reported in English (2003). See English et al. (2002) for full documentation of the methods used to obtain the NVUM data [S. Charnley, pers. comm.].

The BLM recreation data come from a corporate database called the recreation management information system (RMIS). This system went on-line on the BLM intranet in 1999, but previous data were not accessible. Up until September 1999, recreation data were retained as paper records only. The RMIS is accessed currently on the BLM intranet. That agency's recreation monitoring data began with 1999 because earler data were difficult to obtain and not reliably accurate [S. Charnley, pers. comm.].

Forest land use reports (FLUR) cannot be used to estimate facilities because they track facilities with permits or concessions and not those both owned and operated by the FS [S. Charnley, pers. comm.].

Data on the number of ski areas in the Plan area and on visitation came from hard-copy, hand-written records kept by individual ski resorts, which maintain them to report to ski associations [S. Charnley, pers. comm.].

Recreation facilities may conflict with tribal interests because of their proximity to special forest products, spiritual practices, or other treaty rights, but this conflict cannot be addressed without description of the recreation areas.

Metadata about search for data

How data were requested

Data contacts-program leads	Recreation, engineering, lands and minerals (REALM) staff in the FS Regional Office.
Data standards	
Where data were found	Corporate database
Data quality	BLM: recreation management information system) started in 1984; but the recreation data were kept only as paper records until 1999.

FS: INFRA started in 1999; RIM and RRIS started earlier, but data were lost in migration from Applix to INFRA.

Recommendations

Better upward-reporting processes are needed for geospatial data about recreation resources. These data should include all kinds of recreation facilities including ROS classification, sense of place, and viewshed mapping, if available. Knowing the location and extent of all existing recreation facilities is important for monitoring modules including tribal and implementation. Tracking of the building and demolition of facilities is also needed including the use of geospatial data to determine effects to watersheds.

An interagency project number is recommended as a key field to link spatial data with tabular information about a facility or its uses. Visitor-use rates at the various recreation facilities are important information to collect because they can be used to estimate effects of the activities to the ecosystem.

Recreation spatial data must relate well to special forest products, land-use allocations, roads, hydro, KWS, riparian reserves, and so on.

Issue ID ***10***

Data topic **Local unit implementation monitoring data (activities)**

Data description:

Self reporting on compliance with the plan comes from local units. These data record whether unit resource specialists thought a given project was implemented according to their instructions as planned. These data are inherently tabular, but they have links to spatial data in many instances.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☐	☑	☑	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	Low	Very high
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	None	None
Tribal	Moderate	Moderate
Watersheds	None	None

Comments:

Many units have these data but not in any standard format. Because these data are inherently subjective, they need independent verification.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Priority issue
Maintenance	Contributing issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

Local-unit implementation-monitoring data are tabular and about activities with a spatial component. Linkage between project implementing data and spatial data might be best facilitated by using a project indexing number as a key field.

Because these data are inherently subjective, they should be verified before conclusions can be drawn. Lack of standardization and consequent unavailability of data to regional analyses affects this issue.

Tribes may wish to have the opportunity to review projects they currently do not know about.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality	Any data that asks the units to rate themselves on compliance is highly subjective. Thus, these data would not be considered objective under the Data Quality Act, and should not be used

Recommendations

These data are useful as a self-evaluation tools for the units, or as a means of evaluating the compliance of their contractors. Although these data are valid to put together at the regional scale for cumulative effects analysis, they need to be independently verified because they cannot be considered completely objective.

All local unit implementation-monitoring data should be linked to the spatial data, for each project

monitored, by using a key field with an interagency project-numbering scheme.

Issue ID ***11***

Data topic **Procurement contracting data for ecosystem management work (activities)**

Data description:

Procurement contracting data describe the value and number of contracts and distances between contractor headquarters and the site where the work is accomplished, recorded by county.

The data for the regional analysis are drawn from the Federal Procurement Data Center's database, which includes information from all federal agencies compiled from the SF-279 form that each federal agency must fill out for contracts with an estimated value above $25,000. Our data set includes contracts from FS and BLM in western Oregon and Washington and northwestern California, awarded between fiscal years 1990 and 2002.

More specifically, the data set includes contracts for land management work in the Plan's affected counties, as defined in the jobs-in-the-woods program. The data set includes product service codes (the codes) related to land management, broadly defined, using the same criteria as Moseley and Shankle (2001) and Moseley and Toth (under review). That is, the data set includes contracts related to forestry and watershed management, such as thinning, brushing, piling, noxious-weed control, biological surveying, riparian restoration, and road building and maintenance. Contracts involving fire suppression are reported separately because they are procured differently than other forestry services. Prescribed burning, however, is reported in the same product service code as fire suppression, and therefore cannot be distinguished from the regional portion of the study.

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☐	☐	☐	☐	☑	☑	☑	☐

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	Low	Low
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	High	High
Tribal	Very high	Very high
Watersheds	None	None

Comments:

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA **FS R6**

BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Priority issue
Production	Not an issue
Maintenance	Not an issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

The federal procurement data center's database includes information from all federal agencies composed from SF-279 for contracts of more than $25,000 in value. Fire suppression is reported separately from other types of work; prescribed burning is reported in the same product service code as fire suppression and cannot be distinguished from suppression. Contract registers are not available for all years for all units. Because the work is recorded by county, poor correlation exists with national forest or BLM boundaries. Even though the BLM and the FS follow the same procurement laws, past studies have suggested that their procurement practices are quite different, so the two agencies needed to be analyzed separately (Moseley and others 2002).

Unfortunately, contract registers were not available for all of the years of the study period. For the Olympic, Klamath, and Mt. Hood national forests, we were able to obtain contract registers for 1990 through 2002. But for the Coos Bay BLM District, we were only able to obtain contract registers for 2000 through 2002 [S. Charnley, pers. comm.].

The federal procurement data center records the location of work at the county scale. Consequently, we report most information about procurement at the county scale rather than at the forest or BLM district scale. Use of Plan provinces was impossible because they were not well correlated with the county or national forest boundaries, which was how the place of performance was recorded [S. Charnley, pers. comm.].

To understand to what extent local contractors were awarded contracts, we calculated the distance between the contractors' headquarters and the national forests where the work was done by using an approach similar to Moseley and Shankle (2003). After deriving the national forest, we calculated the distance by averaging the distance in air miles between the weighted center of the zip code, as provided by Environmental Systems Research Institute (ESRI), where the contractor has its headquarters, and 25 random points in the national forest. Because the BLM contracting is more centralized, we could not derive the BLM district from the information available [S. Charnley, pers. comm.].

Tribes may want to review these projects to understand effects to treaty resources.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality

Linking this relational data describing the contractors who were accepted to do work with the units providing the work was difficult. This linkage is not really a data-quality issue as much as an indexing issue, perhaps to do with archiving. Spatially enabling activities-contracts data could solve the problem.

Recommendations

Linking procurement contract data to spatial and relational data sets for activities would best solve this problem. It could be done using a project-numbering scheme, which would serve as a key field between the various data sets. Following such a scheme could give spatial description of location and extent of projects, enabling description of locations by unit and by distance from contractor's headquarters as required for analysis. Exact location of the projects would be known, hence results could be reported by unit, by county, by state, land-ue allocation, or any other spatial attribute available, as needed.

Issue ID *12*

Data topic **Collaborative forest stewardship data (activities)**

Data description:

Collaborative forest stewardship data describe trends in volunteerism and partnerships. Data surveyed was from INFRA; wildlife fish and rare plants (WFRP); senior, youth, volunteer (SYV); economic action programs (EAP); and national fire-plan operations and reporting system (NFPORS).

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☑	☑	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	Very high	None
Tribal	Very high	None
Watersheds	Low	None

Comments:

The collaborative forest stewardship data sets have not been fully populated with available historical data, typically containing only very recent data not linked together, and they may contain redundant and contradictory information. Monitoring partnership agreements are removed from the database once they are terminated. Thus, agency databases contain information only on active partnership agreements.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Contributing issue
Production	Not an issue
Maintenance	Priority issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

Analysis of trends in volunteerism and partnerships are based on agency data relating to volunteers and other work programs, as well as partnership agreements such as memoranda of understanding, cooperative agreements, and joint venture agreements. Databases surveyed include INFRA; wildlife, fish and rare plants; senior, youth, volunteer; economic action programs; and national fire plan operations and reporting system. These databases have not been fully populated with historical data, and typically contain only very recent data. They are also not linked together and contain redundant and contradictory information. [S. Charnley, pers. comm.]

One of the problems associated with monitoring partnership agreements is that they are removed from the database once the work is terminated. Thus, agency databases only contain information on active partnership agreements. Obtaining data regarding past agreements is difficult, if not impossible. Hard copies of these agreements may be stored in FS warehouses, but trying to retrieve them from warehouses for this monitoring report was impractical.

Additional data on trends in collaborative forest stewardship were gathered during case-study interviews with forest employees and community representatives and stakeholders [S. Charnley, pers. comm.]

Tribes may have interest in these projects because of the potential effects on the resources.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality This part of the activities data suite should gain spatial resolution.

Recommendations

This example of a spatial activity data set was not recognized as such. If each of the projects or agreements described had geospatial registration and a project number, linkages could be made to extract data from them.

Regular maintenance and archiving are essential.

Project data either needs to be kept in the existing database once contracts are closed, or moved to a separate data set and kept.

Issue ID ***13***

Data topic **Grazing (activities)**

Data description:

Data requested was the number of allotments, number of permittees, areas of allotments, and number of animal-unit months for each FS and BLM unit in Plan area from 1990-2002. This could only be estimated; spatial data were not available, and tabular data were generally of limited quality.

FS grazing data are stored in the INFRA database. We requested data on the number of allotments, number of grazing permittees, area of grazing allotments, and number of animal unit months for each FS and BLM unit in the Plan area for 1990-2002. Obtaining these data was difficult; the historical data, in particular, were of poor quality. Two years -- 1993 and 2002 -- were used to compare range us before and after the Plan' record of decision. Actual activities based on agency records were used, aggregating unit estimates up to the Plan area [S. Charnley, pers. comm.].

Data sources included agency grazing records, agency annual Plan accomplishment reports, and personal interviews with agency specialists.

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☐	☐	☐	☑	☑	☐	☑	☐

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	Very high	Very high
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	High	None
Tribal	None	None
Watersheds	None	None

Comments:

Grazing data were not available for anlaysis.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	Available with modest effort	**FS R6**	Available with modest effort
BLM OR,WA	Available with modest effort	**Other**	
FS R5	Available with modest effort	**Description of other:**	

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
FS R5	☐	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐
R-6, R-5	☐	☑	☐	☐	☐	☐	☐	☐	☐	☑	☐

Spatial data availability (by agency)

BLM CA	Not available	**FS R6**	Not available
BLM OR,WA	Not available	**Other**	
FS R5	Not available	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Contributing issue
Maintenance	Priority issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

Interagency standardization and a designated data steward or data stewardship team for these data are recommended.

Compilation of existing data from the land management agencies describing grazing allotments, permits, or activities at regional scale was problematic. The FS grazing data are stored in INFRA. Records for many years were estimated from earlier years, not measured; hence they were considered unreliable.
Two years -- 1993 and 2002 -- were used to compare range use before and after the ROD. Lack of data reliability led the experts to look at the data for the years just before the Plan and around 2002 to see if any of those data appeared to be actual measurements. From this comparison, a set of data was calculated. The calculations are labeled 1993 and 2002 because those are the mid-point years. In reality, the data for any one administrative area came from one of the three years (1992-1994) before, and one of the three years (2001 and 2003), after the ROD. Actual activity rates based on agency records were used, aggregating unit estimates up to the Plan area [S. Charnley, pers. comm.].

The BLM does not report acres of active allotments or number of permittees, so those data were not available. The FS totals are known and reported from tabular data, but geospatial data were only

partially available [Baker, pers. comm.].

California BLM reported numbers of allotments, but not leases; Oregon BLM reported leases, but not allotments. Neither reported the number of permittees, so an assumption was made, just for display purposes, that the number of allotments or leases equaled the number of permittees for BLM.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality	Virtually no spatial data were found. Much of the data were estimated from the year before; hence, experts judged the data to be of poor quality.

