ARMY ECOSYSTEM MANAGEMENT POLICY STUDY

AEPI

Army Environmental Policy Institute

This report reflects the views of its authors, who are solely responsible for its content. The findings in this report are not to be construed necessarily as the opinions or views of any organization cited, quoted, or mentioned in this document. The findings are not to be construed as an official position of the Department of the Army, unless designated by other authorized documents.

Contents of this report are not to be used for advertising, publication, or promotional purposes. Citation of trade names does not constitute official endorsement or approval of the use of such commercial products.

RECYCLE THIS REPORT WHEN IT IS NO LONGER NEEDED.
DO NOT RETURN IT TO THE ORIGINATOR.

PRINTED ON RECYCLED PAPER

Army Ecosystem Management Policy Study

John J. Fittipaldi
John W. Wuichet

March 1997

Abstract

Each of the products presented in this document describes a portion of the issues presented by the current direction of the Departments of Defense and Army toward implementing ecosystem management as the guiding principle for sustainable management of lands for training and testing.

Collectively, the reports represent the results of a multi-year effort on the part of AEPI to examine the emerging concept of ecosystem management as a set of guiding principles for Army land management and planning. Together, they help move the Army ever closer toward the ultimate goal of an overall environmental program that simultaneously conserves natural resources and enhances mission readiness capabilities.

AEPI-IFP-397

ACKNOWLEDGMENTS

This study was prepared by the Army Environmental Policy Institute (AEPI) under the guidance of the Director, Dr. Edward Novak. The paper is a product of a broad team approach to a pressing issue of concern to the Army.

The project was managed and executed at AEPI by Mr. John Fittipaldi.

Chapter Two was written by Mr. David Eady, Mr. John Fittipaldi, Dr. Richard Haeuber, Mr. Peter Rzeszotarski, and Mr. John Wuichet.

The remaining four chapters were authored by Dr. Gregory Bourne, Mr. Chris Conrad, Dr. Richard Haeuber, and Drs. Robert Keiter and Robert Adler, respectively.

Command Control, Incorporated provided technical editing and coordinated final report production under Contract Number DACA01-97-P-0963.

ACRONYMS

AMC	Army Materiel Command
ARSTAFF	Army Staff
BLM	Bureau of Land Management
CDPA	California Desert Protection Act
COE	Corps of Engineers
CONUS	Continental United States
CRM	Coordinated Resource Management (Missouri)
DA	Department of Army
DASA-ESOH	Deputy Assistant Secretary of the Army for Environment, Safety and Occupational Health
DMG	Desert Managers Group
DoD	Department of Defense
DOI	Department of Interior
DUSD-ES	Deputy Under Secretary of Defense for Environmental Security
ESA	Endangered Species Act
FACA	Federal Advisory Committee Act
FEMAT	Federal Ecosystem Management Assessment Team (Pacific Northwest)
FOA	Field Operating Agency
FWS	Fish and Wildlife Service
GIS	Geographical Information System
HQDA	Headquarters, Department of Army
INRMP	Integrated Natural Resource Management Plan
ITAM	Integrated Training Area Management
LRAM	Land Rehabilitation and Maintenance
MACOM	Major Command (FORSCOM, TRADOC, AMC, etc.)
MDEI	Mojave Desert Ecosystem Initiative
MOA	Memorandum of Agreement
MOU	Memorandum of Understanding
NASA	National Aeronautics and Space Administration
NEPA	National Environmental Policy Act
NPR	National Performance Review
NPS	National Park Service
NRCS	Natural Resources Conservation Service
RCRA	Resource Conservation and Recovery Act
SCOPE	Scientific Committee on Problems of the Environment
SDMIWG	Science-Data Management Interagency Works Group
SERDP	Strategic Environmental Research and Development Program
TECOM	Test and Evaluation Command
TES	Threatened or Endangered Species
TNC	The Nature Conservancy
TRI	Training Requirements Integration
USACHPPM	U.S. Army Center for Health Promotion and Preventative Medicine
UST	Underground Storage Tanks

TABLE OF CONTENTS

CHAPTER 1. INTRODUCTION 1-1

CHAPTER 2. POLICY PERSPECTIVES ON THE IMPLEMENTATION OF ECOSYSTEM MANAGEMENT ON ARMY LANDS 2-1

2.1 Introduction 2-1
2.2 DoD/Army Progress Toward Ecosystem Management 2-1
2.3 An Ecological Approach 2-3
2.4 Scientific and Field-Tested Information 2-4
2.5 Stakeholder Involvement and Collaboration 2-5
2.6 Adaptive Management 2-6
2.7 Conclusion 2-8
Bibliography 2-9

CHAPTER 3. COLLABORATIVE PLANNING AND ECOSYSTEM MANAGEMENT 3-1

3.1 Overview of Issues 3-1
3.1.1 Defining Characteristics of Ecosystem Management 3-2
3.1.2 Defining Characteristics of Collaborative Planning 3-3
3.2 The Nature of Ecosystem Management 3-4
3.2.1 Differing Values and Perceptions 3-5
3.2.2 Competing Missions and Interests 3-6
3.2.3 Science-Based Decision-Making 3-6
3.2.4 Place-Based Issues 3-7
3.2.5 Political and Multi-Jurisdictional Implications 3-7
3.3 Addressing the Challenges of Ecosystem Management Through Collaborative Planning 3-8
3.4 Applying Collaborative Planning to Ecosystem Management 3-14
3.4.1 Primary Characteristics of Collaborative Planning 3-14
3.4.2 Initiating a Collaborative Planning Process 3-15
3.4.3 Conducting Joint Problem-Solving 3-18
3.4.4 Assessing Progress 3-19
3.4.5 Implementing Agreements 3-20
3.5 Summary: Integrating Collaborative Planning with Ecosystem Management 3-21
3.6 General References for Additional Reading 3-23
3.7 Briefing Slides 3-24

CHAPTER 4. MISSION IMPLICATIONS OF REGIONAL SCALE ENVIRONMENTAL PLANNING 4-1

4.1 Introduction 4-1
4.1.1 Background 4-1

4.2 Installation Missions 4-3
4.2.1 Overview 4-3
4.2.2 Training 4-3
4.2.3 Testing 4-5
4.2.4 Maintenance 4-6
4.2.5 Housing, Community Support and Offices 4-6
4.2.6 Mobilization 4-7
4.2.7 Deployment 4-7

4.3 Current Natural Resource Management 4-8
4.3.1 Policy 4-8
4.3.2 Procedures 4-8
4.3.3 Sikes Act Issues 4-9

4.4 Ecosystem Management 4-9
4.4.1 Definition 4-9
4.4.2 Application 4-10

4.5 Ecosystem Management: Examples 4-12
4.5.1 The Chesapeake Bay Agreement 4-12
4.5.2 The Mojave Desert Ecosystem Initiative 4-13
4.5.3 The Missouri Coordinated Resource Management (CRM) 4-15

4.6 Conclusions and Recommendations 4-15
4.6.1 Factors to Consider 4-16
4.6.2 Costs and Funding 4-16
4.6.3 Management Requirements 4-17
4.6.4 Mission Impact 4-17
4.6.5 Flexibility 4-17
4.6.6 Skill Development 4-18
4.6.7 Control 4-18
4.6.8 Deployment and Mobilization 4-19
4.6.9 Public Expectations and Involvement 4-19

4.7 Conclusions 4-20

4.8 Study Plan 4-21

Bibliography 4-25

CHAPTER 5. IMPLEMENTING ECOSYSTEM MANAGEMENT ON ARMY LANDS: A COMPARISON OF ALTERNATIVE PLANNING APPROACHES 5-1

5.1 Introduction 5-1

5.2 Conservation Policy and Environmental Planning 5-3
5.2.1 Definition of Ecosystem Management 5-3
5.2.2 Evolution of Ecosystem Management Policy in the DoD and DA 5-5

5.3 Planning Approaches and Case Studies 5-9
5.3.1 Integrated Natural Resources Management Plans 5-9
5.3.2 Fort Knox Integrated Natural Resources Management Plan 5-11
5.3.3 Fort Polk Integrated Natural Resources Management Plan 5-16
5.3.4 The Camp Clark Conservation Plan 5-20
5.3.5 Bioregional Planning 5-23
5.3.6 Mojave Desert Ecosystem Initiative 5-24
5.3.7 Alternative Futures for the Region of Camp Pendleton, California 5-31

5.4 Findings 5-34
5.4.1 Ecosystem Management Implementation Issues 5-34

5.5 Implementation Recommendations 5-37
5.5.1 Develop a process-based approach for Integrated Natural Resources Management Planning. 5-37
5.5.2 Develop a process for establishing and understanding the regional context of an installation. 5-37
5.5.3 Develop a process for establishing a vision of ecosystem health. 5-37
5.5.4 Develop collaborative processes for stakeholder involvement in installation INRMP development. 5-38
5.5.5 Identify and utilize biological and physical process models in understanding the structure and function of ecological systems on installations and in the surrounding regions. 5-38
5.5.6 Develop standard, generalizable methods and tools for monitoring progress and evaluating outcomes. 5-38
5.5.7 Identify or develop standard, generalizable adaptive management mechanisms and tools. 5-39

Bibliography 5-41

CHAPTER 6. NEPA AND ECOLOGICAL MANAGEMENT: AN ANALYSIS WITH REFERENCE TO MILITARY BASE LANDS 6-1

6.1 Introduction 6-1

6.2 Ecological Management Principles 6-1

6.3 Ecological Management, NEPA, and the Sikes Act 6-5
6.3.1 Basic NEPA Provisions and Requirements 6-5
6.3.2 Programmatic EISs and Tiering 6-7
6.3.3 The Sikes Act 6-8

6.4 Employing NEPA as an Ecological Management Tool 6-9
6.4.1 Creating a Shared Vision 6-9
6.4.2 Facilitating Interagency Cooperation and Consultation 6-11
6.4.3 Compiling Integrated and Comprehensive Scientific Information 6-13
6.4.4 Maintaining and Restoring Biodiversity 6-15
6.4.5 Managing at Large Spatial and Temporal Scales 6-16
6.4.6 Targeting to Select Achievable Solutions 6-18
6.4.7 Adaptive Management 6-18

6.5 Conclusions and Recommendations 6-19

Bibliography 6-23

INDEX

LIST OF TABLES

5-1 Ecosystem Management: Agency Definitions 5-4

5-2 DoD Ecosystem Management Principles 5-5

CHAPTER 1. INTRODUCTION

Protection of the environment is the key to ensuring we can continue to conduct tough, realistic training and keep the Army trained and ready in the future.

—General Reimer, Chief of Staff of the Army

Each of the products presented in this document describes a portion of the issues presented by the current direction of the Departments of Defense and Army toward implementing ecosystem management as the guiding principle for sustainable management of lands for training and testing.

Policy Perspectives on the Implementation of Ecosystem Management on Army Lands was written by Mr. David Eady, Mr. John Fittipaldi, Mr. Peter Rzeszotarski, and Mr. John Wuichet. It reports on the findings of the AEPI sustainability team during FY97 and reflects on ecosystem management as a guiding principle for sustainable management of lands for training and testing.

Collaborative Planning and Ecosystem Management was written by Professor Gregory Bourne, Department of City Planning, Georgia Institute of Technology. The paper finds that collaborative planning is an effective approach for dealing with the complexities of ecosystem management. It recommends Army leadership demonstrate support for collaborative planning by issuing policy memoranda and developing pilot projects.

Mission Implications of Regional Scale Environmental Planning was written by Mr. Joseph C. Conrad of Springfield, Virginia. The paper outlines the factors that must be examined to determine the impact of ecosystem management policy on an Army installation's mission capability. The principal conclusion is that each installation must be analyzed independently.

Implementing Ecosystem Management on Army Lands: A Comparison of Alternative Planning Approaches was written by Dr. Richard Haeuber of the Ecological Society of America's Sustainable Biosphere Initiative. The paper compares approaches currently being tested in implementing ecosystem management on DoD lands, and recommends, among other things, that the Army establish a vision of ecosystem health, and a process for understanding the regional context of an installation.

NEPA and Ecological Management: An Analysis with Reference to Military Base Lands was written by Professors of Law Robert Keiter and Robert Adler of the Wallace Stegner Center for Land, Resources, and the Environment at the University of Utah. The paper compares the legal requirements of NEPA and the Sikes Act against DoD's ecosystem management policy and finds that the commonalities between them should allow integrated implementation in a manner that produces funding and personnel efficiencies, while promoting the goals of ecological management.

These papers represent the result of a multi-year effort on the part of AEPI to examine the emerging concept of ecosystem management as a set of guiding principles for Army land management and planning. Collectively, these reports help move the Army closer toward the ultimate goal of an

overall environmental program that simultaneously conserves natural resources and enhances mission readiness capabilities.

This document summarizes some of the most significant findings of the AEPI sustainability team over the past three years and reflects on the possible roles of the Departments of Defense and Army in implementing ecosystem management as the guiding principle for sustainable management of lands for training and testing.

Models for adaptive management of natural and cultural resources mirror ecological processes that occur at multiple spatio-temporal scales. The most appropriate scale for addressing environmental problems is the same scale at which problems are manifest. The unique situation presented by ecosystem management is that it requires simultaneous attention to multiple scales. Developing a model for sustainable Army land management using ecosystem management principles (such as those promulgated by DUSD-ES) requires a designed system of components operating at multiple levels consistent with the overall objectives of the specific management initiative.

Optimally integrated models and indicators for sustainability are flexible and adaptive. Some indicators used for measuring ecological integrity prove obsolete or inappropriate over time in light of new insights, requiring datasets to be flexible. Nonetheless, maintaining at least some historical consistency in datasets is also critical. Historical data allow evaluations of progress toward sustainability and examinations of trends in system integrity. Therefore, models should use multiple ecological indicators while maintaining "indicator control groups" to measure progress.

Sustainable Army land management requires integration, horizontally across organizational functions, and vertically across processes. For example, the Army's Integrated Training Area Management (ITAM) program is designed to integrate various functions such as operations/training, natural resource/environment, and real property management, while integrating HQDA policy with MACOM and installation priorities.

The goal of sustainable Army land management is to engage Army stakeholders and ITAM proponents in a coordinated effort to integrate Army training and mission land-use requirements with sound natural resource management practices. Experience has shown that ecological approaches require open communication, interagency coordination, and collaborative planning across multiple jurisdictional boundaries. Ultimately, collaborative planning and decision-making can reduce the risk of conflict and improve overall quality for Army land management initiatives.

Chapter 2. Policy Perspectives on the Implementation of Ecosystem Management on Army Lands

2.1 Introduction

Few areas of public policy are as contentious as the issues surrounding management of our environment and natural resources. A new generation of environmental issues is now upon us, defined by greater political, economic, social, and even cultural complexity. Ecosystem management is a recent policy alternative proposed to address this new generation of issues. In keeping with the general trend among federal agencies, the Department of Defense has embraced ecosystem management as the philosophical foundation for its natural resources management and conservation activities.

The importance of ecosystems in land management was identified as early as the 1930s, but it was not until 1970 that Lynton Caldwell advocated using ecosystems as the basis for public land policy. The phrase "ecosystem management" probably first appeared in the professional literature in 1979 (Grumbine 1995). As is the case with other federal agencies, ecosystem management is a fairly recent natural resources management approach within the Department of Defense, and has been developing gradually over the last few years.

At the DoD level, ecosystem management is not just a good idea; it is policy, expressed in memoranda and codified in DoD Instructions. It remains to be seen how these Instructions will be applied in the field. At the Army level, the principles of ecosystem management appear in various policy memoranda.

2.2 DoD/Army Progress Toward Ecosystem Management

Initial DoD guidance describing and mandating ecosystem management as a land and natural resources management approach can be found in an 8 August 1994 Memorandum by Under Secretary of Defense for Environmental Security, Ms. Sherri W. Goodman. She establishes DoD policy on natural resources by stating "I want to ensure that ecosystem management becomes the basis for future management of DoD lands and waters." The memo outlines ten ecosystem management principles and guidelines. These ten principles, listed below, have become the cornerstone of DoD ecosystem management policy.

1. Maintain and improve the sustainability and native biological diversity of ecosystems.
2. Administer with consideration of ecological units and time frames.
3. Support sustainable human activities.
4. Develop a vision of ecosystem health.
5. Develop priorities and reconcile conflicts.
6. Develop coordinated approaches to work toward ecosystem health.

7. Rely on the best science available.
8. Use benchmarks to monitor and evaluate outcomes.
9. Use adaptive management.
10. Implement through installation plans and programs.

In an AEPI report entitled "Mission Implications of Regional Scale Environmental Planning," it was noted that of these ten principles, two (1,3) state goals, three (2,7,9) provide broad strategies, and the remaining five suggest procedures.

In 1996, much of the policy guidance included in the 8 August 1994 memorandum was incorporated in DoD Instruction 4715.3, signed by the Under Secretary of Defense for Acquisition and Technology. The Instruction codifies the principles of ecosystem management as official DoD policy, and prescribes specific actions supporting the DoD ecosystem management principles. For example, it directs threatened and endangered species managers to move from single species to multiple species as the focus of management efforts. It also encourages the formation of partnerships with non-DoD stakeholders, and establishes native ecosystem types, ecological processes, and longer temporal scales as the foundation of DoD land management. Noting that healthy ecosystems mean realistic training areas, the Instruction indicates that sustainability contributes to both ecological integrity and the military mission.

The concept of ecosystem management also has become more fully integrated into Department of the Army guidance. Specific objectives for ecosystem management, including restoration and maintenance of biodiversity and "transition from single species management to sustainment of functioning ecosystems," were set forth in a 29 June 1994 memorandum from the office of the Assistant Chief of Staff for Installation Management. This memo established the Army Ecosystem Management Board, an integrated body of Army Staff (ARSTAF), Major Command (MACOM), Field Operating Agency (FOA) and installation ecosystem managers.

Recent efforts to revise AR 200-3 go beyond the concept of managing TES, moving into a discussion of biological diversity and reflecting the adoption of ecosystem management principles. In the revised text of AR 200-3, Chapter 11 now calls for land management on an ecosystem basis, stipulating that healthy ecosystems reduce the potential for species to become listed as threatened or endangered, and thereby minimize compliance costs.

On 3 July 1995, a Conservation Policy memorandum was signed by the Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health. The memo established goals for conservation, directing the Army "to manage its land resources to ensure their useful and perpetual availability for training and testing." An attachment to the memo presents five specific policy initiatives in support of conservation goals, directing that the Army will:

- Be actively engaged in the design of federal ecosystem management.
- Become demonstrably more efficient and effective as a land manager.

- Determine if more training land is needed to accomplish the Training XXI strategy.
- Learn how to involve the public in the decision-making process.
- Review conservation R&D guidance to assure an adequate voice from trainers and testers.

Collectively, these policy memoranda, instructions, regulations, and other guidance support the assertion that ecosystem management has been established as a part of US military policy. DoD and the Army are now grappling with how to go about implementing ecosystem management policy. Using the four themes of ecosystem management identified in Ms. Goodman's memo, we will now look at each of the four general themes of ecosystem management, with attention to DoD/DA involvement in turning the concepts into reality.

For analytical purposes, AEPI consolidated the ten DoD principles (listed above) into four general headings which form the basic outline for the remainder of this report: (1) an ecological approach, (2) scientific and field-tested information, (3) stakeholder involvement and collaboration, and (4) adaptive management.

2.3 An Ecological Approach

Taking an ecological approach involves focusing management efforts on an ecological scale. For ecosystem management, that means managing at multiple scales. Just as local governments are nested within state governments that are, in turn, nested within the federal government, so are ecosystems nested within each other, from those the size of a fishbowl to those the size of the Mississippi River basin. Ecosystem management on a military installation involves taking into account not only the natural resources on-post, but also the ecological integrity of the entire region, along with the local, state, and federal governments concerned with its management.

A 1995 AEPI report entitled "Toward an Ecosystem Management Policy Grounded in Hierarchy Theory" began with the idea that regionally scaled problems such as those relating to regional ecosystems should be addressed by regionally scaled policies. The report concluded that in order to manage ecosystems on a regional basis, regional policy-making bodies should be established and equipped to promulgate, implement, and enforce regional policies.

A 1996 AEPI study entitled "Implementing Ecosystem Management on Army Lands: A Comparison of Alternative Planning Approaches" corroborated the finding of the 1995 report with specific case studies involving DoD and Army ecosystem management pilot projects. A case study method was used, focusing on two current approaches to implementing ecosystem management:

1. Integrated Natural Resources Management Plans at Fort Knox, Fort Polk, and Camp Clark, and
2. Bioregional Planning in the Mojave Desert Ecosystem Initiative and at Camp Pendleton.

The ten DoD ecosystem management principles were employed as a yardstick in judging the extent to which each case reflects ecosystem management, in terms of expressed goals and action items slated for implementation. The report found that the cases studied generally failed to adopt an ecological approach to ecosystem management because they made few attempts to look "beyond the fence line" to the larger regional ecosystem. The report concluded by recommending that Army ecosystem management programs should be established according to physical and biological criteria, and should account for the regional political, social, economic, and cultural context.

2.4 Scientific and Field-Tested Information

The issue of scale in ecosystem management in large part drives the other issues that will be discussed below. Scale determines the kind of information collected, as well as the kind of stakeholders involved. Multi-scale management of ecosystems also generally accounts for the inherently dynamic nature of the natural and human resources found within the region. Human institutions add the element of political dynamics into the equation as well.

If ecosystem management is to be implemented on an ecological scale, then the kind of information that must be collected will also be ecological, or regional, in scale. Without scientific and field-tested information, ecosystem management is no good. Knowledge and information should be addressed on multiple scales as well. Installation resource managers do not necessarily need the same level of information as MACOMs (or regional-scale authorities) and Headquarters, Department of Army (HQDA) offices.

The degree of scientific uncertainty also affects the level of knowledge and the type of information needed. Managing ecosystems involves relatively high degrees of scientific uncertainty. In truth, there is no scientific certainty—only research-based consensus. An AEPI report entitled "Policy Implications of Integrated Models and Indicators for Sustainable Development" points out that scientific uncertainty emerges at three different levels: (1) technical, (2) methodological, and (3) epistemological. Uncertainty emerges at the technical level because of observation or experimentation techniques and the effects of these actions on the object of analysis. We attempt to control for technical uncertainty through the use of statistical procedures. Methodological uncertainty is based on the reliability or completeness of the data used. We attempt to control uncertainty at this level through the use of expert judgement and professional consultation. We may also use triangulation techniques to establish the reliability of data. Epistemological uncertainty is more systemic in nature; it speaks to what is known or what is knowable about a problem or situation. This determination is heavily influenced by social values and perceptions. We attempt to manage uncertainty at this level through negotiations or dialogues between stakeholders to establish consensus on the amount and type of knowledge necessary for solving a problem or addressing an issue.

Ecosystem management often involves uncertainty at all three of these levels. Therefore, traditional scientific approaches to problem solving are inadequate to the task of managing complex ecosystems. Additional consultation with experts and public stakeholders can bolster the knowledge base for planning, analysis, and decision-making.

Appropriate scientific knowledge and information is also determined by social values and the perceived stakes in the problem at hand. When stakes are high, the affected stakeholders are unwilling to rely solely on science for the solutions to complex problems. Scientists interested in improving this situation should look to expand their definition of who counts as a "peer" in their peer-review processes. In short, there is an inherent distrust in science acting alone when the stakes are high, particularly in light of acknowledged uncertainty in the management of complex systems such as ecosystems. Therefore, ecosystem management should extend the traditional definition of "scientific facts" to include more anecdotal or experientially-based knowledge and information. This involves extending the realm of "experts" as well to include the affected community or communities. The uncertainty and complexity inherent in the management of ecosystems necessitates more inclusive processes of analysis and more adaptive organizations for implementation.

One example of how science contributes to sustainability in Army land management can be found in the Mojave Desert Ecosystem Initiative (MDEI). The MDEI represents DoD's commitment to utilization of peer-reviewed science to support land management decisions. However, there remains the need to extend the "peer group" used to include a broader community of knowledge. The project goal is to develop and implement a database to facilitate collection, storage, transfer, sharing, and analysis of information regarding inventories, resource assessments, scientific documentation, and land management by all federal, state, and local agencies, and other interested parties. Ultimately, a queryable computer database will be developed and deployed through the WWW to provide land managers the ecosystem-wide tools for informed decision making. As such, it represents one of the first DoD-led attempts to create a regional scale database that can be utilized to affect dynamic, sustainable land management.

Because the MDEI database will be available to anyone with WWW access, it begins to expand ecosystem management beyond the boundaries of the installations in the region. It remains to be seen how non-military stakeholders can use the information available on the web to participate in decision-making processes for the Mojave region. The question remains whether the public will view this data as credible or beneficial to the task, given the lack of involvement by public stakeholders in the definition and collection of pertinent data. There must be broad based consensus on the validity of data and criteria used to analyze or monitor the integrity of the Mojave Desert ecosystem.

2.5 Stakeholder Involvement and Collaboration

It has been suggested that the best science is "civic science." Is this true for the Army? The regional scale required of ecosystem management and the complexity of the task make it necessary to shift Army reliance on traditional applied scientific approaches toward more collaborative approaches to environmental planning, analysis, and management. "Civic science" integrates the idealistic use of scientific knowledge obtained through experimentation with the pragmatic use of politics and the conflict between social values. Kai Lee (1990) describes civic science as "irreducibly public in the way responsibilities are exercised, intrinsically technical, and open to learning from errors and profiting from successes."

The example of the MDEI presented earlier illustrates the collection of ecological data at a regional scale. Regional-scaled data is necessary, but only if it was collected through a process that included stakeholders in determining how and what to collect. In so doing, decisions that are made based on the data will be more agreeable to parties external to the Army. A recent movement toward what is known as "Post-Normal Science" was introduced at the SCOPE meeting by a community of biologists, ecologists, public policy analysts, and social theorists. Post-Normal Science views the input from communities and other non-scientists as informational inputs to decision-making processes that are of equal or sometimes greater importance than facts derived from conventional empirical science and research. The outcomes from processes using this perspective tend to fuel fewer and less-hostile reactions from local communities, as well as from their representatives in Congress. An AEPI report entitled "Collaborative Planning and Ecosystem Management" found that such approaches to natural resource management planning, analysis, and decision-making could potentially improve Army implementation of ecosystem management.

The Army environmental program, which currently approaches problem-solving from an almost wholly scientific perspective, would benefit from categorizing its environmental challenges with respect to the uncertainty inherent in the problem, and the stakes held by various interested parties, and then applying the appropriate tools to approach those problems, either scientific, expert judgement, or consensus-building. An AEPI report entitled "NEPA and Ecological Management: An Analysis with Reference to Military Base Lands" compared the DoD ecosystem management principles to the statutory requirements of the National Environmental Policy Act and found that the ecosystem management concept is consistent with the intent, history, and direction of the statute.

How should the Army go about integrating the best scientific information, understood to include socially derived or constructed information, at multiple ecological and jurisdictional scales? To do so requires a great deal of flexibility on the part of Army land managers and trainers. That is why one of the ten principles of ecosystem management in DoD is referred to as adaptive management.

2.6 Adaptive Management

Traditionally, there has been a tension between centralized planning and decentralized implementation. Decision-making is often reserved for those in leadership positions, while most knowledge and understanding is acquired from management experiences in the field. Planning and policy development continue to be separated from implementation and management processes, thereby limiting the opportunities for organizational learning. In contrast, adaptive management attempts to integrate centralized knowledge and control with decentralized experience in order to facilitate real learning.

Several Army initiatives reflect an ongoing effort to shift from a reactive, compliance-driven environmental program to a proactive, planning-based approach to managing natural and cultural resources on Army lands. Examples include the development of Integrated Natural Resources Management Plans (INRMPs) and the integration of Army Regulation 420-74 into the new AR 200-3. However, planning processes and management practices must be flexible enough to

accommodate the evolution of scientific understanding of both human and natural systems. In other words, implementation should be based on the practices of adaptive management.

The AEPI Comparative Planning Approaches study reviewed attempts to implement adaptive management practices in conjunction with ecosystem management principles through INRPMs. Throughout the INRMPs studied, efforts were made to implement ecosystem management through installation plans and programs. Many examples can be found:

- Training Requirements Integration (TRI) will be used to rotate training lands and implement the forest management strategy, with a specific schedule attached.
- Mission siting will be used to insure sustainable land use.
- Natural Resources personnel and the Range Division will cooperate in developing training restrictions to implement ecosystem protection measures and the wildfire program.
- Special areas will be taken into consideration in siting training missions.
- Cantonment area management will be used to manage urban habitat for the goal of increasing biological diversity.
- Land Rehabilitation and Maintenance (LRAM) actions in drainage areas and creek crossings will serve to decrease erosion and sedimentation in streams and wetlands.
- Specific efforts will be made to better coordinate Integrated Training Area Management (ITAM), Forestry and Fish and Wildlife personnel for implementing restoration projects.

Benchmarks and feedback mechanisms are two key attributes of adaptive management. Yet there are no feedback loops established within the INRMPs studied by which plans and programs can be modified based upon management experience, nor are there mechanisms established for periodic review of implementation. The only substantive mention of adaptive management in the documents asserts that "research is often evaluation of applied management; this fits into the adaptive management aspect of ecosystem management." Without further discussion, it is not clear how the results of such research will be used in an adaptive management context. In general, the INRMPs studied fail to establish an adaptive management context for implementing ecosystem management. The study concluded that adaptive management is not currently being fully implemented as a part of ecosystem management. Consequently, the report recommended that:

- Installations must manage to learn; knowledge gained from management must be used as input for planning future management actions.
- Research must be linked to management.
- Expected effects of management actions must be recorded; management actions must be monitored; results must be evaluated.

- Installations must establish institutional feedback loops linking the vision of ecosystem health, management objectives, and actions based upon that vision, monitoring and evaluation of management actions, and knowledge gained.

2.7 Conclusion

Experience has shown that ecological approaches to land management require open communication, interagency coordination, and collaborative planning across multiple jurisdictional and organizational boundaries. Ultimately, collaborative planning, analysis, and decision-making can reduce the risk of conflict and improve overall quality for Army land management initiatives. The task at hand for Army natural resource managers is to develop policies, programs, and projects that take an ecological approach to integrating the best (civic) science into management actions through the use of adaptive management principles. This requires collaborative approaches to planning, analysis, and management of Army land used for training and testing. Although it is a monumental task, the direction and path has been laid out by DoD and Army leadership through the development of proactive policies and innovative initiatives. Now we must accept the challenge and begin to make the road by walking.

BIBLIOGRAPHY

Bourne, R.G. Collaborative Planning and Ecosystem Management. Prepared for AEPI through a cooperative agreement with NASA and the Sustainable Biosphere Initiative of the Ecological Society of America, 1996.

Brown, G.C. Memorandum from Director of Environmental Programs, Subject: Development of Army Policy and Program for Ecosystem Management, dated 29 June 1994.

Caldwell, L. *The Ecosystem as a Criterion for Public Land Policy.* Natural Resources Journal 10(2): 203-221, 1970.

Chawla, M., R. Melton, G. Perez, and J. Westervelt. Policy Implications of Integrated Models and Indicators for Sustainable Development. Prepared for AEPI through a cooperative agreement with the U.S. Army Construction Engineering Research Laboratories, 1996.

Conrad, C. Mission Implications of Regional Scale Environmental Planning. Prepared for AEPI through a cooperative agreement with NASA and the Sustainable Biosphere Initiative of the Ecological Society of America, 1996.

Goodman, S.W. Memorandum from Under Secretary of Defense for Environmental Security, Subject: Implementation of Ecosystem Management in the DoD, dated 8 August 1994.

Grumbine, R.E. *What is Ecosystem Management?* Conservation Biology 8(1): 27-38, 1994.

Haeuber, R. Implementing Ecosystem Management on Army Lands: A Comparison of Alternative Planning Approaches. Prepared for AEPI through a cooperative agreement with NASA and the Sustainable Biosphere Initiative of the Ecological Society of America, 1996.

Keiter, R. and R. Adler. NEPA and Ecological Management: An Analysis with Reference to Military Base Lands. Prepared for AEPI through a cooperative agreement with NASA and the Sustainable Biosphere Initiative of the Ecological Society of America, 1996.

Lee, K. Compass and Gyroscope: Integrating Science and Politics for the Environment. Washington, DC: Island Press, 1990.

U.S. Department of Army, Army Regulation 200-3, Subject: Natural Resources—Land, Forest and Wildlife Management, 1995.

U.S. Department of Army, Army Regulation 420-74, Subject: Natural Resources—Land, Forest, and Wildlife Management, 1986.

U.S. Department of Defense DoD Instruction 4715.3, Subject: Environmental Conservation Program, dated 3 May 1996.

Walker, L.D. Memorandum from Deputy Assistant Secretary of the Army for Environment, Safety, and Occupational Health, Subject: Conservation Policy, dated 3 July 1995.

Wuichet, J.W. *Toward an ecosystem management policy grounded in hierarchy theory*. Ecosystem Health 1 (3): 161-169, 1995.

CHAPTER 3. COLLABORATIVE PLANNING AND ECOSYSTEM MANAGEMENT

3.1 Overview of Issues

For many years, a handful of ecologists have been extolling the values of ecosystem-wide approaches to managing natural resources. Ecosystem management has emerged as a broadly embraced concept, however, only during the 1990s. Nonetheless, it remains largely underutilized because of the complexity associated with managing entire ecosystems. One technique for addressing this complexity is collaborative planning. Collaborative planning is an open, consensus-oriented approach involving key stakeholders in designing and implementing policies and management strategies.

Like ecosystem management, collaborative planning has been used in a variety of settings without a universal set of standards or definitions. Having a common understanding of what is meant by collaborative planning and how it is to be used, however, is essential for support within sponsoring organizations as well as among potential participants. Equally important is an understanding of what enhances the probability of making collaborative planning successful, avoiding the pitfalls that can render the process ineffective.

Incentives to use these processes, or the lack of incentives, are also crucial to using collaborative planning. What is the incentive for undertaking a "new" approach to problem solving and the perceived "risks" associated with that approach? One can view the issue of incentives in several ways. DoD has officially committed to ecosystem management and the use of collaborative processes to achieve related objectives. As stated in a 1994 memorandum from the Deputy Under Secretary of Defense,

> *I want to ensure that ecosystem management becomes the basis for future management of DoD lands and waters. Ecosystem management is not only a smart way of doing business, it will blend multiple-use needs and provide a consistent framework to managing DoD installations, ensuring the integrity of the system remains intact. Ecosystem management of natural resources draws on a collaboratively developed vision of desired future ecosystem conditions that integrates ecological, economic, and social factors.*

This policy mandates the use of ecosystem management and collaborative approaches to achieving ecosystem management objectives.

From another perspective, incentives also relate to creating the highest likelihood of success. An assessment of incentives and risk must not look at a new approach in isolation; the new approach must be compared with the likely outcomes of more traditional approaches. History and experience from the last twenty years of environmental decision-making demonstrate time and again the shortcomings of more traditional, legalistic approaches. Due to a lack of inclusion and openness, distrust and lawsuits have proliferated. Trying new approaches carries little risk in comparison (if

properly planned and implemented), and encourages new leadership and problem-solving paradigms that build public trust.

The purpose of this paper is to discuss how collaborative planning can be used to address the challenges of ecosystem management. In addition, this paper discusses potential barriers to using collaborative processes, strategies for overcoming those barriers and guidelines for implementing an effective collaborative planning process.

3.1.1 Defining Characteristics of Ecosystem Management

Ecosystem management builds on a holistic approach to natural resources management using more than the traditional single species/single resource approach to management. To many, ecosystem management is synonymous with sustainable development. To others, ecosystem management involves the management of natural resources over a larger geographic boundary than typically considered. To yet others, ecosystem management is the balancing of economic and biological resources. Different public agencies have developed their own definitions of ecosystem management to meet the specific needs of their organization and mission. Not surprisingly, working definitions of ecosystem management are highly variable. Systemic assessment, adaptive management and integrated natural resource management are all used to refer to aspects of ecosystem management. Understanding the differences in ecosystem management definitions, however, can help illuminate the complexities and various challenges associated with ecosystem management.

To enhance the likelihood of developing implementable ecosystem management strategies, it is important to identify clearly the basic characteristics and principles of ecosystem management, regardless of differing definitions. Generally, ecosystem management can be differentiated from other approaches to natural resource management, in that ecosystem management should accomplish the following:

- Address the holistic needs of an entire ecosystem rather than the needs of one species/ resource
- Manage using concepts of natural succession and natural occurrences such as flooding, fire, etc.
- Define the effective geographic boundaries of an ecosystem based on geology, topography, vegetation, etc.
- Incorporate concepts of sustainability into management practices which address the human/nature interface.

These four characteristics relate closely to the ecosystem management definition contained in the "DoD Environmental Conservation Program Instruction," which is consistent with the memorandum on ecosystem management cited earlier:

> *Ecosystem management: A goal-driven approach to managing natural and cultural resources that supports present and future missions requirements; preserves ecosystem*

integrity; is at a scale compatible with natural resources; is cognizant of nature's timeframes; recognizes social and economic viability within functioning ecosystems; is adaptable to complex and changing requirements, and is realized through effective partnerships among private, local, State, tribal, and Federal interests. Ecosystem management is a process that considers the environment as a complex system functioning as a whole, not as a collection of parts, and recognizes that people and their social and economic needs are a part of the whole.

Two common contexts for the application of ecosystem management principles are the development of strategies for sustainable development and protection of endangered species. These applications represent the complexity of applying ecosystem management when many national initiatives, regulations and organizations beyond those in local settings are involved. They also suggest why it is important to have some common definitions and appreciation for the dynamics of ecosystem management. Ecosystem management must often be considered from local, regional, national and even global perspectives.

3.1.2 Defining Characteristics of Collaborative Planning

Collaborative planning has also been used increasingly in the 1990s. The concepts that embody collaborative planning, however, have been used extensively in other contexts for a much longer period of time. Collaborative planning borrows from disciplines related to strategic planning, public participation, team-building, negotiation and conflict resolution. Used by different organizations in different settings, definitions of collaborative planning vary.

As with ecosystem management, many agencies and organizations have developed their own interpretation of collaborative planning. The problem arises when the same term is used for different approaches or processes which then results in confusion about the goals, approach or intent of the process. Thus it is important to clearly define and explain the intent of collaborative planning processes. The following attributes characterize collaborative planning:

- Collaborative planning integrates tools and techniques from strategic planning, public involvement, negotiation, mediation and consensus- building processes.
- Enhanced cooperation and coordination between/among agencies and governments is essential to collaborative planning, but collaborative planning is more, involving representatives of all key stakeholders in the process.
- Collaborative planning is more than traditional public participation, engaging participants meaningfully in joint problem-solving.
- Consensus-based approaches to problem-solving should be the means by which decisions are made.

The working definition of collaborative planning used as the premise for this paper is as follows:

> *Collaborative planning is a cooperative approach to developing implementable plans, policies and programs through interest-based negotiation and consensus-building, involving key stakeholders in the decision-making process in an anticipatory rather than reactive setting.*

Under certain circumstances, collaborative planning represents something much more: a fundamental shift in how government agencies and various publics interact on issues of public concern, leading to new decision-making paradigms. As responsibility shifts from federal to local and regional government officials, or from national headquarters to regional offices or specific units, this takes on even greater significance. Collaborative planning in this context has basic implications for the practice of democracy.

As highlighted earlier, the memorandum from the Under Secretary of Defense states:

> *Ecosystem management of natural resources draws on a collaboratively developed vision of desired future ecosystem conditions that integrates ecological, economic and social factors.*

The question that remains is how to conduct collaborative processes that effectively integrate and resolve the ecological, economic and social concerns of sponsoring agencies as well as affected publics. This paper responds to that question by outlining effective strategies for planning and conducting successful collaborative processes.