Recommendations

Data for grazing activities should be treated like data about any other activity. A project number would be helpful as a key field to both organize grazing information and track cumulative effects and other information related to the activity or its location. Grazing is an activity in a particular place and time, with a permit that can serve as part of that key for data identification.

Interagency standardization and upward reporting of both geospatial and tabular data are needed about grazing by year, allotment, unit, and animal unit months. The intensity (for example, number of animals per acre), location, and extent of the activity are important. A team of grazing experts should be convened to define what data are needed for monitoring and to develop interagency standards and data collection protocols for those data.

No single agency has responsibility for all grazing activities or the data describing them; an interagency data steward or data stewardship team could be assigned to collect and process this information to assure that interagency data standards and data collection protocols are created and followed uniformly.

Issue ID ***14***

Data topic **Special forest products (activities and resources)**

Data description:

Special forest products are divided into convertible and nonconvertible products; convertible products are those that may be converted into units relating to dimensional lumber, such as board feet or cords; and include poles, Christmas trees, & fuel wood. All other products are considered nonconvertible.

Collecting special forest products is an activity, and the products themselves can be considered resources. Agencies collect information about permits and contracts issued and the amount of product sold by administrative unit per year, but not collection areas or effects to the resources, which need to be described. Monitoring cannot track or locate collection areas for special forest products at the regional scale; thus they cannot identify cumulative effects or values, nor estimate effects to abundance or distribution of targeted species. [S. Charnley, pers. comm.]

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☑	☑	☑	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	High	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	High	None
Tribal	High	Very high
Watersheds	None	None

Comments:

Data collected varied by year and agency; thus, the data were hard to standardize. No interagency standards or data collection protocols exist.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	Available with modest effort	**FS R6**	Available with modest effort
BLM OR,WA	Available with modest effort	**Other**	
FS R5	Available with modest effort	**Description of other:**	

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

BLM-CA	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☐
BLM-OR,WA	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☐
FS R5	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☐
FS R6	☐	☐	☐	☑	☑	☑	☑	☑	☑	☑	☐

Spatial data availability (by agency)

BLM CA Not available

BLM OR,WA Not available

FS R5 Not available

FS R6 Not available

Other

Description of Other:

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access Not an issue

Production Contributing issue

Maintenance Not an issue

Data quality Priority issue

Metadata Not an issue

Issue comments:

No interagency data collection protocols or standards exist for the spatial data describing special forest products, although each agency has its own national standards for tabular data collection. Numbers of special forest product permits sold cannot be used to identify the number of units sold or collected.

The FS data for monitoring special forest products during the life of the Plan come from the automated timber sale accounting system (ATSA). For Plan monitoring, records generated electronically through several searches from the FS database in Ft. Collins, CO, and hard copy records from the Region 6 office in Portland, OR, were examined [S. Charnley, pers. comm.].

The BLM timber sale information systemTSIS has tracked consistent categories across time, but the categories differ from the FS system. Comparison od data before and after 1996 is problematic because the categories are not the same. The FS and BLM document the number of permits and contracts issued for several different categories of nontimber forest products, the dollar value of the permits and contracts issued for these products, and the amount of product sold annually by administrative unit. [S. Charnley, pers. comm.]

Free use or casual use by Tribal members cannot be captured in the current system without a spatial element to these data.

Tribes may have significant interest in maintaining certain nontraditional forest products and may wish to be informed about managing these products. Conflicts or effects to tribal uses cannot be identified or quantified without knowing the sites and quantities of the resources. Data tracking of free-use or casual-use by non-Indians and tribal members, including that done to obtain "treaty resources," is non-existent in BLM and inconsistent in the FS.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality

The quality of extant data are pretty good compared to other data needs, although interagency standardization would be helpful. Modeling of habitats for special forest product species would be helpful for estimating effects on populations and to identify localities and products of concern to the tribes.

Recommendations

Special forest product data were another interagency data issue because no one agency controls all special forest product data. Standardization and integration of BLM and FS data standards, data collection protocols, and upward reporting and tracking systems based on existing TSIS (BLM) and TSA (FS) systems is very important if monitoring is expected to describe these resources uniformly across the Plan area. A geospatial component for the data needs to be added. Because no single agency has jurisdiction over all special forest products and associated data, these data need to be handled by an interagency data steward or data stewardship team. Maintaining data and annual archiving are also important.

Special forest products data would benefit from creating of a project-numbering scheme similar to other activities by which known collection areas can be identified and tracked. Resource specialists could then describe the expected extent of resources-based modeling of local collection data. Special forest product data can be used for training sites to expand knowledge of these resources.

Standardization of data collected between the FS and BLM for tracking noncommercial uses by product and location of collection. Modeling of potential conflicts between federal land use and tribal interests and all non-Indian uses.

Issue ID ***15***

Data topic **Watershed boundaries changing (resource)**

Data description:

Watershed boundary data describes the extent and location of watersheds across the whole Plan area for the fifth- and sixth-field watersheds at 1:24,000.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☐	☐	☑	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	High	Very high
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	None	None
Tribal	None	None
Watersheds	None	None

Comments:

During monitoring, certain past activities can appear to be in different watersheds than the ones they were thought to be when the activities were planned or implemented, making assessing compliance more confusing and difficult than necessary.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
BLM-OR,WA	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R5	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐
FS R6	☐	☐	☐	☐	☐	☐	☐	☐	☐	☑	☐

Issue classification:

Access Not an issue

Production Not an issue

Maintenance Priority issue

Data quality Contributing issue

Metadata Not an issue

Issue comments:

Watershed boundaries can change without notice since they are the responsibility of Natural Resource Conservation Service (NRCS), not the FS or the BLM.

Recognizing that watershed boundaries are not resource boundaries is important; they are political boundaries that can change at any time. Not only are they political boundaries, but they are controlled by NRCS and can be changed by them without notice. Watershed boundaries used by Washington also differ from the federal hydrologic unit code (HUC) scheme, and Washington law requires their Department of Ecology to use their system and federal policy requires using the HUC layer created by the REO on the federal units. Cross-referencing between the systems was difficult because of frequent changes and lack of cross-referencing data.

This ever-changing watershed boundary issue is an interagency maintenance and archiving issue that requires annual indexing of both watershed and project data. The fundamental monitoring issue is knowing which watershed a project was thought to be in when it was planned and implemented and not the one it appeared to be in when it was monitored. Periodically maintainingenance and archiving of watershed boundary data are therefore critical needs.

Watershed boundaries valid during the year of project implementation should be used for monitoring activities, not the watershed boundaries described during the year the project was monitored. Units should not be held responsible for changes in boundaries they cannot know about or control - that is, if NRCS changes a boundary after a project is implemented, or without the knowledge of the BLM or FS, it can appear, during monitoring, that a project was implemented in a different watershed than it was thought to be in during planning. The ideal solution would be to accomplish spatial overlay between an activity and the appropriate watershed boundary, which might vary by year or landowner. This solution would require both accurate geospatial data for both watershed boundaries and

management activities.

Annual indexing and archiving of both the federal HUC6 and Washington's watershed boundary data layers are necessary to keep it useful. Each set of activity data needs to be indexed by its year of implementation to capture the appropriate watershed boundary. An interagency GIS shop should handle these data.

Metadata about search for data

How data were requested	From the units, which caused was a challenge for the implementation team to figure out.
Data contacts-program leads	Implementation team
Data standards	The standard was determined by IRICC, the appropriate body to determine it.
Where data were found	
Data quality	The issue was not one of data quality, although it did appear to be. Some state agencies used different watershed boundary schemes than did the federal agencies, so some projects do not correlate to the HUC numbers used when the project was monitored. Crossover tables are being created by state agencies, and these agencies may be going to a HUC scheme used by the federal agencies (need to verify this). The data-quality issue at play here is the timing and manner of release of updated information by the NRCS. Timing and manner of release are not something the FS or BLM have much control over, so the agencies should plan around this issue by relating project implementation to the HUC boundaries extant when the project was implemented.

Recommendations

The primary recommendation is to develop periodic (probably annual) maintenance and archiving requirements for both watershed boundary and activities data sets. Activities must be geospatially correlated to watersheds by year of accomplishment, not by year of monitoring. Both of these data sets also need an appointed interagency data steward or data stewardship team assigned to oversee maintaining and archiving the data.

A project-numbering scheme for every project that includes (or references) dates of implementation along with a spatial (GIS) component for each project might help correlate projects with HUC or other watershed boundaries. All watershed boundaries need to be put on an annual maintenance and archiving cycle so that project data can be related to the valid watershed boundary scheme for which the project was implemented. Activities need to be registered accurately to the year accomplished, to provide a realistic picture of trend. This registration will relate to the activities database issues.

Issue ID ***16***

Data topic **Watershed analysis (activities)**

Data description:

Watershed analysis data can contain text, maps, resource descriptions, locations, watershed numbers, and other data associated with watershed analyses. Riparian reserve data are generated from watershed analyses, as are descriptions of most of the natural and cultural resources in a watershed.

Data sources include: annual provincial implementation monitoring reports (12 each year) 1996-2003, annual regional implementation monitoring reports 1996-2003, and the regional implementation monitoring database [Baker, pers. comm.].

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☐	☐	☐	☑	☐	☐	☑	☐

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	Very high	Very high
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	None	None
Tribal	None	None
Watersheds	Low	Low

Comments:

No corporate watershed analysis database was developed by either agency; that is, resource specialists or project leaders have developed and maintained data sets to fit their individual needs, and no upward reporting requirement was developed across agencies. Also, our intention was to portray a region-wide map of watersheds with completed analyses, but it cannot be produced now because many watershed names, boundaries, and identification numbers have changed over the years, and those changes have not been tracked consistently [Baker, pers. comm.].

Watershed-analysis data need to be archived annually. This issue is also affected by the land-use allocation maintenance and archiving issues because watershed analyses can be in key watersheds and because "as-built" riparian reserve data come from the watershed analyses.

Riparian reserve boundaries cannot be described by using currently available watershed analysis data at the regional scale, so we were unable to answer several monitoring questions.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA Available with modest effort **FS R6** Available after significant effort

BLM OR,WA	Available with modest effort	**Other**	
FS R5	Available with modest effort	**Description of other:**	

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	Not available	**FS R6**	Not available
BLM OR,WA	Not available	**Other**	
FS R5	Not available	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Contributing issue
Maintenance	Priority issue
Data quality	Not an issue
Metadata	Contributing issue

Issue comments:

This issue only applied to a small subset of the activities data, but it had a significant effect on time and thus, also, on completeness of implementation data. This issue is clearly about archiving. A tracking system is needed that includes spatial data and project numbers, so these documents can be recovered and related to the HUC6 layer. Many watershed assessments were done, but the records were not kept over several years and data were lost or discarded after contracts closed and are not available for monitoring.

We cannot identify or recover many legacy watershed analyses. A method is needed to identify projects by watershed and year. A project number could serve as a key field to tie the spatial to the relational HUC data sets.

Each year a tabular list of projects and activities is compiled at the regional scale. Initially, regional databases such as the FS sales tracking and report system or the BLM timber sales information system were used to identify projects. This information was then checked and updated by the regional

implementation monitoring team or the provincial implementation monitoring teams. The data sources proved to be problematic, however, and -- beginning in 1999 -- data calls to the local land management units were initiated for projects or watershed assessments to be monitored [Baker, pers. comm.].

Much of the watershed analysis data that were created at the unit scale were lost because of the lack of archiving at the unit and subunit levels coupled with a lack of interagency standardization at the regional scale.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards	The standard would be a standardized upward-reporting process, perhaps with a project number that serves as a key field to relate spatial, tabular, and written forms of these data.
Where data were found	Contacting individual units
Data quality	The data-quality issue here is the ability to combine these data into a regional, spatial dataset showing which watersheds had been assessed and which had not.

Recommendations

Develop a tracking system that includes upward reporting, annual maintenance, and archiving all geospatial and tabular data related to watershed analyses, including riparian reserve boundaries determined by the analysis.

A watershed-analysis-project tracking number could be based on the watershed HUC number and whether the area was a key watershed, and also the year of the HUC layer. Activities data could then be laid over watershed boundary and other data in GIS to monitor implementation, another component of compliance monitoring.

A method of assessing accuracy for spatial data at the local scale is also needed, to increase the validity of watershed analyses data that will be combined to the regional scale.

Data topic

Data description:

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☐	☐	☐	☐	☐	☐	☐	☐

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	Very high	Very high

Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	None	None
Tribal	None	None
Watersheds	Low	Low

Comments:

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA **FS R6**

BLM OR,WA **Other**

FS R5 **Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA **FS R6**

BLM OR,WA **Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access

Production

Maintenance

Data quality

Metadata

Issue comments:

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality

Recommendations

Issue ID ***17***

Data topic **Vegetation change detection data**

Data description:

The Oregon and Washington change-detection data are a raster-based estimate of the location and extent of stand-replacing events like timber sales and wildfire, in the Plan area, using 1996-ish LANDSAT TM data. Stand-replacing events are shown in 5-year increments from 1972 though 2002. The CALVEG change-detection layer for northern California was also created to vegetation strike team standards, but using different methods. Thus, it was somewhat different than the OR and WA portion of the Plan area.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☑	☑	☑	☐	☐	☐	☑	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	High	High
Late-successional and old growth (LSOG)	High	High
Marbled murrelet (MaMu)	Moderate	Moderate
Northern spotted owl (NSO)	High	High
Socioeconomic	None	None
Tribal	None	None
Watersheds	Low	Low

Comments:

A raster-based vegetation-change-detection layer was created from satellite data to estimate the cumulative effects of stand-replacing vegetation management and disturbance events across the Plan area since 1994.

Change detection was accomplished in two parts by two separate units: the monitoring program contracted with the Pacific Northwest Research Station to create the Oregon and Washington change-detection layer and used the California land-cover mapping and monitoring program (LCMMP) estimate for northern California.

The Oregon and Washington change-detection layer needed recalibration to become more sensitive to stand-replacing fire events once the Biscuit fire data became available. The need for recalibration was not determined until late in the process, hence some analyses were delayed.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA **FS R6**

BLM OR,WA **Other**

FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	Available after significant effort	**FS R6**	Available after significant effort
BLM OR,WA	Available after significant effort	**Other**	
FS R5	Available after significant effort	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Not an issue
Maintenance	Not an issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

Recalibration of change detection to become more sensitive to stand-replacing fire disturbances is a data-quality issue related to several monitoring analyses including the older-forest and habitat analyses. Initial iterations of change-detection data were not sensitive enough to show the location and extent of all stand-replacing wildfire events, but the nature of this deficiency was not recognized until late in the process. The Biscuit fire EIS produced a field-verified coverage showing the extent of stand replacing events that differed markedly from monitoring program estimates. Subsequently, the older forest (LSOG) and habitat teams determined that the change-detection layer was not calibrated correctly and undertook efforts to correct it.

Increasing the sensitivity of change detection to subtle changes in canopy structure could allow monitoring of partial harvests, low-intensity wildfires, prescribed underburns, insect infestations, and invasive pathogens. Current remote-sensing technology cnnot describe these subtle changes, so not all activities or disturbances can be described.

Metadata about search for data

How data were requested	Informal
Data contacts-program leads	Sean Healey, Forestry Sciences Laboratory, Oregon State University
Data standards	Data standards evolved as knowledge was gained.
Where data were found	Files of data contact
Data quality	The data-quality issue was calibration of the models used to generate the change data.

Recommendations

Uniform change-detection data across the entire Plan area is necessary for consistently describing changes in vegetation, and therefore the changes in spotted owl and marbled murrelet habitat. Two approaches for detecting changes in forest vegetation were attempted for the 2004 reports, with one approach outperforming the other in terms of utility for habitat modeling. Using two disparate approaches, both of which were designed to meet the same business needs, resulted in poor compatibility between the two data sets. These and other alternative proposals for creating a unified data set should be studied and evaluated to pick one common approach for the whole Plan area in the next monitoring cycle.

Another recommendation is to improve activity, insect and disease, fire, and other disturbance databases so they can be used to calibrate change detection. Activity or disturbance event data could be used as training data for change detection because the general nature of the activity or event and its extent would largely be known, or could be easily determined. Many units already map these data sets, so collecting this information may be relatively easy. Standardizing these data sets would contribute to their utility.

Descriptions of activities should be standardized between agencies across the Plan area so that, for example, a shelterwood cut on the California coast would be generally similar to a shelterwood cut in the eastern Cascades of Washington, when viewed by the satellite sensors. Currently, they are not similar.

The change-detection calibration issue could provide monitoring with a much more complete picture of the cumulative effects of activities and events across the Plan area.

Issue ID ***18***

Data topic **Vegetation modeling (IVMP & CALVEG)**

Data description:

Late-successional and old-growth mapping is derived data describing vegetation conditions based on remotely sensed data, such as tree size (QMD), canopy structure, and species composition (life form), combined to create 22 older forest classes. Two data sets were used, the IVMP mapping in Oregon and Washington, and the CALVEG modeling in northern California.

The IVMP data were derived from about 1996 LANDSAT TM data.

The development of the CALVEG vegetation data set in the Pacific Southwest Region (R5) was influenced by an existing cooperative mapping effort between the FS and numerous partners (USDI Fish and Wildlife Service, BLM, National Park Service, California Department of Fish and Game, California Department of Forestry and Fire Protection, California State Parks, and Humboldt State University).

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☑	☑	☑	☐	☐	☑	☐	☐

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	High	High
Marbled murrelet (MaMu)	High	High
Northern spotted owl (NSO)	High	High
Socioeconomic	None	None
Tribal	Moderate	Moderate
Watersheds	Low	Low

Comments:

The IVMP and CALVEG vegetation models were not directly comparable, although both data sets met the original vegetation strike team standards. The differences between these data sets hindered efforts to map spotted owl and marbled murrelet habitats in a consistent and repeatable manner between the Washington-Oregon and California portions of the Plan area [Lint, pers. comm., Huff, pers. comm.]. Note, however, that the business need for both IVMP and CALVEG to be compatible with the BIOMAPPER model used for habitat modeling was not known when the data were created.

In general, the finer spatial resolution of the IVMP data and its division into specific floristic attributes with continuous values (1-inch-dbh increments) made it more suited for habitat modeling. The coarser nature of the CALVEG polygons made modeling of habitat more difficult even though more vegetation classes were apparent. Resampling required converting polygon based CALVEG data into the raster-based Biomapper application used for habitat estimation, which skewed acreage comparisons between the two data sets [Lint, pers. comm.]. Future estimates of older forests from mapped data should be derived from data that have been created by using a consistent approach range-

wide.

To some extent, this same situation also happened in Oregon and Washington because of a lack of continuous values (in 1-inch-dbh increments) in the data sets for tree size in the IVMP data sets for the Eastern Cascade Provinces [J. Lint, pers. comm.].

Tribal analysis could use vegetation classes not made available via IVMP vegetation modeling, such as the presence of willows or bear grass. Some of these classes of vegetation were modeled under CALVEG, but differences in spatial resolution and lack of comparable attributes in IVMP made the data unavailable for regional monitoring.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	Available after significant eff	**FS R6**	Available with modest effort
BLM OR,WA	Available with modest effort	**Other**	Available with modest effort
FS R5	Available after significant eff	**Description of other:**	CVS data in OR/WA, FIA data in CA

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	Available after significant effort	**FS R6**	Available with modest effort
BLM OR,WA	Available with modest effort	**Other**	
FS R5	Available after significant effort	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐
BLM-OR,WA	☐	☐	☐	☑	☐	☐	☐	☐	☐	☑	☐
FS R5	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐
FS R6	☐	☐	☐	☑	☐	☐	☐	☐	☐	☐	☐

Issue classification:

Access	Not an issue
Production	Contributing issue

Maintenance	Not an issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

The vegetation strike team initiated interagency discussions about vegetation data needs, standards, and implementation strategies shortly after the Plan was implemented (Report of the vegetation strike team, June 1st, 1995). That team recommended creating a spatially uniform data set for monitoring all areas of the Plan. These data were computed separately in Oregon-Washington and California portions of the plan area, however, because of differing agency responsibilities and authorities. The IVMP data were used to describe vegetation in Oregon and Washington and the CALVEG model was used in California. Spatial grain size and variability in attributes differs between IVMP and CALVEG.

Tree size (QMD) and other data classes was not consistently mapped between CALVEG and IVMP, although both meet vegetation strike team standards. The CALVEG polygon data were not designed for the raster-based Biomapper modeling used in the northern spotted owl and marbled murrelet habitat mapping.

Because IVMP was unable to obtain structured information for the Western Lowlands and Willamette Valley provinces, a modified method of assigning suitability scores was applied in these two provinces, resulting in only three suitability classes. The moderate suitability class (3) was not used in these two provinces. Although not identical to IVMP, the information necessary for habitat modeling was extracted from CALVEG to derive similar older forest polygons for the Coast Range and Klamath provinces in California [Huff, pers. comm.].

These two different vegetation data sources [IVMP and CALVEG] required slightly different habitat map modeling strategies. To the extent possible, vegetation map attributes for modeling were made consistent between the two data sources. The final provincial map products from California, however, are not directly comparable to the provincial maps from Oregon and Washington. In general, the finer resolution of the IVMP data and its division into specific floristic attributes made it more suited for habitat modeling.

Metadata about search for data

How data were requested	Raster-based IVMP data were created by a contractor for the monitoring program. The CALVEG data came from R5's remote sensing lab in polygon format, which was converted into raster format for this assessment.
Data contacts-program leads	Melinda Moeur, Late-successional and old-growth module lead; R5-Ralph Warbington, remote sensing lab; K.C. Kroll at IVMP, for FS-R6 and BLM OR,WA
Data standards	Both of these data sets apparently met vegetation strike team standards, but one was raster-based and the other was polygon-based, making them incompatible with each other from several

	persectives.
Where data were found	Files of data contact
Data quality	The IVMP data were accepted by the monitoring program leads, but CALVEG was questioned extensively because it was created in a different way for different reasons at a different time and apparently did not match with habitat acreages from alterntative sources [Lint, pers. comm.].

Recommendations

To avoid the data compatibility issues faced in the 2004 reports, a critical need exists for a single comprehensive and accurate data set describing vegetation data for the whole Plan area, as envisioned in the vegetation strike team's recommendations. The IVMP and CALVEG approaches for habitat estimation both need to be evaluated for their suitability in habitat modeling for monitoring, and a consistent approach chosen for the whole area. It may be necessary to create a new approach to vegetation modeling based on the best of both approaches for the next monitoring reports.

Greater sensitivity to species would be helpful to several modules. For example, identification of willow stands could benefit the tribal module, identification of bear grass could help tribal and special forest products issues, and identifying wet meadows could help watershed health and wildlife habitat studies.

Any vegetation modeling for monitoring needs to be accomplished by the monitoring program because no single agency has management authority over the whole Plan area, nor over the data describing the whole Plan area.

Issue ID ***19***

Data topic **Potential natural vegetation (PNV)**

Data description:

Mapping of potential vegetation communities across the Plan area was developed by Jan Henderson. It was based on moisture and topography.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☑	☑	☑	☐	☐	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	High	High
Marbled murrelet (MaMu)	High	High
Northern spotted owl (NSO)	High	High
Socioeconomic	None	None
Tribal	None	None
Watersheds	None	None

Comments:

The potential natural vegetation data are considered good data but they were not peer reviewed, so its quality cannot be demonstrated. The effects of lacking peer review are twofold: reduced scientific credibility, and greater risk for the vegetation, spotted owl, and marbled murrelet modules, should litigation arise related to our monitoring reports or the conclusions derived from them.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	Available with modest effort	**FS R6**	Available with modest effort

BLM OR,WA	Available with modest effort	**Other**	
FS R5	Available with modest effort	**Description of Other:**	

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Not an issue
Maintenance	Contributing issue
Data quality	Priority issue
Metadata	Contributing issue

Issue comments:

The issue with potential natural vegetation is the lack of peer review and publication of the methods for creating the data. Jan Henderson, who created the data set, is considered to be an expert in potential vegetation communities in the Plan area, and the data are considered very good. The lack of peer review, however, puts the scientific credibility of the data at risk and is causing a data-quality issue. It is, however, the best available data.