3.2 The Nature of Ecosystem Management

Regardless of how an agency or organization chooses to define ecosystem management, many challenges will be faced in attempting to manage natural resources from an ecosystem perspective. By its nature, ecosystem management is complex for a variety of reasons, including the following:

- Managing by ecosystems often coalesces tensions between economic development and environmental protection, which are based on closely held values and philosophies.
- Economic issues associated with ecosystem management can involve entire communities and regions, creating community- and region-wide concerns that must be resolved.
- In managing entire ecosystems, different governmental jurisdictions are often involved (different federal agencies and different levels of government) as well as private landowners, each of which requires cross-jurisdictional cooperation.
- At the heart of many ecosystem management strategies are the issues of land use and land control, which for many is a sensitive issue.

- Ecosystem management decisions are typically fact-driven, based on scientific and economic information, around which common knowledge may be limited and perceptions of uncertainty and risk are prevalent.
- Ecosystem management is often related to other issues such as protection of endangered species, involving other policies and sensitivities that must be addressed.
- Support for, or opposition to, strategies involving ecosystem management is often fractional, even among similar interests (e.g., recreation v. preservation environmentalists, pro-tourism v. pro-development businesses), requiring greater attention to cooperative problem-solving.

Natural resource managers have come to realize that under most circumstances ecosystem management is the best strategy for maintaining or achieving the long-term health of natural systems and the species that inhabit those systems. Since broad-based cooperation is necessary to accomplish these ends, new approaches to involving various stakeholders in the decision-making process are needed. Support across a variety of constituencies and interest groups is increasingly important, if not necessary, to implementing ecosystem management strategies. Even on military lands, the public has shown increased interest in how land and natural resources are managed.

Before discussing collaborative planning strategies, some of the major characteristics of ecosystem management are described in greater detail, underscoring the need for collaborative approaches to planning and problem-solving.

3.2.1 Differing Values and Perceptions

Underlying values held by individuals and organizations create a complex decision- making environment related to managing natural resources. In conflict resolution, divergent values are generally considered to be the most difficult differences to resolve. For example, some individuals and organizations believe the highest and best use of a natural resource is for economic development that creates jobs, family security, prosperity and/or profits. Others place the greatest value on preserving natural resources for the enjoyment of future generations and to maintain a viable and clean environment. These different viewpoints can be the result of deeply held values driven by religious or philosophical beliefs. Typically, they are not easily modified. Likewise, perceptions of uncertainty and risk add to this complexity. For example, perceptions about appropriate locations, quantities and methods for timber harvesting consistent with ecosystem management perspectives are likely to vary widely in any given setting. Perceptions of risk also play a key role: How much risk is acceptable, and what is the risk associated with a specific decision?

In the past, these differing perspectives have been treated as mutually exclusive concepts that can only be resolved by an either-or proposition. Either development or preservation must prevail at the expense of the other. Progress from increased interest in and support for sustainability, however, has led more individuals and organizations to conclude that these issues need not be framed as either-or propositions. Working through these inherent differences in perspectives is now widely considered as possible, yet complex and difficult. Thus, differences in values and perceptions make achieving ecosystem management objectives challenging. Considerable attention must be

given to both understanding the nature of differing perspectives and developing approaches to resolving them.

3.2.2 Competing Missions and Interests

Different organizations and individuals involved with ecosystem management issues often have different missions and interests. For example, the National Park Service incorporates in its mission the responsibility to maintain the resources under its jurisdiction in perpetuity, for the enjoyment of current and future generations. On the other hand, a state natural resource management agency may have as its mission the management of hunting and fishing. Insofar as lands and resources are jointly managed by two agencies for different purposes, or lands managed for different purposes are adjacent to each other, differing missions can create real challenges to accomplishing ecosystem management goals.

Likewise, different organizations and individuals often have competing interests. For example, a controversy emerged during the mid-1990s in a southern national forest when the U.S. Forest Service attempted to implement an ecosystem management strategy. A large timber sale was involved and various state and national environmental organizations took exception to the quantity and method of harvesting that was part of this strategy. On the surface, one would expect environmental organizations to be supportive of ecosystem management strategies. In this particular instance, however, the strategy adopted by the U.S. Forest Service to return to native stands of trees, in part accomplished by the timber harvest, was viewed as an excessive and unacceptable loss of trees in the short term. So while environmental organizations may support ecosystem management generically, the parties had different interests around this specific decision. Thus, the missions and interests of different organizations and individuals must be ascertained so that inherent conflicts can be recognized. Also, the varying interests among local and national organizations must be understood (e.g., local or short-term impacts versus national or long-term implications).

3.2.3 Science-Based Decision-Making

Ecosystem management decision-making relies heavily on understanding the bounds and workings of a given ecosystem. How is a specific ecosystem defined? What comprises the boundaries of a given ecosystem? What are the natural patterns of fire, drought, etc., in a given ecosystem? How can these natural occurrences best be managed? What are the interactions among species, geology, vegetation, etc., that are crucial to maintaining a healthy ecosystem? What are the biological needs of an endangered species for survival? The answers to these and many other questions require scientific knowledge of the ecosystem being managed.

The issues are often made more complex, however, because scientists do not always agree on the answers to these questions. Moreover, as laypersons get involved with the issues, the differences voiced by scientists create added uncertainty about not only the depiction of the natural environment related to ecosystems and species, but also the management of these systems. Thus, differences in knowledge and the interpretation of knowledge creates added complexity. “Dueling scientists” frequently fuel rather than resolve uncertainty.

Another important aspect of this issue is that in situations governed by science-based decision-making, public preferences are often overlooked. Preferences in this instance refers to those values held by various publics. For example, concerns about future economic vitality may overshadow concerns about short-term economic vitality within a specific community. Some communities may accept a certain degree of environmental risk for the economic benefits, while others are not willing to accept that same risk. These "values" need to be incorporated into science-based decision-making.

3.2.4 Place-Based Issues

An inherent but important aspect of ecosystem management is that it relates to a specific place. Associated with that place are site-specific characteristics and issues that may be unique to the location of that ecosystem, from a social perspective. For example, a given location has a history of interactions among people, businesses, government, public organizations and nature itself. Some places are pro-development and other places are pro-preservation. Some places rely on the use or development of natural resources for jobs, whereas in other places the pristine environment serves as the economic engine. Some places have a history of cooperation among different interest groups; other places have a history of animosity. Most places have a combination of both.

Under most circumstances, the challenges of ecosystem management are different from the challenges of public policy issues that are not related to a specific place (e.g., health care reform, tax reform). Ecosystem management decisions have implications on individuals, businesses and governments in a specific place, and often disproportionately. For example, land use decisions often affect those immediately within and around the area more than those farther away, or those in control of the land more than those not in control. In other words, land-use decisions often affect different publics disproportionately. Furthermore, these decisions are increasingly being made by officials in closer proximity to the parties affected by the decisions (as opposed to a more generic policy decision made in Washington, D.C.). This can create a higher level of tension between those making decisions and those impacted by the decisions. These are important dynamics of ecosystem management.

3.2.5 Political and Multi-Jurisdictional Implications

Managing natural resources by ecosystems creates a cross-jurisdictional dimension to decision-making. Under more traditional approaches, the tendency is to manage only those resources under the jurisdiction of a particular government or agency. The boundaries of decision-making were defined by the boundaries of a national forest, for example. Under ecosystem management, however, the ideal intent is to manage an entire ecosystem regardless of jurisdictional boundaries. This leads to the need for different jurisdictions and property owners to work together to accomplish the desired ends of ecosystem management.

The challenges emanating from this reality can be significant. For example, a common attitude among landowners in the west is that the government already controls more land than it should. Efforts to oversee the management of other lands by government agencies as part of an ecosystem management plan may be viewed as just another effort to control more land. Overcoming such attitudes can present a serious challenge to ecosystem management efforts. In some cases,

different government agencies may own land within a prescribed ecosystem along with private landowners. Innovative approaches to cross-jurisdictional cooperation are often necessary.

Sometimes the Federal Advisory Committee Act (FACA) is cited as an inhibitor to innovative approaches involving non-federal persons in providing advice to agencies. Rather, FACA provides the guidelines that must be followed in engaging broader "publics" in formulating plans or policies. It is not necessarily a constraint. An FACA Committee can provide the mechanism for a full array of stakeholders to be involved in a collaborative process where advice will be given to the government. Differentiating planning from policy-making, however, can be important in establishing a multi-stakeholder group, and may forestall the need for an FACA committee. Federal agencies vary widely in their interpretation of FACA and their willingness to undertake efforts to establish FACA processes.

The political implications of ecosystem management also need to be considered. Once different jurisdictions are involved, political forces may play a larger role in the decision-making process. While politics can play a role under any circumstances, the likelihood is increased when a wider array of jurisdictions, landowners and interest groups are involved. Potentially, politicians and political strategies can dominate fact-based or interest-based approaches. While this can have negative implications to sound decision-making, political leadership is essential to successful applications of collaborative planning and policy-making processes. Thus, significant attention must be given to the political aspects of these processes and to gaining political support.

3.3 Addressing the Challenges of Ecosystem Management Through Collaborative Planning

Ecosystem management is a holistic approach to managing natural resources. As more is known about what is required to manage natural resources properly for the long term, managing entire ecosystems has become the preferred strategy under most circumstances. Achieving ecosystem management while meeting the needs for "present and future mission requirements" adds yet another level of complexity. Furthermore, the memorandum on implementing ecosystem management states that ecosystem management within DoD will include: an ecological approach, cross-jurisdictional partnerships, public involvement, information exchange and adaptive management.

If ecosystem system management practices are to be successfully applied, the associated complexity must be effectively addressed. Given the nature of these challenges, cooperative approaches to stakeholder involvement in the planning process is crucial. Collaborative planning is one approach that has worked effectively in a myriad of situations, including ecosystem management. This section discusses the attributes, boundaries and incentives to using collaborative planning.

Although ultimate decision-making authority typically resides with the agencies charged with responsibility for the resources, there is still a role for other stakeholders. Interested publics with a stake in the outcome should be engaged in a manner that ensures all substantive interests have been acknowledged and addressed to the extent possible. To exclude the key stakeholders will likely result in resistance at the points of either adopting or implementing subsequent policies. The

consequences are legal gridlock, animosity and the expenditure of significant resources to resolve the issues.

Collaborative planning can help minimize these consequences by incorporating elements of public scoping, joint fact-finding, mutual education of interests and perspectives, interest-based negotiation and consensus-building. It should be an open process in which key stakeholders are active participants in the planning and problem- solving process. Under many instances third-party facilitators/mediators can be used as a way of assuring an open and legitimate process as perceived by all stakeholders. (Third-party refers to a facilitator/mediator who is not directly associated or aligned with any of the potential participants in the process.)

It is important to note that not all issues lend themselves to collaborative problem-solving and negotiation. For example, if a key stakeholder group believes that any further loss of redwoods is unacceptable, they would not likely participate in an effort to plan a redwood timber harvest. In other situations, the need for or existence of legal precedents may influence the decision of stakeholder groups to engage in negotiations and collaborative problem-solving. However, since collaborative planning is intended as an up-front planning process to explore and examine issues, the conditions under which it is considered unacceptable or undesirable are relatively few. Nonetheless, collaborative processes should not be assumed to be appropriate for every situation. Without key stakeholders participating, the legitimacy and implementability of outcomes is questionable.

The reasons for using a collaborative planning process are largely substantiated by the complexity of ecosystem management and the necessity to address a wide array of concerns held by different agencies, communities and publics, as have been previously highlighted. In essence, those publics who are impacted by a decision, who are necessary to implement a decision or who are able to block implementation should be engaged. Several obstacles exist, however, to the use of collaborative planning.

As discussed earlier, an agency must have the incentive to attempt new approaches to resolving issues of public interest; so must those individuals within an agency who are responsible for such processes. As the limitations of more traditional approaches to public participation are increasingly exposed, there is a greater incentive to try new methods. Innovative approaches are needed to respond to the greater accountability required by the public in the 1990s. However, if those responsible for public outreach have concerns about the likelihood of success, or are uncomfortable with a new scheme of doing things, the processes are less likely to be used. Discomfort with new approaches can be a formidable obstacle to overcome. Therefore, the "comfort zone" of users needs to be expanded. This is why organizational leadership and support for collaborative processes is essential. Otherwise, the likelihood of accruing the potential benefits from these processes is greatly diminished.

Assuming that the arguments for using approaches such as collaborative planning are accepted, a series of other potential obstacles must be addressed. In large part, misconceptions or myths about collaborative processes stand as obstacles, particularly from the perspective of those in agencies responsible for decision-making. Seven "myths" are described below, misconceptions that potentially thwart the use of collaborative processes. Recognizing these perceptions when they

exist, and working through the realities of these perceptions, are important steps in moving forward with collaborative approaches to problem-solving. Listed below are some common misconceptions and suggestions for addressing them.

1. **Collaborative processes empower others, thereby reducing my power.** The only way this can be a valid concern is if power is a zero-sum issue. Zero-sum means that in order for one party to gain power, another party must lose power. The assumption is that only so much power exists, and that the main issue is who has it. Research and experience demonstrate, however, that in the arena of negotiation and collaborative problem-solving, power is not a zero-sum proposition. While some organizational leaders and others in positions of power work under the premise that sharing power means losing power, it is not a valid premise. For example, if a politician or administrator with responsibility for a complex and potentially controversial issue can develop a consensus by allowing stakeholders to be involved in the problem-solving process, they will actually gain power by having a consensus solution to a difficult issue. Obtaining that consensus, however, involves sharing power with the stakeholders by allowing participation in the decision-making process. Sharing power often results in each party increasing in power, a clear demonstration that power is not a zero-sum issue.

2. **Collaborative processes undermine my authority/responsibility.** Another common misconception is that engaging in collaborative processes will undermine the authority or responsibility of those charged with making decisions or managing resources. This is a misconception in the arena of public policy and resource management because collaborative processes cannot be designed to set aside legally delegated decision-making authorities. When agencies open up the decision-making processes to other parties, the ultimate outcome must be approved, consistent with existing regulations and policies, by the responsible agency or agencies. If the process recommends a modification in how specific issues are managed or regulated, then other processes (e.g., regulatory reform) become activated, still under the delegated authorities. Most collaborative processes represent a way in which responsible authorities can enhance decision-making through consensus-building without abdicating their responsibility for decision-making. Collaborative processes therefore do not undermine authority or responsibility. It is possible that a collaborative process may shift the locus of decision-making within an agency (e.g., the level at which a policy determination must be made), but that is a different issue and the responsibility still resides with the agency.

3. **Collaborative processes indicate my inability to solve the problem.** Often, managers and leaders do not want to utilize a collaborative process, potentially including an outside facilitator/mediator, because they believe that such a process only demonstrates their inability to solve the issue. This tends to be particularly so in organizations that operate on more of a command-and-control basis. Under these circumstances, personnel may feel even greater pressure to exhibit individual leadership and the ability to unilaterally resolve the toughest of issues. For example, in the military everyone must answer up the chain of command. Traditionally, using a collaborative approach to decision-making would indicate a failure to make an executive decision. Experience shows, however, that a different kind of leadership is required with complex, multi-party issues. More

and more, governmental agencies that historically have worked under a command-and-control organizational culture are recognizing the limitations of that philosophy, particularly when dealing with the public and issues of public concern. Properly designed and conducted collaborative processes can in fact demonstrate far greater leadership abilities than trying to solve issues internally and unilaterally without input from the affected publics.

4. **Collaborative processes put decision-making in the hands of the public and non-experts.** Some natural resource managers want to limit public involvement in decision making processes. The public, it is assumed, generally does not understand the issues fully, nor can they be expected to grasp the complexity of the issues. Resource management questions should be resolved by those with sufficient technical and scientific appreciation of the issues and their possible solutions. Experience again demonstrates, however, that this is not a valid perception. On the surface it makes perfect sense that technical issues be resolved by those with technical knowledge. The problem with thinking that only the "experts" should be in the position of controlling the outcomes of public issues, however, is that the public has a significant role to play. Informed publics typically ask tough questions and insert public values into the equation. Experts in geology and structural engineering can identify the best place on a river to build a dam. But in a democracy the public must pose questions about the need for the dam, the impact of the dam on the environment and the benefits of the dam. Furthermore, when trade-offs must be made, the public must have a role in identifying the trade-offs and placing value on those trade-offs. In the public arena, scores of examples exist where a government agency tried to anticipate the public concerns without involving the public in an effective manner, only to be tied up in the courts trying to validate processes, assumptions and solutions that emanated from those assumptions. Rather than avoiding interfacing with the public, a sound program for involving affected publics in collaborative processes will lead to a more informed public, a more informed decision and a greater degree of public support for the ultimate outcomes.

5. **Collaborative processes result in a loss of control that will jeopardize the outcomes.** This is a misperception that grows from the overriding desire, or habit, of trying to be totally in control of any situation. Fearing the loss of control is subtly different from the issues of power and authority. One can feel no threat of loss of power or authority and still want to be in control. In fact, one can maintain a certain degree of control using collaborative processes under nearly any circumstances as an organization or individual convening a collaborative process. But perhaps more importantly, one can experience the value of not needing to be in total control while still having the interests of the organization met. Often, as with power, giving control away results in outcomes that would otherwise not be possible, that meet the needs and interests of all the affected parties more effectively and that are more likely to be implemented. The ensuing result is a net benefit to the organization. A distinction needs to be made between oversight and control. Administrative oversight of a collaborative process is the responsibility of the sponsoring organization, to the extent practical in partnership with the other participants in a collaborative process. Trying to exert excessive control on a collaborative process diminishes the likelihood of success. This dynamic needs to be

directly discussed and resolved with those who want to exercise tight control over a collaborative process.

6. **Collaborative processes require compromising my values.** It is a common perception that negotiation requires compromise. As such, some avoid consensus-oriented processes for fear of having to compromise their principles or values. In fact, consensus-building is not about compromising closely-held values but about working through potentially different interests. Trade-offs of interests are typically required, meaning, for example, that an individual or organization may agree to a higher timber quota than desired in return for higher set-asides for wilderness in another area. As another example, an individual or organization may agree to the development of one site in exchange for preserved wetland acreage at another site. The focus, and trade-offs, involve the interests of the parties rather than the underlying values. The compromise of values is not the intent of collaborative processes but rather the resolution of issues given the realistic assessment of how the issues would be resolved in the absence of a collaborative process. While litigation has been, and continues to be, the preferred alternative of some individuals and organizations, the uncertainty of outcomes under most circumstances, and the toll imposed on relationships, should make litigation the alternative of last resort. The focus of collaborative planning, however, is to work on issues before polarization occurs, in a proactive rather than reactive mode.

7. **Collaborative processes are too much like a group encounter session.** Some individuals try to avoid the use of consensus processes because they perceive such processes involve overly personal encounters. While the human dimension of policy-making is an important part of collaborative processes, well-designed processes are deliberative and intended to focus on issues. Joint fact-finding, where all the parties jointly gather and assess information, is a common part of many collaborative processes. Technical studies and information exchange often form the backbone of collaborative and joint problem-solving processes. The focus of these processes is typically on substantive issues and their resolution. Collaborative processes involve building trust, sharing values and developing personal relationships, but all in the context of problem-solving and decision-making.

These common misconceptions, if not dealt with directly and forthrightly, can stifle the use of collaborative processes. They can also act to undermine the implementation of these processes. By realizing that some of the fears perceived about collaborative processes are basically unfounded and unwarranted, organizations can move forward in realizing the many benefits that accrue from using them.

Another category of obstacles to consider are those related to individuals and organizations who might serve as participants in these processes. These are the obstacles perceived by the various publics who are potential stakeholders in these processes. Following are five basic issues, and suggestions for addressing them.