Because of this lack of formal credibility for these data, the older forest (LSOG), spotted owl, and marbled murrelet analyses carry an elevated risk of rejection during peer review and legal challenge of adaptive management steps taken as a result of these analyses.

Metadata about search for data

How data were requested	From ecology programs.
Data contacts-program leads	Tom Demao, R6 ecologist Jan Henderson, Mt. Baker-Snoqualmie National Forest
Data standards	None established.
Where data were found	Files of data contact
Data quality	Variable

Recommendations

Although the resolution of the potential natural vegetation issue may not be controllable by the monitoring program, it does highlight the need for accuracy assessment and peer review for key data sets such as about roads, streams, land-use allocations, and activities used in multiple analyses. Quality-assurance plans should be completed and followed for key data sets.

Issue ID ***20***

Data topic **Scenery: spatial data (resource)**

Data description:

Scenery data describe viewsheds, areas seen from commonly used travel routes like highways, trails, or airline routes, or significant recreation sites. Viewsheds can also include areas seen from certain native American spiritual sites, and thus some viewsheds may have standing under the Native American Religious Freedom Act in addition to the National Forest Management Act (NFMA). Scenery data can be related to activities such as site seeing along major highways (one of America's most popular recreation activities) or to the spiritual needs of tribal members meditating on mountaintops. These data are also intimately related to the "sense of place".

Data describing scenic viewsheds, airsheds, and spiritual viewsheds are not available at the regional scale. The FS uses two different systems: the visual management system and the scenery management system. The BLM uses a visual resource management system that is somewhat similar to the FS's visual management system, but not identical. The BLM has mapped only the Eugene Resource Area. The FS has mapped most of its scenic viewsheds, but each unit has done this independently with no common data standards. There is no interagency standard.

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☐	☐	☐	☐	☑	☑	☐	☑

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	Very high	None
Tribal	Very high	Very high
Watersheds	None	None

Comments:

Scenery is a key monitoring item in the ROD (E-9) and an element in the statement-of-mission letter creating FEMAT (page iii), but it was not addressed because of the lack of data. Data exists at many FS units but not in standardized form, hence it cannot be compiled.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**

FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Contributing issue
Production	Priority issue
Maintenance	Not an issue
Data quality	Contributing issue
Metadata	Contributing issue

Issue comments:

Although a key monitoring item in the Plan's ROD, scenery issues became confounded with habitat issues in many areas because late-successional reserve habitat objectives trumped scenery objectives in the plan adjustments triggered by the Plan. This situation remains unresolved.

Tribal spiritual viewsheds are an issue in some areas but cannot currently be quantified. These viewsheds are considered part of the spiritual experience by some tribes and there are Native American Religious Freedom Act issues [Crespin, pers. comm., 2005]. These issues could not be addressed in monitoring because standardized interagency data are lacking.

The BLM had data available only for the Eugene District, while each national forest had scenery data in a nonstandardized format. The BLM and FS use difference visual management systems, although they are similar enough that they could be integrated with minimal effort.

Metadata about search for data

How data were requested	FS: Via REALM, which did not respond. BLM: by contact with the National Landscape Architect.
Data contacts-program leads	Terry Slider, FS Regional Landscape Architect; Brad Cownover, BLM National Landscape Architect.
Data standards	
Where data were found	Contacting individual units
Data quality	Each unit had scenery management areas before the Plan but scenery management areas become secondary to late-successional reserves or other habitat areas, hence the data became less important over time in the eyes of managers despite importance given to it by the ROD. Data are probably still recoverable from the units, but they should be recalculated given today's technology.

Recommendations

The agencies should develop interagency data standards, data collection protocols, upward reporting requirements, and a tracking system to describe scenery information. This might involve cross-walking the BLM and FS systems, or a new common system could be developed based on the common needs of both. The ideal solution might be to integrate the FS and BLM systems into a single system with common interagency data standards and data collection (production) protocols. At a minimum, they should be cross-walked.

Defensible monitoring protocols for scenery management should be developed and followed uniformly.

Issue ID *21*

Data topic **Marbled murrelet habitat data (occupancy, platforms)**

Data description:

Marbled murrelet nesting information is about the size of trees and the amount of moss found during surveys for nest platforms.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☑	☐	☐	☐	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	Very high	None
Northern spotted owl (NSO)	None	None
Socioeconomic	None	None
Tribal	None	None
Watersheds	None	None

Comments:

Platform data-collection protocols are not standardized.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA

BLM OR,WA

FS R5

FS R6

Other

Description of other:

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA

BLM OR,WA

FS R6

Other

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Contributing issue
Maintenance	Not an issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

Differing standards between sources are causing problems.

Metadata about search for data

How data were requested

Data contacts-program leads	Mark Huff, US Fish and Wildlife Service.
Data standards	Data standards are under development.
Where data were found	Other

Data quality

Recommendations

Standardize data collection protocols among sources. Appoint an interagency data steward or stewardship team.

Issue ID ***22***

Data topic **Workforce composition data**

Data description:

Data enumerating position by series and grade per unit or subunit.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☑	☐	☐	☑

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	High	None
Tribal	High	None
Watersheds	None	None

Comments:

Data enumerating agency positions by series and grade were not readliy available. This lack of data precluded a more detailed evaluation of workforce compositon or analysis of the economic benefits of local agency employment to individual communites.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Contributing issue
Production	Not an issue
Maintenance	Priority issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

Limitations to the staffing data and analysis data classifying full-time equivalents(FTE) into permanent full time (PFT), and other positions were not readily available for FS R6 for 1993 and 1994. Aggregate staffing for FS Plan units for these years is therefore enumerated as FTEs only.

Data enumerating positions by series (for example, wildlife biologist, budget specialist) and grade and pay scale (for example, GS-9) were not readily available. This limitation precluded a more detailed evaluation of workforce composition, or an analysis of the economic benefits of local agency employment to individual communities.

Like the budget data, agencies and regions differ in their handling of staffing and data. For example, in 2003, field-unit positions in information resources management began to be tracked under regional staffing. The effect of this change on the staffing data described here is unknown.

Evaluation of staffing data also has been complicated by unit consolidations. Although the Okanagon-Wenatchee, Fremont-Winema, and Rogue River-Siskiyou consolidations were in 2002 and 2003, the readily available, detailed staffing data had been consolidated for the entire period [S. Charnley, pers. comm.].

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality

Recommendations

Interagency standardization and data collection protocols need to be put in place.

Issue ID ***23***

Data topic **Lack of common data distribution platform**

Data description:

Access issues.

Reports affected:	**NSO**	**MaMu**	**LSOG**	**AREMP**	**Socio**	**Tribal**	**Implement**	**Synthesis**
	☑	☑	☐	☐	☑	☐	☑	☐

Nature of effects	**To text**	**To maps**
Implementation (activities/compliance)	Low	Low
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	Low	Low
Northern spotted owl (NSO)	Low	Low
Socioeconomic	Low	None
Tribal	None	None
Watersheds	None	None

Comments:

No single server exists from which all participants in the monitoring program could access project data. Program participants at the US Fish and Wildlife Service and University of Nevada, Las Vegas, were not able to access the monitoring program data server because of agency data management procedures and security rules. This affected access to the monitoring program data sets.

The work-around solution was to use the Washington Office's FTP site for data transfer to the marbled murrelet module because agency policies did not allow them to access the monitoring program's data server. This use was problematic, however, because that server was not always in service when it was needed and the monitoring program had no control over maintaining it. It was also a non-secure site.

Our consultant at the University of Nevada, Las Vegas was able to work through a FS workstation near his office, but this arrangement made passing data cumbersome. The social science module could not access the FS K: drive.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA

BLM OR,WA

FS R5

FS R6

Other

Description of Other:

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Priority issue
Production	Not an issue
Maintenance	Not an issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

The server-platform issue has to do with differing security policies between the agencies. The monitoring program acquired a data server to hold and distribute project data to all modules and parties involved in the analysis. The US Fish and Wildlife and the University of Nevada, Las Vegas, were unable to access this server directly. The UNLV was able to work around this problem because of FS personnel in the office, but Fish and Wildlife did not have that opportunity. Socioeconomic scientists at the Pacific Northwest research station were unable to access the K: drive, which was inconvenient but easy to work around. No single secure server was available that all monitoring program participants could access for data exchange.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found	Files of data contact
Data quality	No data-quality issue existed, as such. An access issue was

related to security of the serves on which data were stored for project use.

Recommendations

Developing a unified set of security policies to allow participating agencies to fully and non-publically exchange sensitive data via some intranet (as opposed to the Internet) would be the ideal solution for passing information internally. The technology exists to allow smooth data transfer, but security policies prevent full exchange of data. This issue is really one of standardization.

Support from the RIEC could help with solving security policy issues because the policies of several agencies are involved.

Issue ID *24*

Data topic **Vegetation inventory and analysis tool (VIM)**

Data description:

The vegetation inventory and analysis tool (VIM) application queries current vegetation survey (CVS) and forest inventory and analysis (FIA) data for selectable attributes and estimates the extent of these conditions across the Plan area.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☑	☑	☐	☐	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	Low	Low
Marbled murrelet (MaMu)	High	High
Northern spotted owl (NSO)	None	None
Socioeconomic	None	None
Tribal	None	None
Watersheds	None	None

Comments:

Used Statistical Analysis System (SAS) software to work around the problem of the vegetation inventory and analysis tool not being completed.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Priority issue
Maintenance	Contributing issue
Data quality	Not an issue
Metadata	Not an issue

Issue comments:

The FIA and CVS data collection protocols were not the same, causing difficulties in developing the application. Issue was resolved.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality

Recommendations

*** TO BE ANNOUNCED ***

Issue ID *25*

Data topic **Cost of implementing the planning requirements of the Plan cannot be determined**

Data description:

Costs associated with planning various activities under the Plan, such as watershed analysis, late-successional reserve assessment, and increased project planning costs.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☑	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	High	None
Tribal	None	None
Watersheds	None	None

Comments:

Costs of implementing the Plan cannot be determined. Without this information, we cannot determine a cost:benefit ratio or whether the Plan's increased cost of planning was justified.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Contributing issue
Production	Priority issue
Maintenance	Contributing issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

The increase in planning costs related to implementing the Plan cannot be quantified. Watershed anlaysis and late-succesional reserve assessment were not required before the Plan, and project planning costs increased significanlty because of it.

Metadata about search for data

How data were requested

Data contacts-program leads	B & F?
Data standards	Accounting standards.

Where data were found

Data quality	Data cannot be combined to the regional scale. Every project has cost data associated with it but no central indexing or organizational scheme exists to look up the data at a later time, or to combine it.

Recommendations

This issue appears to be another one about activities because the subject is the cost of projects. These projects can be tracked by assigning a project number to each activity type such as a watershed analysis, a late-successional reserve assessment, or project planning. Keeping that number associated with all data about the project -- the cost data, as well as the project data -- would allow tracking of costs for each activity type for each agency. Annual reporting and archiving would also be necessary and would be facilitated by attaching an interagency project identifiecation code.

Issue ID ***26***

Data topic **Physiographic province boundaries**

Data description:

Terrestrial ecosystem boundaries were based on physiographic features of the landscape. The product used was from FEMAT analysis and corresponds to the mapping on page A-3 of the ROD.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☑	☑	☑	☐	☐	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	Low	Low
Marbled murrelet (MaMu)	Low	Low
Northern spotted owl (NSO)	Low	Low
Socioeconomic	None	None
Tribal	None	None
Watersheds	None	None

Comments:

Two versions of the physiographic province boundary exist, and the differences are very subtle yet significant to the habitat analyses. Habitat analysts had to decide which to use, both had limitations, and both were presumably made on legacy information systems like MOSS and therefore needed updating.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**

BLM OR,WA **Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Not an issue
Maintenance	Priority issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

Two versions of the physiograhic province map were available, each subtly different from the other. Both had line placement errors around the edges and along the coast lines that misrepresented the actual province boundary. These issues were likely due to lack of maintenance because systems were upgraded from MOSS to ArcInfo and then to ArcGIS.