1. **Limited available personnel within environmental and other non-profit organizations.** Many non-profit organizations operate with limited numbers of people

assigned to specific issues. As such, limitations to participation are often encountered, particularly with those national organizations asked to be involved in numerous "advisory" processes. These organizations tend to participate only in those processes where a high probability of explicit benefits is perceived. Other organizations which rely primarily on volunteers encounter even more serious problems of participation. Therefore, attention should be given to helping potential participants appreciate why it is to their advantage to participate even under conditions of limited personnel.

2. **Unbalanced resources among different participants.** Often, individuals and organizations question whether they should participate in processes in which they perceive they will be disadvantaged by an imbalance of resources. For example, sometimes smaller organizations with limited resources perceive they will be at a disadvantage in comparison to businesses with greater resources to participate. To counter this perception, which may be realistic, resources can often be provided to help disadvantaged organizations participate on a more level basis in terms of technical and financial support.

3. **Lack of perceived benefits and incentives.** In some cases, stakeholders or those important to implementing potential outcomes do not perceive that the benefits of participation outweigh the costs. In other cases, incentives are not perceived as sufficient to warrant participation. In these cases, it may be necessary to clarify the benefits that will accrue from their participation, or what will likely happen in the absence of their participation. When stakeholders conclude that the costs outweigh the benefits, and incentives are not sufficient, participation from those parties is unlikely. The consequences of their non-participation must be evaluated and incorporated into decisions about whether and how to proceed.

4. **Cultural differences that create disincentives for participation.** Often, collaborative processes are designed without sufficient attention to the impacts of cultural differences on participation. Cultural differences lead to varying perspectives about deadlines, organizational representation and other protocols that may be part of collaborative processes. Thus, greater attention should be given to creating processes that do not exclude meaningful participation due to fundamentally different, culturally-based perspectives. This suggests that effort be given to understanding how best to involve people of different cultures. Without doing so, a collaborative planning process stands to be de-legitimized.

5. **Uncertainty about collaborative processes.** The mission of many interest groups is built around advocacy for a specific set of concerns, or a desire to protect against certain threats. Under either condition, these groups are accustomed to acting as strong advocates for a particular point of view. Confusion often exists around participation in collaborative processes: Will strong positions need to be abdicated? Can an advocacy group have its needs met by such a process? Will such a process undermine the organization's mission? In some cases, organizations have answered negatively to these questions and resist participation. Since these and other concerns can stand as a barrier to participation, they must be understood and resolved among all potential stakeholders, often by evaluating the alternatives to and impacts of not participating.

It is clear that to maximize the probability of success, individuals or organizations convening collaborative planning processes must be attuned not only to the internal obstacles to convening a process, but to those obstacles affecting broader participation in the process.

3.4 Applying Collaborative Planning to Ecosystem Management

This section describes the various considerations in preparing for and implementing a collaborative planning process. Collaborative planning represents a valuable tool for dealing with the complexities of ecosystem management issues and, if properly designed and conducted, can help resolve the issues that often stand in the way of accomplishing ecosystem management objectives. The key is to involve, early in the process, the parties who have a stake in the outcome, who are necessary to implementation or who can block implementation of an ecosystem management plan. Collaborative planning, as the term suggests, is a planning process which should be conducted early in the developmental stages, not waiting until polarization of issues occurs or until a plan is already formulated or ready to be implemented.

3.4.1 Primary Characteristics of Collaborative Planning

As indicated earlier, collaborative planning draws from several disciplines, including strategic planning, public involvement, negotiation, consensus-building and mediation. This explains in part why differences exist in defining collaborative planning. At a minimum, however, it is important to note what should and should not be considered collaborative planning, and to define the linkages to the disciplines noted. In general, collaborative planning processes should draw from these disciplines in the following ways:

- **Strategic planning:** establishing a joint vision; assessing information and resources; defining goals and objectives; creating a joint sense of purpose.
- **Public involvement:** identifying interest groups and affected publics; increasing an understanding of public perspectives; increasing pubic awareness of the sponsoring party's interests; creating forums for meaningful public input.
- **Negotiation:** identifying areas of agreement and disagreement; identifying common and diverging interests; developing mutually acceptable solutions built around an understanding of each party's interests; assuring appropriate representation of affected publics.
- **Consensus-building:** approaching the process by trying to address the concerns of each party, even if a lone voice; seeking the development of outcomes that are acceptable to each party; identifying at the outset of the process how to deal with non-consensus, if it occurs.
- **Mediation:** using a neutral third party to help legitimize the process and assure participants that the process is not "captured" by the sponsor; allowing the sponsoring party to be a full participant in the process; helping identify participants and appropriate representation; helping to frame the issues and work through differences; helping to

conduct joint fact-finding and problem-solving; helping to brainstorm options for mutual gain; helping to structure implementation plans.

Collaborative planning processes should draw on these disciplines in the ways noted. By integrating the various facets of these disciplines, a clearer picture is drawn of what comprises collaborative planning. At the same time, each collaborative planning process will be different given the issues, the participants and the intended objectives.

Collaborative planning processes should be comprised of three stages: 1) issues assessment and process preparation, 2) joint problem solving, and 3) implementation.

Phase 1: Issues assessment and process preparation. Before any collaborative process is designed or implemented, a thorough and deliberate assessment of the issues, interest groups, internal and external incentives, internal and external obstacles and objectives should be conducted. Only then can the process be designed, at which point potential participants should indicate their willingness to participate and be involved in establishing meeting protocols.

Phase 2: Joint problem-solving. The problem-solving phase is comprised of the meetings which bring all the participants together to clarify issues and individual interests, brainstorm options for mutual gain, conduct joint fact-finding, evaluate options, prepare plans and policy recommendations, and frame agreements. In the context of ecosystem management, ecological risk assessment is the type of issue which lends itself to joint fact-finding and problem-solving, and the formulation of policy alternatives.

Phase 3: Implementation. The implementation phase is the most frequently overlooked element of a collaborative process. At the point where agreements are reached on plans, policies or strategies, an implementation plan should be developed. This provides a mechanism for assuring that agreements are realistic and viable, and details the tasks, resources and deadlines necessary to implement the agreements reached. Without attention to this phase, agreements often languish, leave the desired outcomes unachieved and frustrate the participants.

A common mistake in conducting collaborative processes is to place most of the attention on the problem-solving phase, when in reality the assessment and implementation phases are at least as crucial to the success of collaborative processes.

3.4.2 Initiating a Collaborative Planning Process

To maximize the probability for success, several factors should be considered when initiating a collaborative process. It is helpful to consider these from the standpoint of what it takes to make collaborative processes work. The following three issues should be evaluated, internal to a convening organization, to determine whether to proceed with a collaborative process.

1. **Support exists from leaders within the convening organization.** Support of organizational leadership is essential. Collaborative planning requires working with individuals and organizations in new ways. It requires a degree of openness and transparency to which organizations and leaders may be unaccustomed. This may place pressure on both individuals and organizations to perform in new ways, which requires the support of organizational leaders to reinforce. Organizational leaders also need to be in the position of approving potential plans and agreements that come from the process, and implementing them. Without support of organizational leaders, the likelihood of this occurring is significantly diminished.

2. **Incentives are present for both the sponsoring organization and stakeholders to undertake the process.** Both convening and participating organizations need to have ample incentive to undertake the effort required of a collaborative planning process. This is particularly true of collaborative planning processes. In conflict-resolution processes, the need to resolve conflicts acts as an inherent incentive. For a planning process, however, more attention needs to be given to outlining clearly why it is in everyone's interest to engage in such a process. If groups do not have an incentive to participate, it is unlikely they will do so.

3. **An appropriate match exists between process objectives and the use of collaborative planning.** This is a crucial point in evaluating whether to use a collaborative process. Often, organizations are not clear about what they want to achieve, but think a collaborative process is desirable, given the increased popularity and use of these processes. In fact, a more traditional public involvement program may be what is actually needed, or a public education program, or perhaps even a public relations campaign. Great care must be taken to match objectives with the appropriate process. Trying to use a process portrayed as collaborative for reasons other than truly collaborative, or in a manner other than truly collaborative, results in negative public perceptions and undermines legitimate collaborative processes. Disingenuous motives are quickly perceived as various publics gain experience with truly collaborative processes. Thus, before initiating a collaborative process, convening agencies should be sure it appropriately matches the process with desired objectives.

Once the decision is made to proceed, based on affirmative responses to the above criteria, the next step is to determine whether a neutral facilitator/mediator is advisable. Examples of situations where an independent facilitator/ mediator might not be required include "internal" processes (as opposed to those involving a range of stakeholders) when the sponsoring agency is not a direct party to the issues or implementation strategies, or when the agency is in the position of a mediator by virtue of their relationship to the parties.

When multiple organizations and individuals are part of a collaborative process, it is advisable under most conditions to engage a professional facilitator/mediator. Many other conditions might also warrant the involvement of an independent facilitator/ mediator. As discussed earlier, an "outside" facilitator/mediator helps assure participants that the collaborative planning process will be open and genuine, and not excessively controlled by the organization convening the process. A mediator can help the sponsoring agency to be an active participant in the process

while it retains the role of informing participants when the limits of regulations, policy mandates and/or resources are being approached. An experienced mediator can improve communications and build trust where such are needed. Likewise, the mediator can conduct, or help conduct, the issues assessment and then be prepared to help design the process and assure appropriate participation. An appropriate first action is to have the mediator assess the status of the three criteria listed above to assure a neutral perspective on the issues.

After determining whether to use an outside mediator, an issues assessment should be conducted which forms the basis for designing the collaborative planning process. Thus, after the decisions are made whether to proceed with the process and use a facilitator/mediator, the following steps should be followed in initiating a collaborative planning process. If an outside facilitator is not used for some reason, it is even more important that this planning and preparation process be conducted openly, incorporating consultation with the full range of stakeholders. Many collaborative processes have failed due to inadequate planning, the inability to overcome historical distrust or animosity among potential participants, and the absence of a skilled, neutral process facilitator to help plan and conduct the process.

1. **Conduct a thorough process assessment, which under most circumstances is the most important step towards success of collaborative processes.** A detailed assessment of the objectives, issues, incentives, potential interest groups and potential conflicts is necessary before any activity related to the collaborative process proceeds (including scoping meetings). This is necessary also as the basis for designing the collaborative planning process and obtaining commitments of key stakeholders to participate. Under most circumstances, particularly those involving a wide range of publics, the assessment should be conducted by a neutral facilitator/mediator.

2. **Design the collaborative planning process.** The collaborative planning process should be designed by an experienced facilitator/mediator. The process design should be based on stakeholder objectives, issues, relationships, deadlines, the likelihood of conflict and potential sources of conflict, and political realities, among other factors. In essence, the design should be based on the assessment. The recommended process could be a short and intense meeting similar to a retreat, a series of meetings in a short time-frame, a more prolonged process with regular, less intense meetings (to allow sufficient time for trust-building, fact-finding, etc.) or a hybrid of these.

3. **Determine the willingness of the key stakeholders to participate in a collaborative process, and obtain commitments to do so.** Based on the design of the process and clarifying the objectives and time-frame of the process, potential participants should be asked for a commitment to participate. In order to proceed, all the major stakeholder groups should be willing to proceed, or at a minimum, not object to the process proceeding. Obtaining commitments of the key stakeholders is essential to the success

of the process. They should also have an opportunity to provide input on the objectives and issues addressed by the process, as well as the process itself.

4. **Establish an agenda for the first meeting of all participating stakeholders, with their input.** The last step in initiating the process is establishing an agenda that clarifies the purpose of the first meeting, conveys commitments by the convening organizations and other participants, and details the intent of the first and subsequent meetings. All participants in the process should have some input into the agenda for the first meeting, as well as subsequent meetings.

The degree of formality associated with any given collaborative planning process can vary depending on the complexity of the issues, the number of stakeholders, any legal mandates, any political implications, the relationships among the stakeholders, and any previous attempts to solve the issues, among other factors. Collaborative planning processes can range from a few informal meetings conducted by the convening entity with identified interest groups to highly structured processes guided by a professional facilitator/mediator. A common mistake, however, is to convene meetings before all these issues are fully evaluated. Experience has shown that underestimating the importance of these first seven steps and overlooking the value of conducting an unbiased assessment can be costly.

Many attempts to conduct collaborative processes have been initiated by a convening agency deciding to simply "pull together a few people" with known interests for a discussion. Without a full assessment of the implications of doing so, however, convening organizations many times have unintentionally handicapped processes eventually undertaken, and thus added an unnecessary degree of difficulty to conducting a successful process. As such, a cardinal rule in conducting collaborative processes is to never convene a meeting until all the preparation work, as represented by the above seven steps, is conducted. This will assure that even the more informal processes will have a higher likelihood of meeting intended objectives.

3.4.3 Conducting Joint Problem-Solving

Once the assessment phase is complete and the first meeting convened, the collaborative planning process is in its second phase: joint problem-solving. Good relationships must be forged and numerous activities conducted before joint problem-solving occurs. Whether the purpose of the process is to develop some common visions for the future, or to develop and implement strategies for dealing with issues of common concern, joint problem-solving is required.

The following steps are common to joint problem-solving:

1. Clarify process objectives for all stakeholders.
2. Use visioning or other similar tools, identify the interests and concerns of all stakeholders.
3. Develop agreements in principle on both substantive and process issues.
4. Clarify common and differing interests related to process objectives.

5. Identify issues to be resolved.
6. Brainstorm possible options based on objectives, issues requiring resolution and an understanding of stakeholder interests.
7. Identify data/information necessary for evaluation and decision-making, and design and conduct joint fact-finding.
8. Establish evaluation criteria as the basis for evaluating options.
9. Develop integrative solutions to meet process objectives and stakeholder interests using consensus-building tools, guided by evaluation criteria.
10. Frame agreements and draft details on how to proceed with implementing agreements.

These are the typical steps involved with joint problem-solving. Numerous tools have been developed to assist parties with each phase of this process. Process tools include a wide range of activities designed to enhance creative thinking and assessment such as visioning, collaborative learning, values mapping, force field analysis, preference ranking, and computer-assisted idea generation. The list of these kinds of tools is nearly endless. Other tools include using computer models for simulating natural conditions under various conditions as the basis for assessing alternatives and using single negotiated texts for formulating agreements. Interagency agreements and interorganizational pacts also can play a role in implementing plans and agreements. The tools must match up with the objectives, available information and desired outcomes.

3.4.4 Assessing Progress

Collaborative planning processes are typically complex, given the numerous issues and interest groups typically involved. It is sometimes difficult to assess how these processes are progressing, since interpersonal relationships and trust are such important components and often take some time to develop. Therefore, it is helpful to be able to evaluate potential measures of success as the process proceeds. Too often, convening organizations, as well as other participants, become frustrated when progress is not immediately evident. Realistically, however, many of these collaborative processes involve overcoming past relationships which may be strained due in part to more adversarial approaches that previously characterized interactions among participants. As such, time should be considered an ally and not a deterrent, as increased understanding of different viewpoints progresses, along with the development of relationships. Within this environment, to counter the frustration sometimes encountered, the following seven criteria can be used to measure progress:

1. Widespread and committed participation among all stakeholders, and increased agency coordination and cooperation, are evident.
2. The interests of all participants are clear, and participants are moving past position-taking as the basis of discussions.
3. Differences among the stakeholders are being honestly and forthrightly clarified and candidly addressed.

4. Participants are demonstrating an increased understanding of others' viewpoints and concerns.
5. Joint problem-solving is a reality, in that stakeholders are working on solutions that represent mutual gains.
6. New ideas are emerging for dealing with the tensions between development and preservation of natural resources that are characteristic of ecosystem management.
7. At a minimum, broad agreements in principle are being formulated, both substantive and procedural.

If some of these characteristics can be observed, progress is being made. If not, increased attention may need to be given to reinforcing the incentives for participation and clarifying why stakeholders should not only continue to participate but make greater effort to work through differences together.

3.4.5 Implementing Agreements

The implementation phase of collaborative processes is the phase most frequently overlooked or underemphasized. So much attention is given to reaching agreements that implementation is often given little energy. Yet, without clear delineation of how agreements will be implemented, they may fall apart if the reality of deadlines, re-allocation of resources, developing new resources, establishing new policies, etc. are not clearly addressed. Thus, an agreement should not be considered complete until the issues of implementation are directly incorporated into the agreement. The elements of an implementation plan include identification of the following:

- Tasks and deadlines, including contingencies that may be part of the agreement
- Individuals/organizations who will be responsible for the tasks identified
- Individual(s)/organization(s) who will oversee implementation
- Mechanisms for evaluating the agreements to assure that they are meeting the intended objectives
- Mechanisms for refining the original agreement(s) if warranted

At the closure of the joint problem-solving phase, the mechanisms for continuing with the implementation phase must be clearly identified and put in place so that no discontinuity exists between these phases of the process. Without explicit attention given at the beginning as well as later in the process, implementation of agreements will likely be undermined. Resources also need to be allocated for implementing agreements and evaluating the outcomes over time.

3.5 Summary: Integrating Collaborative Planning with Ecosystem Management

Ecosystem management represents a relatively new direction in the way natural resources are managed. It embodies the principles of sustainable development and builds on long-term, holistic perspectives considered necessary for effective resource management. Ecosystem management presents many challenges because it often requires cross-jurisdictional cooperation, involves potentially significant economic implications, embodies closely held values among various stakeholders, and builds on technically-based understandings of how various ecosystems operate.

Collaborative planning refers to a myriad of approaches that incorporate multi-stakeholder participation in planning and decision-making. It builds on the concepts of joint planning and problem-solving, addressing issues before polarization occurs to prevent the need for other, more adversarial forms of resolving differences. As such, the use of collaborative planning is an effective approach for dealing with the complex issues of ecosystem management.

DoD Ecosystem Management Principles and associated policies clearly mandate the use of collaborative processes in achieving natural resource management objectives through ecosystem management. It is therefore imperative to understand how best to plan and implement collaborative processes. This will present some specific challenges related to developing and embracing new ways of doing business. If appropriate attention is given to the constraints and strategies for success that have been outlined, the rewards of using collaborative approaches will be significant by many measures.

To work effectively, collaborative planning must have the support of leaders in all participating organizations, beginning with the sponsoring organization(s) at the highest levels of leadership. This support is essential when the challenges of cross-stakeholder collaborative processes are encountered. Under most circumstances, it is advisable to use an "outside," neutral facilitator to conduct the assessment phase as well as the joint problem-solving phase of the process. A facilitator/mediator can help assure that the process is appropriately matched to the intended objectives. This adds credibility to the process and helps create an open, transparent process that is crucial to participation by other stakeholders.

Collaborative planning can deal with framing inter-agency cooperation and coordination among agencies. It is particularly helpful among agencies or organizations with little history of cooperation. Collaborative planning can help surface issues, concerns and interests between stakeholders. It can help define commonly held visions and work through differences. It can help facilitate joint fact-finding and joint problem-solving that focuses on developing options for mutual gain. It builds on the propositions that economic and conservation concerns are not mutually exclusive, and that win-win solutions are possible even with the difficult issues associated with ecosystem management.

Four recommendations are proposed for moving forward with the application of collaborative planning to ecosystem management:

1. With the assistance of an experienced mediator/facilitator, convene a meeting of top DoD leaders to discuss new approaches (such as collaborative planning) to involving affected publics and stakeholders in ecosystem management and other such issues. If support is forthcoming, it should be demonstrated through memoranda reflecting upper echelon support for collaborative processes, policy guidelines indicating how to initiate collaborative processes, internal review/promotion policies that encourage using new approaches, etc.
2. Commit to negotiation/collaborative problem-solving education and training for personnel who interface with the public or other agencies/jurisdictions, or who would be responsible for administering or overseeing collaborative processes.
3. Identify several possible situations where collaborative processes might be helpful; work with an experienced mediator/facilitator to identify one or two appropriate pilot projects and initiate the assessment/design process for those projects.
4. Commit to evaluating the pilot projects as the basis for ongoing learning and improving future efforts involving the public and other agencies/jurisdictions in planning and decision-making; use the results to refine education/training curricula designed for installation level personnel, as recommended above.