The existance of state boundaries in the physiographic province map is not appropriate because the ecosytem does not change along political boundaries.

Metadata about search for data

How data were requested	Retrieved from files without metadata.
Data contacts-program leads	Unknown.
Data standards	Unknown.
Where data were found	Corporate database
Data quality	Poor

Recommendations

Consider using EPA's ecoprovinces, which do not have state lines; they are based on purely physiographic criteria.

Issue ID *27*

Data topic **Digital orthophotoquad coverage did not describe the whole Plan area**

Data description:

The 1996 and 2002 digital orthophotoquads (DOQs) are electronic aerial photographs covering portions of the earth. They have been digitally corrected to adjust for the curvature of the earth and the shape of the lens taking the photo. They are often called digital orthoquads for short.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☑	☑	☑	☐	☐	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	Low	Low
Marbled murrelet (MaMu)	High	High
Northern spotted owl (NSO)	Moderate	Moderate
Socioeconomic	None	None
Tribal	None	None
Watersheds	None	None

Comments:

Habitat value in some areas could not be verified because 1996 DOQ data were not available for those areas. The 1996 DOQ set is known to have some quads (areas covered by a DOQ) in error, such as a quad describing the northeast corner of Crater Lake that lies in Crater Lake National Park, which is misregistered. The new 2002 DOQs are reported to have significant misregistration issues, so they are not necessarily suitable for habitat analysis for this reason.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
BLM-CA	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
BLM-OR,WA	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

FS R5	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
FS R6	☑	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
Other	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Spatial data availability (by agency)

BLM CA

BLM OR,WA

FS R5

FS R6

Other

Description of Other:

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Not an issue
Maintenance	Not an issue
Data quality	Not an issue
Metadata	Not an issue

Issue comments:

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality

Recommendations

This issue demonstrates that even digital orthoquads acquired from official US Geological Survey sources need some form of accuracy assessment locally before they can be used. A simple registration check may suffice, but accuracy cannot be assumed without validation. This same logic also applies to digital elevation models (DEMs).

Issue ID ***28***

Data topic **Agency budget data**

Data description:

Budget data for the FS and BLM.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☑	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	Very high	None
Tribal	None	None
Watersheds	None	None

Comments:

Having no common format for budget data from the agencies caused difficulties in this analysis. These data are fundamental and should be tracked.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Contributing issue
Production	Priority issue
Maintenance	Not an issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

Metadata about search for data

How data were requested Budget data for the individual agencies were not available.

Data contacts-program leads

Data standards

Where data were found

Data quality

Recommendations

Archiving and interagency standardization are critical needs for these data.

Issue ID *29*

Data topic **Community economic assistance data**

Data description:

Data describing the contribution to each county of the economic assistnace money provided to rural communities in the Plan area.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☑	☐	☐	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	High	None
Tribal	High	None
Watersheds	None	None

Comments:

Changes in community economic health resulting from economic assistance for small communities in the Plan cannot be determined.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA

BLM OR,WA

FS R5

FS R6

Other

Description of other:

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA

BLM OR,WA

FS R6

Other

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Priority issue
Maintenance	Not an issue
Data quality	Contributing issue
Metadata	Not an issue

Issue comments:

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality

Recommendations

Issue ID ***30***

Data topic **Measurement methods for timber volumes**

Data description:

Measurement methods for timber volumes vary by agency. Some units use long logs, some use short logs, and some use cubic measurements. These differences may relate to activities data because it describes log volumes cut from timber-sale activities.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☑	☐	☑	☐

Nature of effects	To text	To maps
Implementation (activities/compliance)	None	None
Late-successional and old growth (LSOG)	None	None
Marbled murrelet (MaMu)	None	None
Northern spotted owl (NSO)	None	None
Socioeconomic	High	None
Tribal	None	None
Watersheds	None	None

Comments:

The FS and BLM use different methods for estimating timber volumes; hence, the total volumes must be estimated from converted values. This conversion leads to uncertainty about the volume of timber harvested.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA	**FS R6**
BLM OR,WA	**Other**
FS R5	**Description of other:**

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA	**FS R6**

BLM OR,WA **Other**

FS R5 **Description of Other:**

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Not an issue
Maintenance	Not an issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards

Where data were found

Data quality	Each method produced reasonable estimates of volume, but the data were not comparable between agencies.

Recommendations

Unify reporting methods for log volumes to achieve consistency between agencies. Log volume data could be related to spatial data about types of activities, or even individual projects, by a project number or other indexing scheme.

Issue ID *31*

Data topic **Total maximum daily load (TMDL)**

Data description:

Total maximum daily load (TMDL) is a calculation of the maximum amount of a pollutant that a water body can receive and still meet water-quality standards. The Clean Water Act, section 303, establishes the water-quality standards and TMDL programs. The TMDL standards are set by the states, territories, and tribes, and identify the common uses for each water body, such as drinking water, recreation, or fisheries. A TMDL is the sum of the allowable loads of a single pollutant from all contributing point and nonpoint sources, including a margin of safety to ensure that the water body can be used for the purposes the state has designated. The calculation must also account for seasonal variation in water quality.

Reports affected:	NSO	MaMu	LSOG	AREMP	Socio	Tribal	Implement	Synthesis
	☐	☐	☐	☐	☐	☐	☐	☑

Nature of effects	To text	To maps
Watersheds	Low	None

Comments:

The monitoring program cannot characterize the amount of pollution of streams across the Plan area or changes since the Plan's advent, because of interagency data standardization issues from state to state and year to year. Status and trends in watershed health across the Plan area are thus difficult to describe.

2004 report monitoring questions:

Tabular data availability (by agency)

BLM CA		**FS R6**	
BLM OR,WA		**Other**	Not available
FS R5		**Description of other:**	EPA, States

Tabular data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Spatial data availability (by agency)

BLM CA		**FS R6**	
BLM OR,WA		**Other**	Not available

FS R5 **Description of Other:** EPA, States

Spatial data availability (by year)

Agency	All years	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003

Issue classification:

Access	Not an issue
Production	Contributing issue
Maintenance	Not an issue
Data quality	Priority issue
Metadata	Not an issue

Issue comments:

Standards change every year, and each state sets its own standards.

Metadata about search for data

How data were requested

Data contacts-program leads

Data standards	Inconsistent from state to state, year to year.
Where data were found	Other
Data quality	Varialble.

Recommendations

The monitoring program needs to work with EPA and the states to create a single set of multiagency data standards and data collection protocols to be used every year by each partner. These standards would then be useful for both monitoring and management.

Appendix B: Data Used in the 10-year Reports

Type A - Data created by the monitoring program (internal*)*

Implementation Monitoring Module

Implementation monitoring field data
Implementation monitoring survey responses
Issues database
Compliance database – for the RIEC and PIEC's to choose projects to monitor
Tabular data for:

- Timber Volume
- LSR Assessments
- Watershed analyses
- Road building and decommissioning
- Recreation facility construction
- Grazing
- Procurement contract

Late-successional and old-growth **(**LSOG) Module

Interagency vegetation monitoring program (IVMP)
Late-successional and old-growth (LSOG)
Vegetation change detection
VIM Application that queries CVS & FIA plot data
Interagency vegetation mapping (IVMP)

- (1992-1996 mixed vintage 25 meter LANDSAT TM, considered 1996)
- QMD in 1inch dbh increments (only measures conifers)
- Structure by single or multiple stories
- Species by conifer, conifer/deciduous mix, or predominantly deciduous
- LSOG mapping of forest 22 classes

Vegetation change detection

- 1972 to 2003 in 5 year increments
- based on changes from 1996 IVMP baseline LANDSAT TM)
- shows stand replacing events only.

Potential natural vegetation (2004)
Fragmentation analysis (2004)

- based on 1996-ish LSOG data and change detection

Marbled Murrelet Module

Marbled murrelet module data collection

- habitat ground based data
- at-sea surveys
- occupancy

Updated marbled murrelet zone inland boundary maps (2004, based on IVMP with change detection applied)
Baseline marbled murrelet habitat from Biomapper modeling (2004, based on IVMP with change detection applied)
Current marbled murrelet habitat from Biomapper modeling (2004, based on IVMP with change detection applied)
Baseline marbled murrelet habitat (expert judgment)
Current marbled murrelet habitat (expert judgment)

Northern Spotted Owl Module

Northern spotted owl population demography studies
Northern spotted owl module habitat layer
Baseline northern spotted owl habitat from on Biomapper modeling (2004, based on IVMP)
Current northern spotted owl habitat from on Biomapper modeling (2004, based on IVMP with change detection applied)
Spotted Owl Activity Centers (compiled from agency data)
Spotted Owl demography areas (compiled from agency data)
Spotted Owl fecundity (compiled from agency data)

Spotted Owl survival (compiled from agency data)

Aquatic and Riparian Module

250 Sample Watersheds (2004)
50 Sub-sample Watersheds (2004)
Sampled road construction and decommissioning within the 50 watersheds
Sampled legacy roads
Roads - used modified BLM layer.
Watershed health assessments

- Stream physical characteristics
- Fauna and macroinvertebrates

Decision support (Fuzzy logic curves)
Field data collection protocols
Culverts and Fish Passage/Barriers

Social and Economic Module

Community case studies
Community maps (block group aggregates)
Ecosystem management decision support (EMDS) fuzzy curves
Mining sites
Census block group aggregates ca. 2000 (modified from US Census block groups)
Census data (compiled from 1990 & 2000 US Census Reports)
Community studies for 6 areas, (2003/2004):
Collaborative Forest Stewardship contracts
Procurement Contracting data
Local Unit Implementation Monitoring data
Restoration projects (IRDA aquatic)
Economic data (compiled from several sources)
Special forest products ca 2003 (compiled from agency data)
Procurement and tewardship contracts, etc. (compiled from agency data)

Type B - Essential Data Obtained From Agencies (External) for One or More Monitoring Module

Activities (limited) – (multiple agencies)
CALVEG
Census data – (US Census Bureau)
Changes to ROD S&Gs - (FS/BLM)
Coastline with offshore rocks and islands – (States)
Collaborative forest stewardship projects - (FS/BLM)
Commodity production data - (FS/BLM)
County boundaries - (States)
Culvert & barrier – (multiple agencies)
Current Vegetation Survey (CVS); Forest Inventory and Analysis (FIA) plots
Digital Elevation Models (DEMs) - (multiple sources)
Digital Orthoquads (DOQs) - (multiple sources)
Economic data - (FS/BLM)
Fish distribution
Grants and Agreements
Grazing summaries - (FS/BLM)
Hydro - (FS/BLM)
Landsat images for IVMP Vegetation modeling
Local unit implementation monitoring - (FS/BLM)
LUA ca. 2003 - (FS/BLM)
Administrative boundaries, key watersheds, LSRs, changes to LUA
MAMU platforms – (multiple agencies)
Plan Boundary- (= FEMAT spotted owl range line)
Non-federal ownership – (wasn't obtained)
Physiographic provinces - (FEMAT)
Planning Provinces - (FEMAT)
Potential Natural Vegetation - (FS/BLM)
Procurement contracting - (FS/BLM)
Recreation facilities & activities - (FS/BLM)
Reservation boundaries (wasn't obtained)
Restoration projects – (multiple agencies)
Riparian Reserve - (wasn't obtained)
Roads, road construction and decommissioning - (FS/BLM)
Scenery - (wasn't obtained)