These recommendations provide a blueprint for beginning the process of integrating collaborative planning principles into DoD activities related to ecosystem management and other similar issues.

3.6 General References for Additional Reading

Cortner, Hanna J. and Margaret A. Moote. *Trends and Issues in Land and Water Resources Management: Setting the Agenda for Change*. Environmental Management. Vol. 18, No. 2.

Fraley, John. *Cooperation and Controversy in Wilderness Fisheries Management*. Fisheries. Vol. 21, No. 5, May 1996.

Goldstein, Bruce. *The Struggle Over Ecosystem Management at Yellowstone*. BioScience. Vol. 42, No. 3, March 1992.

Gray, Barbara. Collaborating: Finding Common Ground for Multiparty Problems. Jossey-Bass. San Francisco, 1989.

Ingram, Helen, et. al. *Managing Transboundary Resources: Lessons from Ambos Nogales*. Environment. Vol. 36, No. 4, May 1994.

Riebsame, William, E. *Ending the Range Wars*. Environment. Vol. 38, No. 4, May 1996.

Roy, Mike and Hank Fischer. *Bitterroot Grizzly Recovery: A Community-Based Alternative*. Endangered Species UPDATE, University of Michigan. Vol. 12, No. 12, December 1995.

Slocombe, Scott D. *Implementing Ecosystem-Based Management*. BioScience. Vol. 43, No. 9, October 1993.

Selin, Steve and Deborah Chavez. *Developing a Collaborative Model for Environmental Planning and Management*. Environmental Management. Vol. 19, No. 2.

Walker, Gregg B. and Steven E. Daniels. *Public Deliberation and Public Land Management: Collaborative Learning and the Oregon Dunes*. Oregon State University, November 1994.

U.S.D.A. Forest Service. Collaborative Planning: Sustaining Forests and Communities. FS-578, Ongoing Series.

3.7 Briefing Slides

CHARACTERISTICS OF COLLABORATIVE PLANNING

1. Integrates tools and techniques from strategic planning, public involvement, negotiation, mediation and consensus-building processes
2. Is more than enhanced cooperation and coordination between/among agencies: involves representatives of all key stakeholders in the process
3. Is more than traditional public participation, engaging participants meaningfully in joint problem-solving
4. Uses consensus-based approaches as the means to problem solving and decision-making

ECOSYSTEM MANAGEMENT IS COMPLEX FOR A VARIETY OF REASONS

1. The attempt to manage ecosystems often coalesces tensions between economic development and environmental protection, which are based on closely held values and philosophies.
2. Economic issues can involve not only individual businesses but entire communities and regions, creating community- and region-wide concerns that must be resolved.
3. Different governmental jurisdictions are often involved, as well as private landowners, each of which requires cross-jurisdictional cooperation.
4. At the heart of many ecosystem management strategies are the issues of land use and land control, which are sensitive issues for many.
5. Decisions are typically fact-driven based on scientific and economic information, around which common knowledge may be limited and perceptions of uncertainty and risk are prevalent.
6. Ecosystem management is often related to other issues, such as the protection of endangered species, which involve other policies and sensitivities that must be addressed.
7. Support for, or opposition to, strategies is often fractional, even among similar interests requiring greater attention to cooperative problem-solving.

CHALLENGES TO RESOLVING ECOSYSTEM MANAGEMENT ISSUES

1. Differing Values and Perceptions
2. Science-Based Decision-Making
3. Place-Based Issues
4. Political and Multi-Jurisdictional Implications
5. Competing Missions and Interests

MYTHS ASSOCIATED WITH COLLABORATIVE PLANNING

1. Collaborative processes empower others, thereby reducing my power.
2. Collaborative processes undermine my authority/responsibility.
3. Collaborative processes indicate my inability to solve the problem.
4. Collaborative processes put decision-making in the hands of the public and non-experts.
5. Collaborative processes result in a loss of control that will jeopardize the outcomes.
6. Collaborative processes require compromising my values.
7. Collaborative processes are too much like a group encounter session.

OBSTACLES TO PARTICIPATION

1. Limited available personnel within environmental and other non-profit organizations
2. Unbalanced resources among different participants
3. Lack of perceived benefits and incentives
4. Cultural differences that create disincentives for participation
5. Uncertainty about collaborative processes

PRIMARY CHARACTERISTICS OF COLLABORATIVE PLANNING

1. **Strategic Planning:** establishing a joint vision; assessing information and resources; defining goals and objectives; creating a joint sense of purpose.
2. **Public Involvement:** identifying interest groups and affected publics; increasing an understanding of public perspectives; increasing pubic awareness of the sponsoring party's interests; creating forums for meaningful public input.
3. **Negotiation:** identifying areas of agreement and disagreement; identifying command and diverging interest; developing mutually acceptable solutions built around an understanding of each party's interests; assuring appropriate representation of affected publics.
4. **Consensus-Building:** approaching the process by trying to address the concerns of each party, even if a lone voice; seeking the development of outcomes that are acceptable to each party; identifying, at the outset of the process, how to deal with non-consensus, if it occurs.
5. **Mediation**: using a neutral third party to help legitimize the process and assure participants that the process is not "captured" by the convener; allowing the convening party to be a full participant in the process; helping to identify participants and appropriate representation; helping to frame the issues and work through differences; helping to conduct joint fact-finding and problem-solving; helping to brainstorm options for mutual gain; helping structure implementation plans.

PHASE OF COLLABORATIVE PLANNING

Phase 1: Issues assessment and process preparation. Before any collaborative process is designed or implemented, a thorough and deliberate assessment of the issues, interest groups, internal and external incentives, internal and external obstacles and objectives should be conducted. Only then can the process be designed, at which point potential participants should indicate their willingness to participate.

Phase 2: Joint Problem Solving. The problem-solving phase is comprised of the meetings which bring all the participants together to clarify issues, individual interests, brainstorm options for mutual gain, conduct joint fact-finding, evaluate options, prepare plans and policy recommendations, and frame agreements. In the context of ecosystem management, ecological risk assessment is the type of issue which lends itself to joint fact-finding and problem-solving, and the formulation of policy alternatives.

Phase 3: Implementation. The implementation phase is the most frequently overlooked element of a collaborative process. At the point where agreement are reached on plans, policies or strategies, an implementation plan should be developed. This provides a mechanism for assuring that agreements are realistic and viable, and details the tasks, resources and deadlines necessary to implement the agreements reached. Without attention to this phase, agreements often languish and leave the desired and anticipated outcomes unachieved.

INITIATING A COLLABORATIVE PLANNING PROCESS

1. Support exists from leaders within the convening organization.
2. Incentives are present for both the convening organization and stakeholders to undertake the process.
3. An appropriate match exists between process objectives and the use of collaborative planning.
4. Conduct a thorough issues assessment, which under most circumstances is the most important step towards the success of collaborative processes.
5. Design the collaborative planning process.
6. Determine the willingness of the key stakeholders to participate in a collaborative process, and obtain commitments to do so.
7. Establish an agenda for the first meeting of all participating stakeholders, with their input.

CONDUCTING JOINT PROBLEM-SOLVING

1. Clarify process objectives for all stakeholders.
2. Using visioning or other, similar tools, identify the interests and concerns of all stakeholders.
3. Develop agreements in principle on both substantive and process issues.
4. Clarify common and differing interests related to process objectives.
5. Identify issues to be resolved.
6. Based on objectives, issues requiring resolution, and an understanding of stakeholder interests, brainstorm possible options.
7. Identify data/information necessary for evaluation and decision-making, and design and conduct joint fact-finding.
8. Establish evaluation criteria as the basis for evaluating options.
9. Using consensus-building tools, guided by evaluation criteria, develop integrative solutions to meet process objectives and stakeholder interests.
10. Frame agreements and draft details on how to proceed with implementing agreements.

ASSESSING PROGRESS

1. Widespread and committed participation among all stakeholders, and increased agency coordination and cooperation, are evident.
2. The interests of all participants are clear, and participants are moving past position-taking as the basis of discussions.
3. Differences among the stakeholders are being honestly and forthrightly clarified, and candidly addressed.
4. Participants are demonstrating an increased understanding of others' viewpoints and concerns.
5. Joint problem-solving is a reality, in that stakeholders are working on solutions that represent mutual gains.
6. New ideas are emerging for dealing with the tensions between development and preservation of natural resources that are characteristic of ecosystem management.
7. At a minimum, broad agreements in principle are being formulated, both substantive and procedural.

WHAT ARE THE ELEMENTS OF AN IMPLEMENTATION PLAN?

1. Tasks and deadlines, including contingencies that may be part of the agreement
2. Individuals/organizations who will be responsible for the tasks
3. Individual(s)/organization(s) who will oversee implementation
4. Mechanisms for evaluating the agreements to assure that they are meeting the intended objectives
5. Mechanisms for refining the original agreement(s) if warranted

CHAPTER 4. MISSION IMPLICATIONS OF REGIONAL SCALE ENVIRONMENTAL PLANNING

4.1 Introduction

4.1.1 Background

The federal government has retained about a third of the nation's total land area for various purposes. The Army manages about 12 million of the approximately 25 million acres of federal land controlled by the military. This land provides a venue for training and equipping the armed forces. Department of Defense (DoD) facilities constitute a small percentage of the total federal land; however, many of these installations are surrounded by developed land and are therefore disproportionately important to the health and viability of the ecosystems that contain them.

The Army recognizes its civic and military responsibility to protect and improve environmental quality, aesthetic value, and healthy ecological relationships in order to maintain the value of its land for public and military purposes. The Army has traditionally managed its land for multiple uses, including timber production, agricultural outleases, and recreation, as well as for military mission purposes. Like all Army responsibilities, natural and cultural resource management is subject to programming and budgetary constraints. It is subject to priority decisions at all levels from Headquarters, Department of the Army, to the Director of Public Works at each installation and is, therefore, like other functions, often not fully funded.

Prior to 1960, the Defense Department was exempt from most natural resource planning and protection requirements out of deference to military missions such as training and testing. As relatively undisturbed natural habitat became increasingly scarce in the United States, the priority for its protection rose, leading to the passage of the Sikes Act in 1960. This law authorized and encouraged, but did not require, the armed services to conserve fish and wildlife and, where compatible with the military mission, to allow public access to outdoor recreation. In the 36 years since the passage of the Sikes Act, such pressures as a rising population and agricultural and industrial development have continued to impinge on wildlife habitat, leading to increasingly stringent protection laws and regulations. The Endangered Species Act of 1973 (ESA), for example, requires federal agencies to protect habitat as well as threatened or endangered species and establishes procedures for consultation with the Fish and Wildlife Service if a proposed activity may harm listed species. For the Army, this activity normally consists of training units, testing equipment, or constructing facilities. The ESA is a powerful statute and has stopped or reshaped many significant federal, including Army, activities. It is, however, a blunt instrument and is often criticized as reacting to failure rather than preventing it. Thus, during the last decade, ecologists have developed the theories and language of conservation biology, and natural resource policy-makers have attempted to keep pace with new management approaches that focus on the viability of ecosystems rather than on political boundaries or individual species.

In the early 1990s, various federal agencies established ecosystem management policies and joined other agencies to develop common definitions and procedures. In September 1993, Vice President Al Gore's National Performance Review recommended the development of a "cross-agency ecosystem management process" (Gore 1993). Shortly thereafter, the Interagency Ecosystem Management Task Force was constituted "to restore and maintain the health, sustainability, and biological diversity of ecosystems while supporting communities and their economic base." This task force, made up of assistant secretaries from 12 departments and agencies (including one from DoD) has established a vision of natural resource management that is collaboratively developed and defined by ecological, not political, boundaries. Subsequently, each federal department and agency has developed its own definition of ecosystem management and four pilot projects have started.

The Sikes Act Improvement Amendments (H.R. 1141) also reflect the trend toward integrated management of natural resources. These amendments have been introduced, but not passed, by the last two Congresses and would require Army Integrated Natural Resource Management Plans (INRMPs) to be approved by the Secretary of the Interior and appropriate State agencies. While this amending legislation has not yet been passed by the Congress, it is another indicator of the trend toward a more integrated management of natural resources.

4.1.2 Objective

This paper outlines the factors that must be examined to determine the impact of a particular land or natural resource management approach on an Army installation's mission capability. The military is unique among federal government land managers. Land use is vital to the national defense mission of the armed services, but land management is not its primary mission, as it is with most other agencies that manage federal land. Thus, a management approach or requirement at a particular location that may be acceptable to the Forest Service or the Department of Interior agencies might significantly hinder an Army installation mission capability.

Ecosystem management is still defined with a broad brush. It is still in its formative stage; therefore, agency differences, reflecting their different missions, have not yet generated significant conflicts. As the pressure to manage federal lands with an increased priority on natural resource protection continues, resulting in legislation or an Executive Order, the Army must develop a systematic method for analyzing the potential impact of this change on mission accomplishment. This paper reviews installation mission activity, current natural resource management practices, the application of ecosystem management as it can be determined from current publications, and projects that may illuminate some of the issues. From this review, the paper will present a set of factors and an outline for analyzing them to determine the mission impact of a particular ecosystem management approach.

4.2 Installation Missions

4.2.1 Overview

The typical Army post consists of a small city with housing, commercial, and light industrial components; a road, rail, and air transportation infrastructure; and a large, relatively undeveloped area for training, testing, or storage. Army installations cover a wide range of activities, sizes, and locations, from Walter Reed Army Medical Center, with 315 acres in downtown Washington, D.C., for example, to White Sands Missile Range, with almost 2 million acres, 27 miles from Las Cruces, NM. There are approximately 100 major installations in the United States, each usually responsible for two or more sub-installations.

Within a typical Army post's perimeter the land can be "owned" by the Army, other federal agencies, the State, or private individuals. Lands may be leased, loaned with a special use permit, or withdrawn for military use from other agencies by an Act of Congress. Each installation is subject, in different ways, to the laws and ordinances of the state and surrounding communities; jurisdiction varies widely.

Installations are big business. Out of a total annual budget of $60 billion, the Army spends about $9 billion on installations. With a large and aging infrastructure, Army installations are facing many of the same repair and maintenance problems that afflict civilian communities. The maintenance and repair backlog, $4.6 billion in FY94, has grown so large that it is no longer stated as a single statistic.

With the end of the Cold War, Army installations entered a period of extreme turbulence. Units have been disestablished; divisions have returned from overseas; installations have closed, causing a reshuffling of tenants; most remaining installations have changed their strategic focus; civilian and military manpower has been greatly reduced; and funding has evaporated. The Army must now balance its training and readiness requirements with the conservation of natural and cultural resources.

The following sections summarize the major activities at the largest Army installations. This list focuses on installations that have significant land area, that is, the major troop installations, training schools, and testing facilities. Industrial and administrative activities generally have an insignificant impact at the ecosystem level, or have unique environmental challenges that confound generalization.

4.2.2 Training

Most Army installations use undeveloped land principally to support the field training requirements of combat and supporting units. Were it not for this training requirement, most Army posts could divest themselves of the bulk of their natural resource inventory. But the peacetime mission of the Army is to train, and no substitute has been found for going to the field to practice required wartime capabilities.

Training by armored units generates the Army's greatest cumulative disturbance to natural resources. Tank, mechanized infantry, self-propelled artillery, and combat engineer units are extremely mobile because of their tracked vehicles. These vehicles are also heavy, fast, and capable of producing significant physical damage to the natural environment in a very short period of time. While these units provide the most dramatic potential for natural resource disturbance, other units and types of training can also contribute to environmental degradation.

For example, light infantry units can move through an area with virtually no impact; however, they must be trained to dig in—to prepare field fortifications—which can alter vegetation, drainage, and wildlife patterns. Engineer units must practice obstacle construction, demolition, and road building and maintenance. Logistics units must learn to operate in a field environment where they set up a small town with trucks, and sometimes tracked vehicles, to practice light industrial operations. Helicopters must practice hovering and landing, which often cause soil erosion and create vegetative bare spots from rotor downwash. Units must learn to operate in all climates and in all types of terrain, from mountain to desert, in jungles, and across beaches and frozen tundra. All this activity develops necessary skills but often results in natural resource destruction.

Training facilities at a typical troop unit or school post consist of:

- Classrooms and open areas within the cantonment area for developing individual, staff, and basic small unit skills
- Motor pools, where maintenance and other skills such as crew drills may be practiced
- Small areas close to the cantonment area for command post exercises and unit drills
- Small arms ranges, often close to the cantonment area
- Large maneuver areas, perhaps 50-100 thousand acres, for full-scale exercises at battalion and brigade levels
- Large impact areas for artillery, mortar, air defense, aerial rocket, tank, and anti-tank weapons, and other high-explosive systems

The Army increasingly uses simulators to develop individual and collective skills prior to practicing unit operations on the ground. Simulators have matched weaponry in technology and sophistication and have become an integral part of Army training strategies. Increasingly, systems are purchased with training devices already imbedded. While simulators reduce the time that individuals or units might otherwise have spent in the field, and thereby reduce consequent environmental damage, countervailing factors exist. The number and complexity of missions have increased; equipment is heavier, faster, and allows more independent movement; and communications and weaponry have greatly expanded the area of a battalion's influence. While simulators can teach skills, only field experience can train leaders in the "art" of tactical command and prepare a unit to accomplish its mission in the dark, the rain, the mud, or whatever conditions obtain. To the extent that time and funding will allow, field training will be a continuing requirement for the Army.

The typical Army post supports many more units than are physically stationed at the installation. Reserve components—both Army Reserve and National Guard—will frequently train at the nearest installation that has sufficient land to accommodate them. Other services and federal agencies also may use such post training facilities as small arms, aerial weapons, or demolition ranges.

The end-state damage sustained by a training installation's natural resources is determined by the fragility or robustness of the natural resources themselves and the type and number of units, type and length of training, weather conditions, recovery potential of the area, and the land and wildlife protection and maintenance procedures in effect. Environmental impacts of training include vegetation destruction, soil compaction and erosion, increased suspended solid levels in streams and lakes, increased levels of volatile organic compounds (VOC) and particulates in the air, elevated noise levels, and occasional loss of wildlife. On the positive side, military control of a training area precludes development. Even with limited and controlled recreational uses, military maneuver areas are free of human activity most of the time; impact areas are free almost all of the time.

The Army views protection of natural resources as more than a civic duty. It has established a substantial body of policy and procedures as well as a professional force of land managers to provide the necessary management and expertise. Its leaders are beginning to recognize that training lands are not totally renewable resources. In 1994, the Army training community formally took, from the engineering community, responsibility for the condition of training areas. It is funding efforts to determine the carrying capacity of training areas and to link environmental conditions and costs to specific training densities.

4.2.3 Testing

Providing reliable equipment and weapons for the Army requires constant research, development, acquisition, and evaluation. All these activities require testing facilities. Most evaluations take place at the eight testing centers of the Test and Evaluation Command (TECOM), a Major Command of the Army Materiel Command (AMC). Of these centers, the most significant are the proving grounds at Aberdeen, MD; Dugway, UT; and Yuma, AZ; and the missile range at White Sands, NM. The others are collocated with other Army installations. The TECOM conducts tests and simulations across the full spectrum of environments (arctic, desert, tropical, underwater, and live fire).

The U.S. Army is the most technologically advanced army in the world. Its technology and its superior training are the foundation of its consistently high degree of performance and the primary reasons for the quick resolution and limited casualties in Panama, Iraq, Haiti, and other locations of recent conflict.

Army testing provides an independent assessment of materiel and weapons, verifies their safety, and meets congressional requirements for live fire testing of vulnerability and lethality. Tests must replicate the most destructive forces on the battlefield while protecting the testers and the environment. This often requires innovative and expensive apparatus to contain toxic materials such as chemical agents and heavy metals.

Materiel testing often requires large areas to provide realistic conditions and sufficient buffer zones for noise, safety, and security. Land used for evaluating weapons and ammunition will often be contaminated with explosives and become unusable for other purposes.

In addition to materiel testing, the Army performs operational testing—testing new equipment or concepts in the context of a field exercise, using operational units of various sizes. These tests are normally conducted within a training installation's maneuver areas and are similar, from an environmental perspective, to training exercises.

4.2.4 Maintenance

With the exception of a few small administrative facilities, all Army installations include maintenance activities. Troop unit posts with heavy units such as armored or mechanized divisions or brigades, and training schools such as the Armor School at Fort Knox, Kentucky and the Artillery School at Fort Sill, Oklahoma, have dozens of motor maintenance facilities which repair and maintain armored vehicles. They also contain large, installation-level, maintenance facilities that include a whole range of industrial activity, from foundries to laboratories.

Maintenance facilities can impact the natural environment by discharging hazardous wastes such as oils, acids, heavy metals, paints, and solvents during diagnosis, repair, and testing. Army maintenance facilities now include oil/water separators as a part of the standard design in the parking hardstands and the maintenance bays. Underground storage tanks (UST) are being pulled up, as required by law, and when replaced, are being replaced with above ground tanks. Wash racks for heavy vehicles are now designed with recirculating pumps and filters, to reduce the amount of water used and to eliminate contaminated effluents.

Aircraft maintenance facilities (the Army has more than 7,000 aircraft) mirror ground vehicle facilities in the use and potential for spill of hazardous materials. In addition, aircraft test flights often take place over maneuver areas. There are some indicators that helicopters can disturb certain bird species at critical times during the year.

Because of the level of hazardous materials used in maintenance activities, the Army has integrated environmental protection training into the basic and advanced training programs for these occupational specialties.

4.2.5 Housing, Community Support and Offices

All major Army posts provide housing and community support facilities for assigned personnel and other military families that live in the area. The number of people living on the post varies widely with the mission of the installation and the availability of private housing in the vicinity. A typical troop installation looks like a small city with a full range of community support.

Normal military activity at an Army installation requires office buildings for the installation and tenant unit staffs, and light industrial activity such as photo labs, warehouses, commercial motor pools, museums, and classrooms.

Housing consists of barracks for troop units, apartment-type complexes for assigned and visiting personnel, and family quarters in the form of single-family dwellings, duplexes, townhouses and apartments. Community support includes hospitals, police and fire stations, shopping malls, daycare centers, gas stations and garages, schools, parks, gymnasiums, bowling alleys, crafts shops, auto and woodworking shops, swimming pools, and other recreational facilities.

Army posts have the same environmental concerns and programs as any small city: municipal solid waste, recycling, drinking water quality, stormwater and wastewater systems, asbestos, lead, radon, construction waste, pest control, and other pollution control activities.

4.2.6 Mobilization

About half the Army is in the reserve components: the Army Reserve and the National Guard. Reserve components frequently train at Army posts and may expand the population of the installation by a significant percentage, especially in the summer. During periods of national emergency, a partial or general mobilization will cause reserve component units to muster at their mobilization stations. Since many such stations are Army installations, a mobilization or reserve call-up may double or triple a particular post's population.

Many installations store reserve component equipment for training and mobilization. Reserve component units will draw this equipment, or will take over the equipment of an active unit already deployed overseas to draw pre-positioned equipment. Reserve units may be housed in otherwise unused barracks, in tent cities, or in barracks vacated by deployed active component units.

Training activity will increase to the maximum level the installation can support. Maneuver areas and firing ranges will be scheduled around the clock. Environmental carrying capacity of the training facilities would, at most installations, be immediately exceeded.

The massive population and activity increases will cause the typical post to exceed permit limits in many areas: industrial, water, stormwater, landfills, air, water, and special use of training lands belonging to other agencies. If a form of regional ecosystem management is in place, mobilization would probably require special variances to permitted activity.

4.2.7 Deployment

The end of the Cold War has forced the Army to revise its strategic purpose and focus. Previously, the Army was a "forward deployed" force, that is, a large proportion of the Army was stationed very close to where the most significant combat might occur. Today, the Army has drawn back most of its forces from overseas and has either disbanded them or stationed them in the continental United States (CONUS). This requires the Army to become a "force projection" army. Installations must become capable of rapidly deploying stationed and mobilized forces and supplies.

During deployment for a contingency mission or for training, the installation must plan, generate, and provide for a high volume of transportation activity. Road, air, and rail facilities will

become crowded for extended periods; normal activities will be suspended. Staff and command activities will be directed toward, and focused on, the deployment mission.

Activities associated with deployment have a high potential for pollution. Units muster; draw special equipment, ammunition, and supplies; pack unit and individual equipment in vehicles and special containers; and move to marshalling areas. Heavy equipment and vehicles marshall in areas that are often closed during normal operations. Roads, railheads, and airports are crowded with troop units. Units clear and depart permanent facilities generating large quantities of solid, often hazardous, wastes.

4.3 Current Natural Resource Management

4.3.1 Policy

Army natural resource management policy is established by Army Regulation 200-3 which requires installation commanders "to plan land utilization to avoid or minimize adverse effects on environmental quality and provide for sustained accomplishment of the mission." The commander is further told to protect wildlife, habitat, and threatened or endangered species, and to use the land for production of food, fiber, and timber products, "consistent with the assigned military mission and conservation of healthy ecosystems and biodiversity." In addition, commanders must provide for recreational use of land and water areas—again, without impairment of the military mission.

The basic policy regulation outlines program analysis, funding, land and forest management, fish and wildlife management, and outdoor recreation, as well as protection of endangered and threatened species. Basic criteria for an integrated natural resource management plan are established. Installations are directed to "cooperate" with the Fish and Wildlife Service and the host state to plan, maintain, and coordinate fish and wildlife management activities on the installation.

Commanders are also directed to implement an Integrated Natural Resources Management Plan (INRMP) and are authorized, in accordance with multiple Memoranda of Agreement, to execute cooperative agreements with all of the various federal and state natural resource agencies and The Nature Conservancy (TNC).

4.3.2 Procedures

Each installation employs a professional natural resource manager and staff, or is provided that support from a servicing installation. The number of natural resource professionals at an installation varies greatly, depending on the resources, the management difficulty, and the priorities of the particular installation and the Major Command (MACOM).

Funding is provided through the normal installation and MACOM programming and budgeting process. The base operations account used to fund the particular installation generally provides the natural resource management funds as well. Thus, natural resource management is subject to the same prioritization process as all other installation mission activities and, in addition, is subject to the Department of the Army environmental funding categories that create priorities for

"compliance" projects. During the last few years, special earmarked "Legacy" funds have been made available from the Office of the Secretary of Defense for some specific projects. Natural resource funding is, thus, neither simple nor protected.

Natural resource managers normally operate in close cooperation with other federal and host-state land management agencies. Often, installation lands actually belong to another agency and are used by the Army under a special use permit. Although cooperative agreements are voluntary, many installations have them and work within the region's habitat, game, and wildlife priorities. Resource management goals are usually the same or similar; however, land uses differ and can lead to differing approaches toward the goals.

Consultation with other agencies and public inclusion in the decision process are often required by existing laws such as the National Environmental Policy Act (NEPA) and the ESA. For example, a base realignment action normally requires an environmental impact statement and may involve formal consultation with the Fish and Wildlife Service (FWS) over endangered species issues. Under an endangered species management plan, activities such as forest management, training, burning, and endangered species activities will have to be integrated. The installation INRMP will be evaluated in this consultation process and accepted (or rejected) by the FWS as a part of its Biological Opinion

4.3.3 Sikes Act Issues

The Sikes Act Improvement Amendments of 1995 specifies multi-purpose use and wildlife-oriented recreation to be management objectives for each installation INRMP, and requires public comment on the plan and FWS approval. In addition, the Secretary of the Interior must annually report on expenditures on conservation activities conducted pursuant to the INRMPs. This act is currently stalled because of disagreements between DoD and the International Association of Fish and Wildlife Agencies, representing state game and wildlife managers, regarding approval authority over the INRMP. In effect, the new amendments would force a form of ecosystem management on DoD by appointing, in law, the FWS and the states as primary natural resource managers of DoD lands.

The Army, and the other services, are reluctant to give up control of training and testing lands to state and federal agencies with different missions.

4.4 Ecosystem Management

4.4.1 Definition

An ecosystem may be defined as all the interacting populations of plants, animals, and microorganisms occupying a volume, or area, along with the physical environment of the area. Ecosystems are usually classified according to structures that have both physical and biological components. Physical components include landforms and water systems, while biological components include the living organisms within the defined volume. Both physical and biological

components are developed and maintained through various processes among the components, such as weather, nutrient cycles, and dispersion and succession patterns.

An ecosystem can exist on any scale, from a drop of water to a planet, and normally interacts—for example, an ecosystem may interact with other ecosystems by providing moisture or nutrients across borders. A large ecosystem will contain multiple smaller ecosystems and will overlap with other large ecosystems. An ecosystem is, therefore, not a true system, because it is not closed. This causes difficulties in developing definitions with the precision required for most management structures.

The foundation of ecosystem management is found in the theories of "conservation biology" with its concepts of forest fragmentation, edge effects, island biogeography, historic range of variability, patch size, and biological corridors. The goal of ecosystem management is biodiversity—another term that is more conceptual than precise.

All four of the primary federal land management agencies and DoD have announced that they are now, or will soon, begin implementing ecosystem management—as a process. There is almost universal agreement that ecosystem management must become the organizing principle for future land management paradigms.

4.4.2 Application

Ecosystem management, if incorporated into natural resource law, could fundamentally change the way land is managed. However, neither the legal mandates of the land management agencies nor the federal environmental regulatory programs are written to incorporate ecosystem or biodiversity principles. Forest Service and the Bureau of Land Management (BLM) lands are to be managed for multiple uses, including emphasis on commodity production. The Park Service and the FWS, on the other hand, manage their lands primarily for conservation purposes. DoD manages its lands for national security purposes with a secondary mission of multiple use and conservation. Traditionally, the managers and scientists of each agency were trained to accomplish the agency mission with little interagency communication. Different perspectives by the agencies are evident in the definitions of ecosystem management as emphasized below.

- The BLM sees it as an integration of principles to manage systems in a "manner that safeguards the long-term ecological sustainability, natural diversity, and *productivity* of the landscape."
- The Forest Service believes that it is an approach that blends "the needs of people and environmental values" to achieve healthy, *productive*, and sustainable ecosystems.
- The FWS emphasizes "*protecting or restoring* the function, structure, and species composition of an ecosystem."
- The National Park Service sees it as a "philosophical approach that *respects all living things and seeks to sustain natural processes* and the dignity of all species."

- DoD and the Interagency Ecosystem Management Task Force definition, in a less poetic but more pragmatic style, sees it as a "goal driven approach to restoring and sustaining healthy ecosystems...using the best science available."

There is almost unanimous agreement that ecosystem management is the right thing to do. Unfortunately, agreement on ecosystem management procedures will be more difficult to obtain. Not only do federal and state agencies differ in management goals, strategies, and cultures, but the whole management system must also encompass the private sector, where broad philosophical disagreements over fairness to individual people versus species protection.

The Government Accounting Office has identified four practical steps that must be taken before the basic principles of ecosystem management can be implemented (GAO 1994):

1. Ecosystems must be delineated; you cannot budget for management until you describe the unit to be managed. However, different agencies often employ different data standards and resource classification systems. For example, the FWS identifies ecosystems with watersheds, while the Forest Service use physiography, soils, and natural communities.
2. The ecology of the ecosystem must be understood based on the best available scientific data. In most areas, ecological and economic data is outdated, filled with gaps, and unavailable in a format common to all agencies.
3. The desired future ecological condition must be identified initially; however, disparate agency missions, cultures, and planning processes already present significant hurdles before the private sector can even be considered.
4. Adaptive management must be used; the planning requirements of various federal statutes (including NEPA) and the inertia of most bureaucratic processes will severely limit the flexibility required for true adaptive management.

Even within a single agency, translating the agreed-upon principles into a set of managerial guidelines will be difficult. For example, within DoD, Department of Defense Instruction 4715.3, Environmental Conservation Program, provides guidelines for developing ecosystem management at DoD installations. These guidelines are extremely broad and generally take the form of desirable end-states rather than specific tasks. For example, the Services are told that a "key element" of ecosystem management and biodiversity conservation is to "integrate ecosystem management with mission readiness in the context of a shrinking DoD land base and budget."

Of the ten principles and guidelines for ecosystem management, two (1,3) state goals, three (2,7,9) provide broad strategies, and the remaining five suggest procedures. The procedural guides, however, provide little assistance to the Services in resolving the most basic issue: priority. Principle 5 tells installation commanders to "Develop priorities and reconcile conflicts." This advice is key, of source, since Principle 4 requires a shared vision, and Principle 6 directs the development of a detailed ecosystem management implementation strategy based on that vision. There is no guidance for the installation commander, however, in those circumstances where the visions of all interested parties do not coincide. Principle 5 suggest that "regional workshops should be convened periodically

to ensure that efforts are focused and coordinated." Commanders with readiness responsibilities are not going to be inclined to depend on regional workshops as a conflict-resolution methodology. The difficult, but critical, guidance on how the installation commander can resolve a conflict between his mission responsibilities and various stakeholder desires is not offered.

While federal agencies will probably not be in a position to establish management rules that will seriously implement ecosystem management in the immediate future, there is little disagreement that regional planning will eventually become a reality. Already, other federal or state agencies can assume a primary role in natural resource management by using current laws, such as the ESA. In the near future, the Sikes Act could be amended with provisions like the current bill that would require Department of the Interior approval over DoD management plans. At any time, the Executive Order, recommended by the National Performance Review, could be drafted and signed using the general principles already established.

Under these circumstances, it is prudent for the Army to develop ways to assess the potential impact of an ecosystem management regime on mission activity at a typical installation. Since there are no practical examples of ecosystem management, the following section reviews some regional planning efforts that have incorporated military installations.

4.5 Ecosystem Management: Examples

Some experts describe ecosystem management as a philosophy, or simply as a way of looking at management choices. As a management system it is still too new to have formed hard rules, and doing so will be difficult since the goal-oriented principles published by government agencies do not easily translate into techniques. To gain insight, it is useful to examine instances where a form of ecosystem management is actually being used. The following applications illuminate some of the issues that may arise for an installation considering a new form of resource management—regardless of whether compliance is compulsory or voluntary.

4.5.1 The Chesapeake Bay Agreement

The latest federal initiative for regional cooperation in the Chesapeake Bay Program is the Agreement of Federal Agencies on Ecosystem Management in the Chesapeake Bay, signed on July 14, 1994. The Army and the other services were signatories. This agreement is a follow-on to prior DoD and Service agreements with other federal agencies to assist in the restoration of Chesapeake Bay. It supports the Chesapeake Bay Program, an agreement among the states of the region and EPA, originally signed in 1983. The federal agreement lists areas of cooperation among federal agencies and provides some specific goals.

This initiative and the preceding DoD agreements on the Chesapeake have not had a significant impact on the 21 Army installations within the watershed. From the installation's perspective, environmental requirements generally fall into two categories:

1. Pollution prevention required by Executive Order, state law, or local ordinance
2. Initiatives generated by the installation as a part of the program

The original and amended state agreements require each state to establish specific management practices and limits to reduce pollution in the Chesapeake. Installations in the watershed must comply with those laws and regulations which pertain to wastewater treatment effluents, stormwater runoff, construction BMP, the use of pesticides, and other practices that can lead to increased nutrients, sediments, or toxic substances flowing into the Bay. Installations can fund these requirements as Category 1 projects.

Initiatives generated by the installations, MACOM, or service headquarters are generally funded or assisted by the Army Environmental Center and usually represent little or no shifting of priorities or resources at the installation. Since senior officials have obligated the Army to participate, installations that do face significant expenditures have sought additional funding from their higher headquarters.

From a management perspective, the Chesapeake Bay Initiative's most significant result is the growth in partnering relationships among the agencies. Army installations have assisted other agencies with available resources, for example providing research assistance to study submerged aquatic vegetation, in exchange for receiving a wastewater treatment plant assessment by a recognized expert in the field. Ecosystem management aims to leverage resources—this has been a positive outcome of the Chesapeake program.

The primary focus of this initiative, so far, has been to control effluents. Installations have generally been able to obtain funds for required projects, and few requirements have had appreciable impact on the activities on the installation. At this point, the program has not caused sufficient disruptions to installation missions to provide useful insights into conflict resolution.

The Chesapeake Bay Program and its various agreements is an example of ecosystem management in its formative stage. It is also constrained by the size of the ecosystem and the number of political jurisdictions and installations it encompasses. It therefore focuses on communications and research and lacks specificity in requirements.

4.5.2 The Mojave Desert Ecosystem Initiative

In Southern California's Mojave River watershed, rapid population growth has resulted in increased recreational use of the fragile desert ecosystem. In response, the State of California organized the various governmental land agencies to voluntarily start managing the Mojave natural resources in a cooperative way, prior to the passage of the California Desert Protection Act of 1994. With the passage of the Act, a new alliance was forged using the funds in the Act and the management

system already in place. Since the military manages about 25% of the land in the Western Mojave, it was concerned that if it did not become an active participant, the other stakeholders would begin to exert pressures on military installations, adversely affecting their missions. Department of Interior planning in the Mojave Desert includes the lands under the jurisdiction of the services. It became clear that the long-term capability of the military installations in the Mojave to accomplish their readiness missions depends on the health of the entire ecoregion.

The Mojave Desert Ecosystem Initiative (MDEI) currently focuses on identifying existing data and building a database. Funding is provided from Legacy funds with the Army (Fort Irwin) as the federal project leader. The initial effort aims to develop the scientific base necessary to establish the ecosystem management process. Phase I of the project links a geographic information system (GIS) network to all the military installations and allows California and the Department of Interior access to the network. The next phases include the building of the database.

The goals of the MDEI are to:

- Establish a broad-based partnership
- Foster cooperation and communication
- Reduce duplication
- Leverage resources
- Enable sound, scientifically based decision-making
- Sustain human enterprises as well as natural and cultural resources

All agencies approach these tasks focusing on different missions:

- BLM: grazing and mining
- FWS: protecting species
- California Natural Resources: managing wildlife
- Cities: providing housing, services, and economic growth

All of these priorities compete for the same resources: land and water. Conflicts are inevitable. The MDEI will provide an excellent laboratory for addressing the conflict-resolution and priority issues that must eventually be resolved for ecosystem management to work.

The primary lesson learned in this initiative, so far, is that differences in agency personalities and missions must be reconciled before significant progress can be made toward common goals. Agency cultures often provide and define the issues. For example, the decision-making processes differ between DoD organizations and Interior organizations. A true partnering relationship is also difficult to establish between a service-purchasing agency and a service-providing agency. Many government agencies, state and federal, now depend on reimbursable work for other government

agencies. A true partnership is difficult to establish today, with an agency that will be in competition for your dollar tomorrow.

4.5.3 The Missouri Coordinated Resource Management (CRM)

The Missouri CRM coordinates the ecosystem management efforts of the state and federal agencies in Missouri and involves the citizens in the decision-making process (Parker 1996). The Army's Fort Leonard Wood is contained within the management area and voluntarily recognizes the state as the primary natural resource manager.

Currently, seven major state and federal agencies have signed a Memorandum of Understanding (MOU). These agencies make up the CRM Interagency Committee. Although Fort Leonard Wood is not a signatory to the MOU, the Corps of Engineers is, and Fort Leonard Wood abides by the natural resource management guides of the state. Participating agencies are under no legislative mandate and can withdraw from the process at any time.

Ninety-three percent of Missouri's land is privately owned, so landowner input is critical. Since private landowners participate in achieving CRM objectives on a strictly voluntary basis, public input and education and information programs have become key elements. Public input during open public meetings allowed each region to develop a prioritized "top ten issues" list. This prioritization gives a significant boost to the planning process and allows the plans to focus on goals that are meaningful for conservation and useful for management.