Special Forest Products - (FS/BLM)
Spotted Owl Activity Centers
Spotted Owl demography areas
Spotted Owl fecundity
Spotted Owl survival
State boundaries – (States)
Timber volumes - (FS/BLM)
Watershed analyses - (FS/BLM)
Watershed boundaries (HUCs)
Watershed (aquatic) provinces - (FEMAT)
Workforce composition - (FS/BLM)
ZIP Code boundaries

Appendix C: Effectiveness monitoring issue management form

Issue description				
ID number (leave blank)	**EM**	**Date presented:**	**Select staff(s) and program areas affected:**	
Topic			MPM	☐
Initiator name		**Date closed:**	RMT	☐
Initiated date			REO	☐
Submitted to (name of manager or staff)		**Last updated:**	AREMP	☐
			LSOG	☐
Brief Issue Statement (Describe the issue, associated risk or consequence, and proposed resolution or action)**:**			Social & Economic	☐
			MAMU	☐
			SPOW	☐
			Tribal	☐
			Implementation	☐
			GIS	☐
			Information management	☐
			2004 interpretive report	☐
				☐
Attachment Included? (use attachment for further explanation or details): YES ☐ NO ☐				
Purpose (select one):		**Initiator's expected result:**		
Information only	☐			
Action requested	☐			
Decision requested	☐			
Date needed by (If action or decision is requested):				
For use after staff meeting				
Decision:				

Actions to Implement Decision

Item	Who?	When?	Move to proj. plan? Resources needed?	Status

Attachments

Appendix D: Effectiveness monitoring and monitoring program managers issue log

Last updated: 09/22/2003 By: B. Bingham

The following summary lists issues related to the implementation or operations of effectiveness monitoring. The issues were identified by members of the monitoring program managers (MPM), the effectiveness monitoring team, or other interested parties, and require discussion, confirmation, decisions, or resolution. Issues that have been resolved are "closed." Issue numbers should track to the issue development form and any other related documentation. Please note that information in table reflects the last entry date (09/22/2003) and may not be current, particularly the primary contact information.

Issue no.	Category or topic	Issue statement	Date opened	Resp. groups	Request	Status	Date closed	Priority	Primary Contact
EM0510031	Hydro data	Completing the 1:24000 hydrography framework layer for the R6 Plan area in time for the 2004 interpretive report. The watersheds scheduled for completion in 2002 have been delayed until June 2003. The hydro framework is not expected to complete all 250 watersheds by 09/03	05/10/ 2003	RMT/MPM	Action by 6/1/2003	Open See Issue Statement for status			SLanigan
EM0522031	Implementation monitoring	Lack of usable local field unit (BLM & FS) implementation monitoring (compliance) data for use in 2004 interpretive report.	05/22/ 2003	RMT	Info only	Open			DBaker
EM0528031	Implementation monitoring	Expectations that management implications of IM findings (noncompliance) will be covered in the 2004 interpretive report and the lack of a process to assess any implications (see attachment)	05/28/ 2003	RMT	Decision by 9/1/2003	See Issue State-ment decision			DBaker
EM0528032	Implementation monitoring	Possibility of changing regional implementation monitoring team (RIMT) composition before completion of the 2004 interpretive report and commitment of 25% of their time.	05/28/ 2003	RMT	Decision by 7/1/2003	See Issue Statement Action Items			DBaker

Issue no.	Category or topic	Issue statement	Date opened	Resp. groups	Request	Status	Date closed	Priority	Primary Contact
EM0530031	Roads data	A consistent roads layer across the Plan area for both 1994 and 2003 does not exist because individual forests and BLM districts have used different methods for building roads layers, and the FS has not tracked road construction or decommissioning data in an agency database.	05/30/ 2003	RMT	Info only	Open			PEldred
EM0508032	Legacy data	Lack of legacy spatial data at the regional scale. Units archiving legacy data only keep it 1 to 5 years. Much of the spatial data that did exist in 1994 is now lost.	05/08/ 2003		Action	Open			RMorganti
EM0508033	Data standards	Lack of well-established standards for regional data; misperception by agencies of what regional data are and applicable standards	05/08/ 2003	MPM	Action	Open			RMorganti
EM0508034	Riparian reserves data	Spatial data for an interagency riparian reserve layer has not been collected at the regional scale and a standard by which to create, process, analyze, or store the spatial data has not been designed.	05/08/ 2003	MPM	Action	Open			RMorganti
EM0508035	Scenic manage-ment data	Scenery is a key monitoring item in the ROD [E-9] and was specifically mentioned in the enabling letter forming FEMAT. Electronic spatial data are not available at the regional scale and no standard exists for collecting, storing, analyzing, or reporting these data.	05/08/ 2003	RMT MPM	Action	Open			RMorganti
EM0509031	Legacy watershed data	Watershed boundaries (and IDs) have changed radically since the Plan, and the old boundaries and watershed numbers have not been retained in a usable form.	05/09/ 2003	RMT	Action	Open			RMorganti

Issue no.	Category or topic	Issue statement	Date opened	Resp. groups	Request	Status	Date closed	Priority	Primary Contact
EM0512031	Land use allocation data	Basic land use allocation data may not be available in final form until after 10/2003.	05/12/ 2003	RMT MPM	Action	Open See Issue Statement			RMorganti
EM0512032	Roads data	Data about the current extent, location, and condition of roads is not available at the desired accuracy (1:24K).	05/12/ 2003	RMT MPM	Action	Open			RMorganti
EM062303	Stream and riparian reserves layer	Stream layer available from hydro-framework group not likely to meet needs for modeling riparian reserves	06/23/ 2003	RMT	Info	Open			JLint, RMorganti
EM072203	Recreation data	Unable to get support or acquire some types of recreation data. No response to several requests.	07/22/ 2003	RMT	Action	Open			SCharnley
EM0910031	Spatial data, activities	No spatial definition exists at the regional scale for projects that need monitoring.	09/10/ 2003	RMT	Action	Open			RMorganti
EM0910032	Subunit boundaries	No spatial data for subunit (FS ranger district, BLM resource area) boundaries at 1:24k.	09/10/ 2003	RMT	Action	Open			RMorganti

Appendix E: Minutes of Information Management Strategy Meeting, Interagency Regional Monitoring Program

Date: September 17, 2003; 1:00 PM to 3:30 PM; Regional Office

Participants: Dave Baker, Bruce Bingham, Bruce Crespin, Joe Lint, Melinda Moeur, Roberto Morganti, Craig Palmer, Linnae Sutton, Tim Tolle, Regina Winkler

Agenda

- Introductions
- Module presentations

  *****Flow of data (fig. 8.2, p. 219), and sources of data (fig. 8.3, p. 220) in Palmer, 2003[1] were used as a basis for discussion.

  Each module lead or representative provided an overview of current information management practices that described the sources and flow of data in their programs. Roberto Morganti and Regina Winkler provided program-scale overviews of spatial data management and systems management, respectively. Chris Moyer submitted a written overview for the aquatic and riparian effectiveness monitoring program (AREMP) module.

- Vision for a long-term information management strategy
  Concepts
  Group discussion of 10 questions (box 8.1; p. 223[1])

  Participants brainstormed on characteristics of an information management strategy as a means of leading to the development of an information management vision. Each participant contributed terms that characterize the vision.

  Action: *Participants agreed to expand on these terms (attached below), describing what they mean in context to information management.*

- Near-term needs

[1] Palmer, C.J. 2003. "Approaches to quality assurance and information management for regional ecological monitoring programs." Chapter 8 in: Monitoring Ecosystems; eds. Busch, D.E. and J.C. Trexler. p. 211 – 225, Island Press.

Near-term needs are information management practices critical to producing the 2004 interpretive report. Perhaps the most important near-term need is ensuring protection of your data from loss or corruption.

Action: *The module representatives were asked to provide a written description of their information (data) backup practices and describe how their module is ensuring (or will ensure), that monitoring program data collected or managed in the module is protected from being lost or corrupted (for example, their back-up protocols and the frequency, location and the responsible person.) Future direction will require that their data are backed up on the monitoring program server, located at the regional office.*

Action: *Each module was asked to respond to the 10 questions on page p. 223 in Palmer, 2003. (See attached)*

- Long-term strategy

We did not have enough time to discuss a long-term strategy: it was postponed until the next meeting.

Meeting adjourned at 3:30 p.m.

Attachment 1: Characteristics of an Information Management Vision

Central Archive

- A central location for research and monitoring data (databases, GIS coverages, documents, and so on). The location should use current technology and all older data should be transferred into the newer technology.
- An easily accessible location -- both physically close to the workstations and close to network connections because speed, dropped connections, and incomplete communications being the three important components.
- An archive implies a location for storing and preserving public records or historical documents for public and historical uses. The storage of computer files in accessible formats also preserves research data meticulously collected over generations for future research and trend analysis.

Standardization

- Communicating information can be a compound problem because not only can the database or GIS structures used differ, but so could the terminology used to describe similar types of information. The lack of standardized structure and terminology makes passing data difficult. The need for data standardization is critical to using data to effectively monitor and manage natural resources.
- Formats for data and protocols for collecting it should be the same between modules where appropriate. These two steps will facilitate data sharing and simplify the use and accession of information.
- Standardizing the formats in which data files are delivered ensures that the meaning of the elements in the files is not misconstrued.

Documentation and Metadata

- Metadata are data about data: they describe the content, quality, condition, and other characteristics of the data. Good documentation and metadata are necessary so that misinformation and misinterpretation are minimized.
- Documentation and metadata will preserve data integrity into the future. Metadata should be in the same format across modules with the same definitions for like attributes.
- Documentation of the methods used to acquire the data and a rating of the quality of the data are essential to determining their usefulness. And completing the metadata is essential to determine exactly what is being preserved and its usefulness in comparative studies with like data.

Change management

- One meaning of managing change is the making of changes in a planned and managed or systematic way. The aim is to effectively implement new methods and systems in an ongoing organization -- an anticipative or proactive response.
- Change management implies having a method in place to manage change to data, methods of collecting data, or technology used to store or collect data. A successful methodology implies the support of all interested parties and minimal disruption to essential services and products.

Safe and secure

- The data need protection from unauthorized (accidental or intentional) modification, destruction, or disclosure.
- The data need to be managed by a control point (data base administrator or ?) so that the quality and integrity of the data will not be compromised with too many hands in the pot. Responsibility for a complete data set (data, complete documentation, complete metadata, backups, availability, and so on) should reside with the control point.
- Safe and secure generates the requirement to plan and provide for numerous issues such as a safe and climate-controlled environment for servers where access is limited to authorized personnel only; networks protected from intruders via firewalls and virus protection software; web sites able to block requests by unauthorized sessions, prevent multiple log-in by the same user ID, and force specific users off of the server regardless of the server they come thru; databases that preserve the integrity of data via identifying permissions for database objects and users; and database, system, and network backups in place to ensure recovery of essential services and data.

Accessible

- Data accessibility can be in terms of ordering, format, and price. The format of the data should be standard so that the users know they can use the data. The price of the data should be comparable with work and data developed elsewhere or no fee might be needed with public data if they are downloaded over the web. If the data are downloaded over the web, they should be filed in a usable form, not one that would take a potential user hours to locate or download.
- Data should be available whenever and to whomever is appropriate. This availability probably should be managed through a government intranet site for complete data sets and an internet site for public use.

- The appropriate individuals need access to the data in locations easily accessible, either by networks or the internet in formats meaningful to the individual.

Quality assurance

- Data quality is the degree of excellence in a database. It can simply be defined as its fitness for use for specific data sets. It fully depends on the scale, accuracy, and extent of the data set, as well as the quality of the other data sets to be used. Data quality also contains several components such as accuracy, precision, consistency, and completeness. Quality assurance (QA) would be the effort and process, defined in a policy, put into assuring a high degree of accuracy, precision, consistency and completeness in a data set.
- The steps taken in developing a program to ensure that the product meets targeted goals of quality (accuracy, precision, an so on). Although QA needs to be considered in the beginning of any project, it is usually added on after the fact. A solid guidance in developing QA and identifying existing QA from the centralized control point makes sense and ensures that all modules perform the same level of analysis.
- Quality assurance is also a process that ensures that the data provided are accurate, timely and delivered in a usable format.

Funded and staffed

- An information management system needs funding and staff to carry out its role. Some of the items that the system should be responsible for are a central backup archive, setting data standards, maintaining data and a metadata library, and facilitating and completing change management.
- A staff (1, 2, or 3? people) should be funded off the top to manage the data for all modules of the Plan. Most likely, this would include a full time database administrator (trained in the areas of large corporate data sets and management) and a person trained in the art of information management. This staff would be charged with data management and storage, as well as data quality procedures and ensuring that a complete data package (see *Safe and secure* above) is available to current and future staff.
- Funding and staffing to provide the necessary resources and expertise in managing data requires budgeting by all participating organizations in the information management plan.

Permanence

- Data permanence would mean that the information management system should act as a repository, management system, and archival system for current and older data. All data including older data should be kept and transferred to newer technology so that it is usable. Although data collection techniques and the quality of older data change over time (because of changes in science, for example), keeping the older data is still important, as a time-stamp of the conditions then the data were gathered. Keeping the older data allows researchers to develop, for example, trend data.
- We all want to think that what we are doing now has meaning. Permanence gives this work meaning into the future by ensuring a complete data set, including data, not-data (where data is missing and why), documentation, metadata, and so on.

- Keeping the data provides for its permanence throughout generations and a permanent but evolving process remains in place to manage the data.

Scalability

- The metadata associated with a data set should mention the scale at which the data were collected and the bounding-scale range at which the data can be used.
- The information management plan must provide a vision for managing data whether it is captured in a data warehouse or on a spreadsheet.

Current and useful

- This topic is similar to permanence.
- If the internal support exists, new technology can improve data quality as well as the rate at which it is available. Information needs to be current to address the questions of both politicians and the constituency. That information needs to be accurate and relevant to the issues at hand. Many of the previous discussion points lead to the idea of data being current. Managers need to decide, given direction from their supervisors, what is useful.
- The information management plan is dynamic, responsive to the current data requirements and providing useful and meaningful solutions to the management of those data.

Relevance

- The metadata explain the applications for which the data are developed and the limitations of the data set. In turn, this information will help potential users determine the relevance of the data for their intended use.
- If the information system is not relevant, it won't get funded. Economically, it makes sense to focus on what is relevant to the current politicians and constituency.
- The information management plan must be relevant and meaningful to all the forms of data possible under its jurisdiction.

Efficiency

- Efficiency is enhanced when data are standardized, scalable, and useful with thorough metadata.
- Any realized efficiencies will greatly enhance the product. Technology will lend itself to time efficiency. Prevention will lend itself to monetary efficiency. Maintenance will lend itself to data permanence. Although these later two efficiencies are not glamorous, they will – in the long run – boost the utility of the program and help ensure longevity at several scales
- The data management plan should identify and provide methods that provide efficient and fast access to data. When products and services for data management are evaluated, efficient and fast access to data must override

lesser factors. For example, running client applications off a server leads to inefficient access to data, which leads to frustration, which affects the quality of data collected by that application, thus defeating the purpose of the application.

User Friendly

- The data need to be accessible and easily found in a searchable library. By developing thorough metadata, the data can be filed so they are easy to locate.
- Anyone who needs to should be able to access the data at the user level they are comfortable with. Beginners users should be able to query the database structure for the information they need and have it output in something simple like Excel. Scientific and analytical users should be able to generate the queries and reports to support their work.
- Applications and methods that are intuitive and easy to learn should receive preference in valuations used by the data management plan.

Searchable library

- A searchable library incorporates a database explaining the types of data available, who and how to get the data, and includes the metadata in a standard format. Searchable means that potential users can query to find data that might suit their purposes.
- The aquatic and riparian effectiveness monitoring program module has cataloged all of the documentation used in developing the field protocols and the original evaluation criteria. This was a time consuming exercise (one person full-time for several months, GS-5). In the scope of the project and the resultant utility of the references, however, it was a minimal expenditure and well worth it. Metadata should also fit into a searchable library context, that is, with cross-references to other metadata with like terms or like attributes.
- A catalog of data resources that can be searched and is available on the internet, and indicates what kind of data are available for a particular subject, the quality of the data, and the method of retrieval would provide an extremely powerful tool to researchers who want to incorporate data from other sources and times into their research.

Broad user-utility

- Each data set has many potential uses. The limitations are stated clearly, and do not hinder many uses.
- The data management plan should be useful for nontechnical as well as technical users. In other words, the plan must have as much meaning to those who collect data as to those who write web applications, manage systems, and manage databases.

Popular

- A data set is popular when there are many users of the data.

- The management plan should outline a preference for methods and applications which lets users accomplish their jobs more easily, better meet the goals of their organization, and increase the enthusiasm and support for these methods.

Current Technology

- The data management plan should encourage the use of technology that is available, newer, and currently used by many users.
- From a business perspective, technology buys time. As tasks become automated, employees become free to take on other tasks and contribute to the organizational goals in other ways. The government culture tends to be slow to adopt or adapt new technology.
- Obsolete technology is not a viable method of storing data for long-term storage.

Attachment 2: Summary of Responses to 10 questions in Box 8-1, p. 223 Monitoring Ecosystems

1. **Which interagency body oversees resolution of issues related to monitoring information management?**
   - The regional monitoring team handles attribute issues about data generated for the program.
   - The interorganizational resource information coordinating council (IRICC) sets interagency standards for data quality.
   - A new FS and BLM information management board is forming for data collection.
   - Monitoring program managers and the RIEC.
   - One body should oversee the information management system and procedures for all of the monitoring modules. It should have consistent data protocols and metadata. As a part of the system, a centralized backup of data used in the monitoring process and clearinghouse system should be in place, to allow for security and utility of the data.
   - A centralized body with a unified vision will only benefit the overall goals of information management.

2. **Should the information management system support only the monitoring program, or should related programs be integrated or linked?**
   - The primary responsibility of the information management system would be to support the monitoring program. Related programs should be linked to allow for better data sharing and consistency.
   - The information management system should link to other programs but not support them. Politically and scientifically, it makes sense to build bridges whenever possible; however, no one program can do everything. Terms like 'scope-creep' and 'defined objectives' easily come to mind.
   - At this point in time, linking is the best option.
   - It should be linked with other programs. Clearinghouse format may help organize interagency data.

3. **Should such a system serve as a regional clearinghouse for monitoring information?**
   - The information management system should serve as a regional clearinghouse, perhaps over the web.
   - It makes sense that any information management system should serve as a clearinghouse for its own data (perhaps via a web data-mart approach, etc.). However, with all of the well-established data clearinghouses that exist, why reinvent the wheel?
   - It could be designed with that in mind, but I think the first priority would be to capture the data from the Regional Implementation and Effectiveness Monitoring Program.
   - Yes. And analysis processes, too.

4. **Should the system house and steward the data in a central location, or should these functions be distributed throughout the region?**
   - Centralization seems to work best at the unit level. Since a monitoring program is a unit, then information management should reside at the unit level. This approach affords considerably more consistency in the process as well as the flexibility to make changes to meet demands of each new political or scientific regime.
   - Central server with region wide access.

- Central. Distributed systems are more vulnerable both because more servers are involved and because information passes over one or more networks when moving between servers and hard drives, exposing it to corruption or attack during these processes.
- The information management system should house backup copies of the data in a central location. However, it is more efficient if the original data are housed on the computers of the unit producing the data.

5. **What is the relationship of monitoring information management to existing agency data management systems?**
   - The monitoring program houses data gathered by each of the monitoring modules. This data is from external sources (other agencies / institutions) and from internal sources (Forestry researchers). This data is then reviewed and at times manipulated or summarized.
   - The monitoring program is an octopus reaching its tentacles out to glean information from 8 or more agencies, each with a unique information management system. We are therefore inclined to synthesize information management processes into a single form (if possible) enabling more efficient communication between those agencies.
   - It appears they are independent.
   - Build those bridges! Make the data available to as much of the constituency as possible. This ensures the longevity of the program by demonstrating the utility of the program.

6. **Would the monitoring information network operate best as a metadata database, or should the data and metadata both be included in the regional system?**
   - I think the metadata and data should be housed regionally.
   - The monitoring information network would serve its highest function by containing both the metadata (which is absolutely critical to understanding the data) and the data (which is absolutely critical to meeting the objectives of the program and ensuring program longevity).
   - Both. We cannot depend on other agencies to keep data that we need to keep current, nor to keep legacy data when conditions change. We must have both, but some of the programs we get data from are only interested in snapshots.
   - The metadata and the data need to reside in the same place in order to ensure that the data are meaningful to those who use it.

7. **Can a basic level of support for monitoring information management (estimated to be 15-20 percent of the monitoring budget) be generated?**
   - Legally, we are required to provide support for this program.
   - Unlikely.
   - Yes, with enough whining.
   - I think it is possible to do this, if the information management system can show the utility of the data (who is using the data, products developed, and so on) and its services.

8. **How can security and stability over time be assured in the face of institutional change?**
   - Archiving and metadata.

- The regional monitoring team web server kept up to date, functioning, and backed up.
- Commitment, commitment, commitment .
- The IMS should act as a repository, management system, and archival system for current and older data. All data including older data should be kept and transferred to newer technology so that it is available for use. Although data collection techniques and the quality of older data changes over time , it is still important to keep the older data as a time stamp of the conditions of the time it was gathered. This allows researchers to develop trend data, etc…
- Invest upfront in the data management system. Buy the best technology and development possible and incorporate the metadata so the whole data set is a contained unit.
- Upgrade the software and database to ensure support of the database. Do not let data reside in systems which are no longer supported by the software or hardware company.

9. What is the best way to incorporate valid legacy data into a monitoring information network?

- If it meets predefined minimum data standards, incorporate the information into the data and link it in the most appropriate manner.
- Ensure valid collection methods are used to collect data, and that it is collected in a format that is usable and recoverable. The metadata also needs to be available and recoverable to determine if this data can be incorporated in other studies in a useful and meaningful manner.
- Sorry, don't know, I will need some help from the experts on this one.
- By keeping it. Today's data are tomorrow's legacy data.
- Incorporate legacy data into the data library in a current useable format. Include metadata explaining all information about the uses and limitations of the data.

10. How can a monitoring information system best deal with both the reality and notion of proprietary data?

- Fortunately, most monitoring data collected by federal agencies is public record. Therefore, the real issue lies in protecting the source and integrity of the data.
- We are bound by FOIA and I think that will set the sideboards – from past experience, I do not think we will be able to ensure others that the data they give to us will always be protected.
- With tact. When the data are from government scientists, offer keeping the data private as long as possible as a courtesy but make clear that once the interpretive reports are done, the data must be public by law.
- Data that is available for download should have the confidential information removed and be properly documented as to its application and limitations. This will help prevent improper use. Also, any models/summary procedures used need to be properly documented.

Appendix F: Vision for an Information Management System for the Regional Monitoring Team

Scope and focus

- Primary focus to support the regional monitoring team
- Link to other programs
- Serve as a clearinghouse for data collected by the regional monitoring team
- Allow incorporation of legacy data (meeting certain standards)

Attributes of data in the system

- Safe and secure
- Accessible
- Current
- Permanent
- Maintained in most current technology
- Accurate and complete metadata, such as scale of data addressed
- Useful
- User-friendly, popular
- Searchable access
- High quality

Approach

- Central archive – steward data in one place
- Data and metadata together
- Change management system
- Quality assurance system
- Proprietary issues addressed
- Confidentiality issues addressed

Management

- One oversight body with a unified vision
- Funded and staffed with base-funding support
- Commitment to current technology

Appendix G: Key Information Management Themes from the Synthesis Report

Collated by Nancy Molina, Division of Resources, BLM, March 3, 2005

Below are excerpts from some of the synthesis chapters that capture authors' key points about information management. The key messages in the excerpts below are

- Significant weaknesses are apparent in the agencies' activity tracking that seriously hinder efforts to answer even basic questions. This weakness is probably the biggest criticism of our information management efforts throughout.
- Consistent, wall-to-wall mapping of vegetation that is repeatable (or updatable) and suitable for answering many questions has big payoffs
- The interagency species management system database (ISMS) for the survey and manage species program had a lot of problems, but it is also one of our best models for how to manage interagency data. Learning from both aspects should provide a lot of benefit to the agencies
- A key area for improving is to match up the questions we need answers to with the data we collect, and then with information management processes that actually allow us to answer the questions down the road. A perception suggests we have not done that as effectively as we should have.