The Missouri CRM is apparently working well for the ten regions in Missouri, and is assisting Fort Leonard Wood resource managers by helping to coordinate the various federal and state agencies that influence or direct the Fort Leonard Wood program.

The salient features of the CRM:

- Participation is voluntary.
- Large private landholdings require significant public input.
- The ecosystem is fairly robust and heals rapidly; population density is relatively low.
- Regional planning allows prioritization and specificity in goals.

4.6 Conclusions and Recommendations

Ecosystem management, as currently practiced, is too broad in scope to warrant generalized conclusions. Each installation and region has attributes and difficulties that will require unique solutions. From the above examples, however, we can draw inferences about factors that make establishing a regional management system more difficult.

Clearly, the ecosystem's resiliency and current distress level are significant elements in developing the management process and facing the inherent challenges. These elements must be

measured, usually through expensive database development, and then used to educate the public and the agencies involved.

It is not counterintuitive that the scarcity of particular resources, relative to the demand for them, is directly reflected in the level of complication and controversy to be expected. The Forest Service had the dubious distinction of implementing one of the most high-profile ecosystem management efforts—the Federal Ecosystem Management Assessment Team (FEMAT)—created to solve the spotted owl vs. timber crisis in the Pacific Northwest. The FEMAT alternative choice, based on analysis of biological and socioeconomic science, aimed to balance the need for a healthy ecosystem with the community economic requirements, but resulted in immediate lawsuits from both the environmentalists and the timber industry.

Voluntary agency participation, public education and inclusion in the decision-making process, and planning at the local level are positive factors present in a successful system. From the installation perspective, the level of funding support it receives may be critical to its successful inclusion in good ecosystem management.

4.6.1 Factors to Consider

Ecosystem management is a reality. The question for the installation commander is not whether, but when and how. Most installations are already engaged in some form of regional resource planning and the trends indicate an increasing involvement. As installations consider voluntary linkage with regional planning systems or must attempt to negotiate procedures for mandatory controls, the following factors help analyze the impact on the installation.

4.6.2 Costs and Funding

What will be the direct costs associated with the planning system? In most cases, the first cost will be for surveys and inventories required to develop the necessary databases. Databases must be shared, and this may require significant expenditures for new information systems or conversions.

Regional planning and management may require changes in effluent standards, requiring new wastewater treatment systems or erosion control measures to be implemented.

Some costs may be avoided. Ecosystem management often involves partnering, which may leverage resources not previously available to the installation. Threatened and endangered species require special measures by federal agencies; regional plans may provide some flexibility and relief to the installation.

Installations need to know the source of the required additional funds. Whether additional funding will be available through the budget process is sometimes dependent upon the reasons for the new management scheme. For example, is the installation compelled by law or regulation or is its participation voluntary? The funding process itself must also be assessed for its compatibility with ecosystem management requirements such as adaptive management.

4.6.3 Management Requirements

Ecosystem management requires increased information and knowledge as well as new managerial techniques. The new management system may require dedicated time and personnel from the installation. These are all translatable to costs, but it may be useful to consider this particular requirement separately, as human resources and funding are often not directly tangible.

A commitment to ecosystem management will probably mean that the installation's natural resource manager will be required to enter, and perhaps lead, significant negotiations on behalf of the installation. This may require increased grades, experience, staff, and technical support.

4.6.4 Mission Impact

Mission Impact is the most critical factor and the most difficult to assess. It will be installation-unique, depending on: the particular mission of the installation—training, testing, storage, administration, etc.; the most critical environmental factors likely to be impacted—habitat protection, air or water quality issues, threatened and endangered species (TES), noise, outleases; and the availability of resources and flexibility to respond to new environmental requirements.

A significant difference between military installations and other land management agencies is that the military use of the land does not directly require ecosystem health to the extent that the others do (BLM mineral resources management and exploitation excluded). This fact, and the absolute necessity for training in the field at distances approximating doctrinal requirements, are not always evident to other agencies that may have a primary responsibility for land management in a region.

A training installation deprived of a considerable percentage of its maneuver area either in space or time, may suffer a significant decrease in its mission capability but will not be able to accurately measure that degradation in ways that are meaningful to the public or other land managers. Conversely, an installation may be able to protect its natural resources for the long term and thus avoid mission deterioration by using the resources and flexibility afforded by a regional management approach. Regional planning may protect the installation from loss of training areas due to noise, TES, fugitive dust, water quality, or flooding, for example.

4.6.5 Flexibility

Flexibility has two components of interest to the installation commander. The first is the management system's flexibility to allow changes in environmental law and regulation constraints in order to achieve balance within the ecosystem. For example, the installation may be granted less binding standards in one area, such as endangered species, to accommodate installation requirements or because the installation is providing more than its fair share of environmental benefit in another area. This may depend upon the public and resource manager's acceptance of the installation mission as a social necessity.

The second aspect of flexibility pertains to the management system's capacity for dealing with changes in the mission, troop density, equipment, training procedures, or other factors in the installation's operation. Army posts often undergo significant changes in mission requirements and force structure as a function of national security decisions made in Washington. The installation commander must estimate the proposed management system's flexibility to accommodate changes in mission as well as MACOM or Headquarters, Department of the Army's willingness to recognize the installations position in the ecosystem.

4.6.6 Skill Development

Ecosystem management may require the installation to change how it accomplishes its mission. New skills may be required of troops, small unit leaders, commanders, and installation staff. The natural resources staff and the garrison commander may need new and significantly different training. Most installations are in the training business; however, the training required to participate in ecosystem management may require commitments from the Army to develop requisite skills before an installation can endorse a particular management proposal.

4.6.7 Control

One of the key questions for the installation to answer will be how decisions are to be made. Ecosystem management guidelines and principles do not address this. The DoD guidelines imply that decisions will be made in workshops. Installation commanders cannot accept this lack of specificity. The installation analysis will require a survey of stakeholders:

- Who are the surrounding landholders?
- If government agencies, what is their decision-making preference or culture?
- What is the formulating charter: MOU, MOA, Executive Order, law, etc.?
- How will decisions be made in the regional planning and management system?
- How will differences be adjudicated, decisions appealed?
- Will there be a natural resource primary manager, who will it be and what powers will it possess?

As military installations become increasingly surrounded by development of various kinds, they may enclose some of the last remaining natural habitat in the region. If other agencies are primary managers, there could be a natural tendency to optimize habitat protection on the military reservation while allowing further development outside the boundaries. It does not require a vivid imagination to project the desire to optimize grazing (BLM), silviculture (Forest Service), or housing development (cities and private landowners), for example, on the border of an Army installation, if the installation can be directed to assume the habitat protection role in the ecosystem. Ecosystem management could be the double-edged sword to either accomplish or prevent this.

4.6.8 Deployment and Mobilization

Since one of the principle missions of most training installations is to be a launch platform and force generation facility for contingency missions or general mobilization, the ecosystem management approach must be analyzed for its potential impact on this mission. Deployment and mobilization will often require variances or waivers to environmental regulations. Ecosystem management may help or hinder this process. Ecosystem management, for example, can provide the flexibility needed by the installation to temporarily exceed permitted levels. Adaptive management, properly designed, would recognize installation requirements and provide reactive capability throughout the ecosystem for these temporary perturbations.

4.6.9 Public Expectations and Involvement

Army installations are always concerned with their relationships with the surrounding communities. One of the factors to be considered in analyzing a particular management scheme is the public's role. Public expectations must be held to a realistic level and public involvement in decision-making cannot impinge on mission readiness. At the same time, regional land-use planning—a necessary element of ecosystem management—could become a vehicle for closer and better relationships with the surrounding community. Installation input to local zoning commission decisions, for example, could identify and eliminate or mitigate potential conflicts in development plans.

4.6.10 Future Use

Installation commanders are obligated to protect the land and natural resources primarily to assure its availability for future military use and, secondarily, for conservation. An ecosystem management approach that improved the long-term ecological health of the installation, as well as the region, and preserved the utility of the land for future military use, would have a beneficial impact on the mission. However, a management approach which leverages ecosystem health by constraining military activity on an installation to allow for development or economic gain elsewhere in the region is clearly detrimental.

The principles of ecosystem management require the identification of a desired future ecological condition. Installation commanders would be expected to demand that this principle be strictly implemented prior to undertaking any significant commitments.

4.6.11 Adaptive Management

Ecosystems are dynamic organisms. Ecosystem management requires feedback and control mechanisms to adjust for changing physical, biological, and social conditions. Developing an operational and effective adaptive management system will require changes in law, agency procedures, and cultures, as well as more definitive priority guidance from DoD.

The adaptive management structure must be established in the chartering document. Participating agencies will need to set up and agree to the means of gathering data and evaluating the ecological conditions. The installation should war-game potential changes in all three areas for their impact on mission accomplishment.

4.7 Conclusions

Ecosystem management could have both positive and negative impacts on an installation's mission accomplishment. Each installation and surrounding region have a unique set of conditions which require analysis of all the above factors to determine the net impact.

The most significant factor that the installation commander will need to assess is control: Is the installation participation voluntary or required, and to what extent? What are the differences between the current range of options and those offered in the ecosystem management approach? How are the decisions made, and what is the appeal process?

Army installations currently operate under a variety of state, federal, and local management systems that may direct specific natural resource activity on the installation, or, at best, limit the range of management options. Ecosystem management is an umbrella concept that encompasses these current regional planning requirements and demands management on a larger scale, in area, in time, and in participation. Army installation commanders should recognize that the question is no longer whether they will participate in regional land use planning, but to what extent?

Army commanders will be increasingly asked to assist in establishing the goals, operating procedures, structures and responsibilities for ecosystem management of regions or watersheds which encompass their installations, or to join an established management system. As a strawman for the investigation that must precede such designs or decisions, the plan in Section 4.8 asks generic questions which can be used to initiate an installation-specific analysis. The Army Environmental Policy Institute should conduct at least one such analysis using a selected installation as a case study to validate and improve the plan.

4.8 Study Plan

STUDY PLAN (Notional)

Impact on the Fort Wedgebolt Mission Capability of
(Ecosystem Management Proposal)

Purpose

This plan establishes the major issues, objectives, methodology, and milestones for an analysis to assess the impact on mission accomplishment at Fort Wedgebolt caused by entering into (a proposed ecosystem management agreement).

Study Directive

(Who authorizes, funds, directs, and approves the study?)

Major Issues

1. What effect will the proposed ecosystem management agreement have on current and future mission requirements at Fort Wedgebolt?
2. What is Fort Wedgebolt's long-term vision for its natural resources?
3. What are the decision-making procedures of the management plan, who are the stakeholders, and what is the appeal process in case of conflicts?
4. What will be the costs and benefits of entering into the agreement?

Terms of Reference

Background: Ecological conditions in the region surrounding the installation have declined in the last thirty years in spite of the many laws enacted to protect individual natural resources. Federal and state agencies now advocate a broader approach to manage lands and natural resources in which Fort Wedgebolt will join. (Describe the proposed system.)

Ecosystem management is the current policy goal of all relevant federal agencies, including the Department of Defense and the Army. Guidance for ecosystem management is contained in DoD Instruction 4715.3 Ecosystem Management Principles.

Problem: Fort Wedgebolt has been asked to comment on a draft Memorandum of Agreement (MOA) to be used by all regional land managers to establish the vision, goals, responsibilities and procedures to better manage the natural resources of State Region 8, the Sabot River Watershed. In order to prepare an appropriate response, the Fort must analyze the impact of the proposed agreement on its mission activity, as well as its natural resources.

Study Objectives

1. Assess the proposed MOA with respect to the current system for managing natural resources. What effect will the new management system have on natural resources at Fort Wedgebolt and the Sabot River Watershed? How does the future of natural resources envisioned in the MOA compare with the current installation INRMP and vision?
2. Determine the costs—funding, personnel, skills required—resulting from implementation of the MOA as written. Compare to the cost of maintaining the current system.
3. Examine the proposed methodology for decision-making and conflict resolution to determine if it will constrain or foreclose Fort Wedgebolt's freedom of action to a greater or lesser extent than the current management plan.
4. Assess the potential consequences to Fort Wedgebolt's mission capability, particularly in terms of training, deployment, and mobilization.

Scope

1. The time horizon for this analysis will extend at least 20 years.
2. Consider all tenant unit and reserve component missions.
3. Consider only the terms of the proposed MOA and focus the analysis within the Sabot River Watershed.

Essential Elements of Analysis (EEA)

1. What are the current agreements, legal constraints, contracts, guidance, practices, and other factors that shape the installation's natural resource management?
2. What is the status of the scientific data on the ecosystem, including biological, physical, social, and economic data?
3. What are the current status and trends of the ecosystem in general, and Fort Wedgebolt in particular?
4. What are the natural resource issues for the surrounding community, federal and state managed lands, and the installation?
5. What changes in installation land management or use can be projected under the proposed agreement? How does this differ from current expectations? How will these changes affect the installation's training, deployment, mobilization, and other missions?
6. Who are the stakeholders, and how would they be represented in decisions that will affect the region and the installation? How will decisions be reached and conflicts resolved?

7. What are the managerial and scientific resources that would be needed, and what is the current inventory, including data bases, systems, personnel, and skills?
8. What additional cost, cost avoidance, or change in revenues can be projected for the installation?
9. How will the proposed management system be funded?

Methodology. TBP
Management and Support. TBP
Schedule. TBP

BIBLIOGRAPHY

Ahmann, Steve. *Mojave Desert Ecosystem Initiative*. Paper presented to 22nd Environmental Symposium and Exhibition (ADPA). 18-21 March, at Orlando, FL, 1996.

Army Regulation 200-3. Natural Resources—Land, Forest and Wildlife Management. February 1995.

Congress of the United States. H.R.1141 Sikes Act Improvement Amendments of 1995.

Congressional Research Service. Ecosystem Management: Federal Agency Activities. Washington, D.C. 124 pp., 1994.

Council on Environmental Quality. Environmental Quality: Twenty-fourth annual report. Washington, D.C. GPO, 1995.

Department of Defense Instruction 4715.3. Environmental Conservation Program. May 3, 1996.

Environmental Protection Agency. Agreement of Federal Agencies on Ecosystem Management in the Chesapeake Bay. July 14, 1994.

Gore, Al. Report of the National Performance Review. Washington, D.C. GPO, 1993.

Government Accounting Office. Ecosystem Management: Additional Actions Needed to Adequately Test a Promising Approach. (GAO/RCED-94-111), August 1994.

Parker, Sara. *The CRM Approach: Protecting Missouri's Natural Heritage.* Natural Resources and Environment. Winter, 10-12, 72, 1996.

Thomson, Rebecca W. *Ecosystem Management: great idea, but what is it, will it work, and who will pay?* Natural Resources and Environment. Winter, 42-45, 70-72, 1995.

CHAPTER 5. IMPLEMENTING ECOSYSTEM MANAGEMENT ON ARMY LANDS: A COMPARISON OF ALTERNATIVE PLANNING APPROACHES

5.1 Introduction

Few areas of public policy are as contentious as the issues surrounding management of our environment and natural resources. Pictures on the evening news of spotted owls hung in effigy bear testimony to the hostility engendered by recurring confrontations over the use of natural resources. True, the United States has arguably the most comprehensive environmental policy, statutory, and regulatory framework of any country in the world. However, the last 25 years of increased environmental awareness in the U.S., and the policy and regulatory changes it generated, addressed the easily picked "low-hanging fruit" of environmental issues. A new generation of environmental issues is now upon us, defined by greater political, economic, social, and even cultural complexity. They include difficult scientific questions, such as appropriate scales for resource management; thorny administrative matters, such as inter- and intra-governmental relations; political controversies surrounding land use planning and property rights; the problems involved in restructuring of natural resource-based economies; and the cultural underpinnings of ranching, logging, fishing and other traditional resource-dependent ways of life.

Ecosystem management is a recent policy alternative proposed to address this new generation of issues. The President's Council on Sustainable Development recently endorsed the idea of using ecosystem approaches for natural resources management (President's Council on Sustainable Development 1996). Operating within the context of the federal Interagency Ecosystem Management Task Force, many federal agencies have already considered the concept and its implications for their activities (Interagency Ecosystem Management Task Force 1995). In fact, each of the major land and natural resource management agencies has drafted policy guidance regarding ecosystem management approaches. Even the nation's major environmental regulatory agency—Environmental Protection Agency—has undergone significant reorganization, focusing on a "place-based" ecosystem protection approach to its operation. Federal sector efforts are just one layer of a wider nationwide phenomenon: similar activities are occurring at state and local governmental levels, as well as within the non-governmental sector (John 1995, Brown and Marshall 1996, Yaffee 1996).

In keeping with this general trend, the Department of Defense (DoD) has embraced ecosystem management as the philosophical foundation for its natural resources management and conservation activities. Current conservation policy guidance stipulates that Integrated Natural Resources Management Plans (INRMPs) are the mechanism through which ecosystem management will be implemented on lands managed by DoD and the Department of the Army (DA) (Goodman 1994; DoD 1996). As federal agencies with land management responsibilities have discovered, however, many difficult issues are encountered in implementing ecosystem management (Haeuber 1996). The purpose of this study is twofold: 1) Examine and compare environmental planning and land management approaches currently being tested in implementing ecosystem management on DoD lands; 2) Develop recommendations for implementing ecosystem management on Army lands. As INRMPs have been identified as the mechanism for implementing ecosystem management on DoD lands, the recommendations will focus on ways to strengthen that planning approach.

This paper employs a case study method, focusing on two current approaches to implementing ecosystem management: 1) Integrated Natural Resources Management Plans (Fort Knox, Fort Polk, Camp Clark); 2) Bioregional Planning (Mojave Desert Ecosystem Initiative; Marine Corps Base Camp Pendleton). In each case, the most current, relevant documents were obtained and analyzed. The study design originally called for supplementing analysis of documents with personal contacts at the installation level. After consultation with senior Department of Army and DoD conservation personnel, however, it was decided to avoid overburdening installation staff with further data calls (e.g., surveys and telephone interviews).

The DoD ecosystem management principles (Table 5-2) were employed as a yardstick in judging the extent to which each approach reflects ecosystem management, in terms of expressed goals and action items slated for implementation. For analytical purposes, the principles were consolidated into four general headings:

1. **Ecological approach**: Comprised of principles 1-3, this category involves the extent to which the planning approach maintains and improves the sustainability and native biological diversity of ecosystems; administers with consideration of ecological units and timeframes; and supports sustainable human activities.
2. **Stakeholder involvement and collaboration**: Encompassing principles 4-6, this category examines how successfully the approach developed a vision of ecosystem health; created collaborative mechanisms for establishing priorities and reconciling conflicts; and developed coordinated approaches to work toward ecosystem health.
3. **Scientific and field-tested information:** Covering principles 7-8, the issues here are whether the approach relied on the best science available and established benchmarks to monitor and evaluate outcomes.
4. **Adaptive management:** Embracing principles 9-10, this heading examines the extent to which the approach establishes an adaptive management strategy and implements ecosystem management through installation programs and policies.

The body of the study is divided into several sections that:

1. Briefly explore the concept of ecosystem management
2. Trace the recent evolution of ecosystem management as a conservation policy within the Department of Defense and Department of the Army
3. Examine the planning approaches and cases
4. Compare the planning approaches and cases as a means for implementing ecosystem management
5. Make recommendations for the further development and implementation of ecosystem management, with a focus on improving the INRMP approach

5.2 Conservation Policy and Environmental Planning

5.2.1 Definition of Ecosystem Management

Just what is ecosystem management, and what are its implications as a land and resource management approach? Over the last ten years, much has been written about ecosystem management, yielding numerous definitions of the concept (Christensen et al. 1996, Moote et al. 1994). In the past, ecosystem management efforts have evolved in an ad hoc fashion in response to localized issues, needs and pressures. In contrast, current proposals advance ecosystem management as a policy for managing all federal land and natural resources, including integrating management approaches of both federal and non-federal landholders. If adopted government-wide, ecosystem management would require a significant and wide-ranging reorganization of the existing land and natural resources management framework.