Another thought that comes up a lot, but I don't have a good excerpt for, is the idea of corporate interagency data management. The FS and BLM together have made a big verbal commitment to it (through the interagency information management board), but we have yet to really produce significant results. The Plan arena is the one area where we have made some progress, and have experiences that will help us improve. Some kind of partnership between the IIMB and ongoing efforts to improve the monitoring program would have substantial benefits, I would think. The key principle that top management has articulated is that we collect information once, and everyone uses it. Not that we can get there for all the information we need, but we move there to the extent possible.

So, here are some excerpts from the synthesis chapters:

The late-successional and old-growth chapter

- Data are not adequate to evaluate the degree to which these thinning operations were conducted in plantations in late-successional reserves. The implementation report shows that 287, 414 acres were treated with partial removal, which includes commercial but not precommerial thinning. (*weakness in activity tracking)*
- Fuel reduction activities in 2003 were estimated to have been 131,603 acres (Baker et al. 2005). These data, however, are limited in that they do not cover all forests in the Plan area and some of it comes from forests not entirely in the Plan area. A crude estimate of the annual area needed for treatment by mechanical means or prescribed fire can be made by estimating the area of fire-prone forest types (all ages and allocations) in the dry provinces (about 12 million acres), and assuming that 80 percent of these landscapes (9.6 million acres) where characterized by low severity, high frequency fires that occurred with a return interval of less than 25 years (Agee

1993, Taylor and Skinner 1998). If the low end of this frequency (25 years) was restored through active management on these 9.6 million acres, then 384,000 acres would need to be treated every year. That would be at least three times the amount that was treated in 2003, if we assume those numbers are a good estimate for the Plan area. The acres treated might actually have to be much higher initially because some stands might need to be treated mechanically first before using prescribed fire. *(weakness in activity tracking)*

- The status and trends report (Moeur et al. 2005) on late-successional and old growth provides a wealth of information about old forests over the first 10 years of the Plan. That report is the most comprehensive monitoring of old-growth conditions that has ever been written. *(kudos for Melinda! – the broad context for this is consistent mapping, and flexibility to use the mapping to spatially model different definitions of old growth)*
- Little information was available through the effectiveness monitoring program on processes and functions of older forests. For example, rates of succession, gap formation, low severity fire, productivity, decomposition, and so on were not part of the monitoring program, and expected trends were not established in FEMAT or the ROD. *(we have data gaps for some of the questions we need to answer)*

Species chapter

- We believe the Lint estimates are an improvement over previous estimates because the data sources and methods used to classify habitat were more consistent across the owl's range. *(importance of consistent mapping standards)*
- One of the major accomplishments of the northern spotted owl effectiveness monitoring program was producing of a rangewide map of northern spotted owl habitat. Until this effort, no wall-to-wall coverage had been made; existing maps covered only federal lands and were assembled from a variety of sources including satellite imagery, professional judgment from local biologists, and other sources. The current map provides, for the first time, a consistent portrayal of the amount and distribution of owl habitat over the full extent of the Plan area. This map provides a fresh baseline to describe initial conditions and from which to assess changes over the first 10 years of the Plan. *(benefits of consistent mapping)*
- Estimating rates of change in habitat over the past 10 years also carries much uncertainty. Ideally, agency records could be used to map all harvest units, but records are incomplete. Instead, harvest was estimated by comparing satellite images to detect change. This comparison could detect only regeneration harvest; thinning and other partial harvest that might affect owl habitat could not be mapped. *(incomplete agency records)*
- The new information was used in the annual species review procedures to reevaluate the conservation management status of each survey and manage species, leading to the removal of some hundred species (about 25 percent) from the list during the overall survey and manage program (fig. 12). This achievement was a significant, based on an unprecedented, massive database on species locations. *(ISMS concept, if not the actual system, was a good model for interagency data management)*
- Although the nearly 68,000 records allowed for better informed decisions, the data had shortfalls that limited their utility for answering the many questions noted previously. Lessons learned emerge from understanding the usefulness or limitations of the data. The majority of records are simply site locations with little or no information on habitat characteristics or species abundance. Thus, even though distribution maps could be generated, they could not be used directly to analyze population trends and dynamics, nor to predict potential habitat

or its distribution. Collecting information on species abundance or habitat characters, however, represents a significant expense compared to noting only presence. *(these weaknesses point out the need to clearly understand the underlying questions that need to be answered, and design the system to accommodate the information needed)*

- Regardless of these shortcomings, the nearly 68,000 record database, on a regional scale, is one of the largest and richest of its kind for poorly known taxa such as fungi, lichens, bryophytes, and mollusks. It could serve not only as a valuable resource for the special status and sensitive species programs of Oregon and Washington, but the rigorous procedures for inventory and amassing survey data could help in developing conservation strategies for rare and little-known taxa in other regions. *(there were a lot of problems with ISMS, but in the end, having the data is extremely important)*
- *Some keys to a successful information management effort*
  - Design an effective database for data storage and analysis that will meet both short- and long-term objectives
  - The database should be robust and easily queryable by diverse users.
  - Know the types of analyses required from the data.
  - Adequately staff this function to provide for quality stewardship and timely analyses.

Aquatic conservation strategy chapter

- Several miles of roads have been improved—that is, actions were taken to reduce sediment delivery and improve stability or to allow more natural functioning of streams and floodplains, which includes improvements in drainage, stabilization, and relocation (Baker et al., draft). The watershed condition models, however, currently do not take this into account because road improvement data are currently not available in the federal agencies corporate databases. *(weaknesses in activity tracking)*
- Producing a quantitative assessment of the aquatic conservation strategy continues to be challenged by issues of data availability and quality. First, the accuracy and quality of data on some activities is questionable. For example, Baker et al. (draft) report in their summary that the FS and BLM reported decommissioning 295 miles of road. When they examined 89 watershed assessments done between 1999 and 2003, they found that road mileage in those watersheds was reduced by 1179 miles. Data on important indicators of effectiveness, such as miles of streams with water-quality problems (that is 303d-listed streams) on federally managed lands and volume of timber harvested in riparian reserves, are not available. Watershed degraded by management activities before the Plan was implemented were expected to take several years or decades to recover (FEMAT 1993). Thus, assembling credible data on activities and actions done under the auspices of the aquatic conservation strategy would still be timely. Field units are improving watershed conditions by removing and improving roads, in-channel restoration projects, improving riparian areas, and so forth, in addition to providing some timber volume from the riparian reserve network. The land management agencies could consider requiring field units to report uniformly on selected key activities and have the data assembled and accessible in a central location. The availability of such data would allow for at least a more defensible qualitative assessment of the effectiveness of the aquatic conservation strategy. *(weaknesses in activity tracking)*

Adaptive Management and Regional Monitoring Chapter

- Recommit to quality record keeping**.** A regionally

compatible system of a quality matching the current BLM or the old FS total resource inventory (TRI) system is needed to document activities so they can be compiled across the entire region. Modern technology should make this job easier than before. Securing, properly archiving and making accessible older records are also vital to learning. Many of these records are disintegrating and some have been lost. Retrospective studies of long-term processes require these records.

Additional Comments: LSOG Chapter – Tom Spies 3/9/2005

Folks, I'm trying to track down information about the LSR assessments. Specifically, I'd like to know the following:
1. Have they been compiled somewhere and are they available as a set?
2. Was there any attempt to coordinate or standardize them, in other words, is there anyone in the regional office who was responsible for reviewing them and knows what they generally contain and how they were used?

My interest stems from the synthesis chapter on LSOG that I'm working on. I realize that I don't really know how much some of the concerns I've raised in that paper about thinning and fuel treatment at stand and landscape levels have also been recognized in these LSR assessments.

Appendix H: Evaluation of regional databases

The following three tables summarize information collected regarding three different regional interagency databases. The information was organized around the topics of background, organization, information barriers, and lessons learned.

Table H1—Attributes of the interagency restoration database

Topic	Information Collected
Name of information system	Interagency restoration database (IRDA)
Background	
Objective	To meet interagency information tracking needs in restoring aquatic systems
Requirements	Mid-level managers met to develop goals and objectives. Data coordination team met to identify core data elements
Application development	Hired programmer. Combined database and GIS application
Current status	Ongoing.
Organization	
Data stewards (local)	Each unit inputs data and then forwards it for merging at a regional level
Data stewards (regional)	Technical leads FS (1), BLM (1)
Oversight	Mid-level managers, state and federal; agreements at executive level (REIC)
Funding	0.5 FTE for maintenance, 0.25 FTE for reporting
Information barriers	
Existence	Units enter data upon completion of watershed restoration projects.
Access	Data can be downloaded from web. Future would be a website with ArcIMS
Consistency	Data coordination team initially established a core data set with regional standards.
Compilation	Data calls to units. Mid-level managers involved is units aren't responding. Compiled at regional level annually. QA of data at regional level.
Maintenance	FS and BLM staff
Documentation	System requirements and documentation available at website www.reo.gov/restoration/
Lessons learned	
Recommendations	Pamphlet describing database helped provide recognition. Focus on a core data set. Keep it simple.
Contact	Debra Kroeger, FS R6, (541) 471-6616

Table H2—Attributes of the Northwest Forest Plan compliance monitoring database

Topic	Information Collected
Name of information system	NWFP Compliance Monitoring Database
Background	
Objective	Support planning, data collection and reporting activities of the regional implementation monitoring program.
Requirements	Regional interagency team developed specifications, with input from provincial team members.
Application development	One programmer developed the application over a two year period (full-time year 1, half-time year 2)
Current status	Ongoing
Organization	
Data stewards (local)	Provincial implementation monitoring team members are responsible for data input; training provided by regional team
Data stewards (regional)	Provide validation of data (one month process each year). Checks are for completeness and consistency
Oversight	Regional implementation monitoring team is responsible for the oversight of the database. This team is coordinated through the Implementation Monitoring team leader, a member of the regional monitoring team.
Funding	Provided through Implementation Monitoring budget in interagency regional monitoring program.
Addressing information barriers	
Existence	Provincial implementation monitoring team leaders input and extract data.
Access	Through intranet on the REO network. Outside access through VPN. Can download data to local network. Annual reports for project available on internet.
Consistency	Database rules developed by interagency team. Provides standardized reports.
Compilation	Provincial data uploaded annually to regional database, where it is checked and then compiled.
Maintenance	Regional data manager, 2 months per year
Documentation	User guide is available on the intranet website.
Lessons learned	
Recommendations	US FWS cannot access database until they upgrade their network.
Contact	Regina Winkler, FS R6

Table H3—Attributes of the interagency species management system

Topic	Information Collected
Name of information system	Interagency species management system (ISMS)
Background	
Objective	Support data collection and reporting activities of the regional survey and manage program
Requirements	Developed through series of 8 meetings with taxa group specialists
Application development	By contractors based on requirement statements. ArcGIS application for data entry. Oracle at regional level.
Current status	Discontinued. FS migrating data to NRIS. BLM continues database development for system. Renamed GeoBob
Organization	
Data stewards (local)	Each unit has identified 2 data stewards (flora and fauna)
Data stewards (regional)	Two regional data stewards check and collate data. Coordinate annual training meeting for local data stewards. Provide user support
Oversight	TBD
Funding	Joint funding for initial development (BLM and FS). Current funding towards developing separate systems.
Information barriers	
Existence	Local data stewards input information
Access	Geobob currently downloaded on a weekly basis to BLM districts
Consistency	Development team identified standards. Reviewed annually.
Compilation	Regional data stewards
Maintenance	Provided by contract staff (2+)
Documentation	TBD
Lessons learned	
Recommendations	Database must address local business needs as well as regional.
Contact	Janice Van Whye, BLM