In the last three years, these ideas have found their way into federal agency memoranda, conceptual documents, and policy guidance (See Table 5-1; Morrissey et al. 1994). Despite the proliferation of academic and agency definitions, an accepted set of DoD ecosystem management principles emerged and has been adopted as DoD policy (See Table 5- 2; DoD 1996). Taken together, they provide a foundation for the basic outlines of an ecosystem approach to managing land and natural resources on DoD and DA lands.

Table 5-1. Ecosystem Management: Agency Definitions

Bureau of Land Management

The integration of ecological, economic, and social principles to manage biological and physical systems in a manner that safeguards the long-term ecological sustainability, natural diversity, and productivity of the landscape.

Department of Defense

A goal-driven approach to restoring and sustaining healthy ecosystems and their functions and values using the best science available.

Department of Energy

A consensual process based on the best available science that specifically includes human interactions and management, uses natural instead of political boundaries, recognizes that ecosystems change, and adopts a flexible planning approach.

U.S. Forest Service

Using an ecological approach to achieve the management of national forests and grasslands by blending the needs of people and environmental values in such a way that national forests and grasslands represent diverse, healthy, productive, and sustainable ecosystems.

Fish and Wildlife Service

Protecting or restoring the function, structure, and species composition of an ecosystem, recognizing that all components are interrelated.

National Park Service

A philosophical approach that respects all living things and seeks to sustain natural processes and the dignity of all species and to ensure that common interests flourish.

Environmental Protection Agency

An approach that integrates environmental management with human needs, considers long-term ecosystem health, and highlights the positive correlation between economic prosperity and environmental well-being.

Interagency Ecosystem Management Task Force

A goal-driven approach to restoring and sustaining healthy ecosystems and their functions and values using the best science available.

Table 5-2. DoD Ecosystem Management Principles

1.	Maintain and improve the sustainability and native biological diversity of ecological systems.
2.	Administer with consideration of ecological units and time frames.
3.	Support sustainable human activities.
4.	Develop a vision of ecosystem health.
5.	Develop priorities and reconcile conflicts.
6.	Develop coordinated approaches to work toward ecosystem health.
7.	Rely on the best science available.
8.	Use benchmarks to monitor and evaluate outcomes.
9.	Use adaptive management.
10.	Implement through installation plans and programs.

5.2.2 Evolution of Ecosystem Management Policy in the DoD and DA

As is the case with other federal agencies, ecosystem management is a fairly recent natural resources management approach within the Department of Defense, and has been developing gradually over the last few years. The evolution of this policy is evident in Department of Defense and Department of Army Memoranda, Regulations and Instructions (referred to generally as DoD and DA guidance).

Threatened and Endangered Species Policy Guidance

The beginnings of ecosystem management are found in DoD and DA reaction to Threatened and Endangered Species (TES) issues, and the policy guidance issued to address these issues. Throughout the 1980s, the inadequacies of single species approaches to conservation were becoming apparent to all who dealt with TES issues (Haeuber 1996). Several regulatory incidents vividly demonstrated for DoD the limitations of the single species approach: 1) the Army was faced with possible loss of training activities at Fort Bragg because of potential impacts to the Red Cockaded Woodpecker, a federally listed endangered species; 2) three civilians were indicted at Fort Benning for conspiracy to violate the Endangered Species Act; and 3) testing of systems developed for the Strategic Defense Initiative was diverted to another location because installation managers did not have sufficient data to assess adequately potential impacts to the Red Cockaded Woodpecker.

As a consequence of these events and other influences, memoranda and regulations issued in the early 1990s focused on actions for the protection of endangered species. For example, an

Army Memorandum dated 17 December 1992 addresses issues surrounding development of Endangered Species Action Plans (Memorandum from the Deputy Chief of Staff for Operations and Plans to the Chief of Engineers; subject: HQDA Endangered Species Action Plan.) The memorandum recommended establishment of an interdisciplinary HQDA Endangered Species Team, as well as DA-level scientific, technological, and funding support to MACOMs and installations. An important goal of this guidance was to increase awareness of endangered species protection by integrating it into environmental compliance. Finally, the memorandum begins to address a fundamental principle of ecosystem management—collaborative decision-making and partnerships—by recommending establishment of "mutually beneficial working relationships" with other DoD and federal agencies, states and public interest organizations on endangered species matters.

DoD Ecosystem Management Guidance

By the mid-1990s, management for TES issues was evolving toward the broader concept of ecosystem management. Initial DoD guidance describing and mandating ecosystem management as a land and natural resources management approach can be found in the August 8, 1994 Memorandum by Under Secretary of Defense (Environmental Security) Sherri Goodman (Goodman 1994). She establishes DoD policy on natural resources by stating that "I want to ensure that ecosystem management becomes the basis for future management of DoD lands and waters." The stated goal of ecosystem management is to balance sustainable human activities (support of the DoD mission) with the maintenance and improvement of native biological diversity. Ecosystem management is defined as a balance of ecology, economics, and social values; partnering, and public involvement together are stipulated as the means to achieve shared goals and make decisions. Integrated Natural Resource Management Plans are established as the DoD installation-level mechanism for implementing ecosystem management. Finally, the Memorandum outlines ten ecosystem management principles and guidelines. These ten principles, listed in Table 5-2, have become the cornerstone of DoD ecosystem management policy.

Further guidance for ecosystem management implementation, including protection of cultural resources, was established at the DoD level with a May 9, 1995 Memorandum (Walsh 1995). This document establishes policy, assigns responsibilities, and prescribes procedures for the integrated management of natural and cultural resources under DoD control. The guidance calls for adaptive management in the form of conservation self-assessments (to be conducted annually) and environmental audits (to be performed every three years for installations requiring INRMPs and cultural resources management plans). In addition, decision-makers are required to consider the cumulative impacts of proposed actions. Other ecosystem management issues are also addressed. Collaboration and public involvement are encouraged through the use of partnerships, interagency cooperation, volunteers, public awareness and education; ecological and cultural values at installations proposed for closure are to be identified and addressed. Personnel training and the control of non-point source pollution, exotic species and agricultural outleasing is stressed. The use of conservation easements is also mentioned as a potential tool for ecosystem management. Finally, the memorandum establishes responsibilities of the Under Secretary for Acquisition and Technology (monitoring implementation, establishing policy, interagency coordination, administration of a Conservation Committee), the Secretaries of the Services (implementation and compliance with

policy, leadership in their jurisdiction regarding stewardship and participation in the Conservation Committee) and the Under Secretary of Defense (Personnel and Readiness) (incorporate conservation requirements into education, training, and performance evaluation policies; ensure sufficient qualified personnel and training are available). The Conservation Committee reports to the Defense Environmental Safety and Occupational Health Policy Board.

In 1996, much of the policy guidance included in the August 8, 1994 memorandum and the 1995 Draft Instruction were incorporated in Department of Defense Instruction 4715.3, signed by the Undersecretary of Defense for Acquisition and Technology. The Instruction assigns responsibilities and prescribes procedures for implementing thirty natural and cultural resources management statutes and regulations applicable to DoD installations, facilities and activities. The Instruction codifies the principles of ecosystem management as official DoD policy (see Table 5-2), and prescribes specific actions supporting the DoD ecosystem management principles. For example, it directs threatened and endangered species managers to move from single species to multiple species approaches as the focus of management efforts. It also encourages the formation of partnerships and volunteer participation in conservation from non-DoD stakeholders, and establishes native ecosystem types, ecological processes and longer temporal scales as the foundation of conservation and natural resources management on military lands. The Instruction even introduces the concept of sustainability in the context of managing for overall ecosystem integrity. Noting that healthy ecosystems mean realistic training areas, the Instruction indicates that the goal of sustainability contributes both to ecological integrity and the military mission. The appended definitions take another important step toward sustainability, defining stewardship to include concern for both present and future generations. Finally, the Instruction establishes Integrated Natural Resources Management Plans as the vehicle for implementing ecosystem management and authorizes publication of "A Guide to Integrated Natural Resources Management," which led to development of the Army INRMP Preparation Guidelines (discussed in Section 5.3.1 below).

DA Conservation Policy

The concept of ecosystem management also became more fully integrated into Department of the Army guidance in the mid-1990s. Specific objectives for ecosystem management, including restoration and maintenance of biodiversity and "transition from single species management to sustainment of functioning ecosystems," were set forth in a June 29, 1994 Memorandum from the office of the Assistant Chief of the Army for Installation Management (Brown 1994). This Memorandum established the Army Ecosystem Management Board (AEMB), an integrated body of ARSTAFF, MACOM, FOA and installation ecosystem managers. Specific objectives for the AEMB include the identification of data requirements and appropriate authorities, policies and resources necessary to implement ecosystem management. In addition, evaluation of existing ecosystem-related policy/guidance (such as AR 420-74 and Integrated Natural Resource Management Plans) for decision-making and resourcing processes is required. Finally, specific agencies such as the Army Environmental Center are tasked with proposing a networking and communication plan for the management of conservation information essential for decision-makers.

Ecosystem management issues are addressed in Army regulations as well. In 1986, AR 420-74 updated Army policy on TES. In 1995, promulgation of AR 200-3 consolidated AR 420-74

with other Army regulations. More recently, efforts to revise AR 200-3 go beyond the concept of managing TES, moving into a discussion of biological diversity and reflecting the adoption of ecosystem management principles. In the revised text of AR 200-3, Chapter 11 now calls for land management on an ecosystem basis, stipulating that healthy ecosystems reduce the potential for species to become listed as threatened or endangered, thereby minimizing compliance costs. The revisions do not stop at mere compliance, but recommend that installations take the lead in promoting conservation efforts both on and off Army lands in order to preclude having to sustain a species entirely on Army lands (11-6(d)). The importance of interagency cooperation (11-6(d)) and personnel training (11-10) toward these ends are also stressed. Finally, the regulation acknowledges the importance of management with consideration of ecological units and timeframes. (See Section 5.3.1 below for a discussion of INRMPs in the context of the pre-revision version of AR 200-3.)

Other relevant Department of Army conservation policy guidance includes a July 1995 Conservation Policy Memorandum signed by the Deputy Assistant Secretary of the Army (DASA-ESOH). While not addressing ecosystem management specifically, the memo established goals for conservation: "The Army will manage its land resources to ensure their useful and perpetual availability for training and testing. The Army will, within its capacity, protect the natural and cultural resources entrusted to its care...and will accomplish the training and testing missions within the bounds of good-faith fulfillment of that obligation. The Army will be a national leader in environmental, natural, and cultural resource stewardship for present and future generations as an integral part of our mission" (Walker 1995).

An attachment included with this memorandum contains specific policy initiatives in support of the conservation goals. The goals are:

1. The Army will be actively engaged in the design of federal ecosystem management.
2. The Army will become demonstrably more efficient and effective as a land manager.
3. The Army will determine if additional land for training areas are needed to accomplish the training strategy contained in Training XXI.
4. The Army will learn how to accommodate the trend of the public becoming increasingly involved in the decision-making process of federal facilities, and will provide guidance and training for appropriate personnel in this dynamic.
5. The Army will review conservation R&D guidance and prioritization processes to assure that the training and testing communities have an adequate and informed voice.

These policy initiatives have relevance for implementation of the DoD ecosystem management principles. The first initiative suggests partnering with federal agencies, while the second resembles the "Reinventing Government" approach of the Clinton/Administration that calls for greater efficiency and effectiveness in implementing government programs. Initiative three—the use of Training XXI, the Army's Strategic Plan for Training, as a determinant of training land capacity—is a response to this shift in government policy. Public involvement and collaborative decision-making are incorporated in policy initiative four as the new dynamic in conservation.

And, finally Initiative five addresses implementation of conservation through resourcing, training, and other means.

5.3 Planning Approaches and Case Studies

5.3.1 Integrated Natural Resources Management Plans

Planning for natural resources management on DoD lands is guided by the Sikes Act of 1960 (16 USC 670 et seq.). The Sikes Act provides a mechanism for cooperative wildlife management on military installations. As amended through 1986, the Sikes Act requires that DoD develop joint programs with the Secretary of the Interior and appropriate state agencies for wildlife, fish, and game conservation and rehabilitation on all installations. The Army requires all installations having land and water suitable for the conservation and management of fish and wildlife to develop cooperative plan agreements. The Sikes Act stipulates that cooperative plans shall provide for:

- Fish and wildlife habitat improvements or modifications
- Range rehabilitation where necessary for the support of wildlife
- Control of off-road vehicle traffic
- Specific habitat improvement projects and related activities, and adequate protection for species of fish, wildlife, and plants considered threatened or endangered
- Wetland protection, restoration, and creation

While DoD regulations stipulate that fish and wildlife management plans be maintained for military installations where appropriate, natural resources management as envisioned in the Sikes Act has been less than ideal on many installations. Unlike other environmental statutes and regulations affecting DoD, the Sikes Act carries no penalties for failure to comply. Consequently, some installations have failed to prepare or implement natural resource management plans. In other instances, plans have been implemented without coordination or integration into other military activities. For example, the National Military Fish and Wildlife Association estimates that of the 250 cooperative plans currently existing for military installations and state National Guard facilities, fewer than one-quarter fulfill the requirements of the current Sikes Act, and fewer than one-tenth are properly integrated or address sustained military capability of the land.

Such difficulties in implementing installation natural resources management and planning programs as envisioned in the Sikes Act have stimulated efforts to revise this legislation. Introduced in March 1995, current revision efforts are embodied in The Sikes Act Improvement Amendments of 1995 (H.R. 1141). On March 16, 1995, during testimony on H.R. 1141 before the House Subcommittee on Fisheries, Wildlife and Oceans, Junior Kerns (then President of the National Military Fish and Wildlife Association) stated that "passage of this bill, with the stronger language requiring Integrated Natural Resources Management Plans to be prepared and implemented, should convince hesitant commanders that this program can no longer be ignored."

Proposed revisions to the Sikes Act require the preparation of Integrated Natural Resources Management Plans (INRMPs), as opposed to the cooperative Fish and Wildlife Management Plans currently required. In addition to the five elements included in current cooperative plans, INRMPs would require:

- Consideration of conservation needs for all biological communities
- Establishment of specific natural resources management goals, objectives, and timeframes for proposed actions
- Needs for fish and wildlife management, land management, forest management, and wildlife-oriented recreation
- The integration of, and consistency among, the various activities under each INRMP
- No net loss in the capability of installation lands to support the military mission
- Sustained use by the public to the extent that such use is consistent with the military mission and the needs of fish and wildlife management
- Professional enforcement of natural resources law

Anticipating these potential changes, DoD already has moved to incorporate INRMPs as an essential component in the implementation of its ecosystem management approach. According to Deputy Under Secretary of Defense (Environmental Security) Sherri Goodman, "On DoD installations, ecosystem management will be achieved by developing and implementing integrated natural resources management plans and ensuring that they remain current" (Goodman 1994). The commitment to ecosystem management as the philosophy guiding DoD conservation, and its implementation through INRMPs, was reiterated through its inclusion in the recently-released DoD Conservation Instruction 4715.3 (DoD 1996).

Army regulations currently in force, specifically AR 200-3, also require that INRMPs be used as planning and operations tools for installation programs. AR 200-3 stipulates that INRMPs will be used to assist planners and implementors of mission activities as well as natural resources managers. In addition, INRMPs should be components and supporting elements of installation master plans. According to section 9-1b, a natural resources management plan is integrated when:

- All renewable natural resources and areas of critical or special concern are adequately addressed
- The natural resources management methodologies will sustain the capabilities of the renewable resources to support the military mission
- The plan includes current inventories and conditions of natural resources; goals; management methods; schedules of activities and projects; priorities; responsibilities of installation planners and decision makers; monitoring systems; protection and enforcement systems; land use restrictions, limitations, and potentials or capabilities; and resource requirements including professional and technical manpower

- Each plan segment or component (that is, land, forest, fish and wildlife, and outdoor recreation) exhibits compatible methodologies and goals, including compliance with the Endangered Species Act and applicable Endangered Species Management Plans
- The plan is compatible with the installation's master plan, pest management plan, and Master Training Schedule

According to Section 9-3a of AR200-3, guidelines for preparation of INRMPs are contained in TM 5-630, TM 5-631, TM 5-633 and TM 5-635. However, these manuals have been outpaced by changes in laws and natural resources management policies. Perceiving the need for more current guidance, the Army Environmental Center (Conservation Division) initiated development of new INRMP preparation guidelines consistent with AR200-3, proposed amendments to the Sikes Act and the DoD Memorandum on Ecosystem Management. These guidelines are intended to apply to U.S. Army installations and other lands used for fulfilling the Army military mission, including those lands used by the National Guard Bureau and the U.S. Army Reserves. The draft guidelines were "tested" through use as a template for preparing draft INRMPs at four Army installations (Fort Polk, Fort Lee, Fort Knox, and Umatilla Depot). Based on the experience gained through their application, the guidelines were revised in January 1996 and are currently under review.

The following analysis of INRMPs as a mechanism for implementing ecosystem management focuses on three INRMPs: two prepared according to the draft INRMP guidelines (Fort Knox, Fort Polk) and one prepared without reference to the guidelines (Camp Clark).

5.3.2 Fort Knox Integrated Natural Resources Management Plan

Ecological Approach

The INRMP includes some significant and important actions with respect to maintaining and improving the sustainability and native biological diversity of ecological systems (Ecosystem Management Principle One). For example, the forest management approach focuses on restoring forests to the native oak-hickory ecosystem that once dominated the area (section 14-2). This goal is to be achieved through silvicultural techniques, including group selection and shelterwood cutting. Similarly, prescribed burning is planned as a technique to manage wildlife habitat, particularly for endangered species such as the Henslow's Sparrow (section 14-3a(2)). The plan also describes in some detail nine areas that have been designated for special protection status because they harbor threatened or endangered species, or represent unique plant communities and associated flora and fauna (section 13-5). For some of these areas, special management plans have been prepared. For most areas, specific management actions are identified that are scheduled for implementation in the context of the INRMP, including restrictions on training, forestry, and other uses; prescribed burning; and restoration using native species. Other actions consistent with the first ecosystem management principle include construction and restoration of wetlands, creation of fish habitat through pond structures, artificial nest box programs, and establishment of native species populations (e.g., wild turkey and ruffed grouse).

Many of the programs and projects described above also are consistent with the third ecosystem management principle, focusing on supporting sustainable human activities. In fact, one of the overall goals of the INRMP directly reflects this principle: "Provide economic and other human-valued products of renewable natural resources when such products can be produced in a sustainable fashion without significant impacts on the military training mission" (section 1-2a). The INRMP aims to accomplish this goal through specific programs. For example, the forestry program not only aims to restore native forest ecosystems but to provide the means to reestablish production of quality sawtimber on a large scale. Similarly, the INRMP describes substantial hunting, fishing, and outdoor recreation programs (sections 19-4, 19-5, 19-6). For example, creation of fish habitat and establishment of native species such as turkey and ruffed grouse strengthen the hunting and fishing programs on the installation. In addition, Fort Knox claims a deer hunting program of regional and national reputation.

Ironically, the strength of the hunting and fishing programs also reflects one of the more significant problems with the INRMP. Three of four major objectives of the section on Wildlife Population Management (section 15) concern conservation of native biological diversity and ecosystems, and management that leads to recovery of endangered species. Yet, nearly twelve pages of the thirteen page section concern fish and game issues such as game harvest, management, and stocking. Another substantial section deals with noxious animal control and integrated pest management (section 15-3). In contrast, barely one page is devoted to endangered species issues (section 15-4) and "other nongame species" (section 15-7). The endangered species section deals only with the fact that the U.S. Fish and Wildlife Service is preparing management plans for endangered fauna at Fort Knox. The section on nongame species admits that "nongame species are seldom directly managed at Fort Knox," but claims that "many habitat protection measures...will be beneficial to nongame species in general." In fact, the only substantive project in the nongame species section involves a neotropical migratory bird monitoring program, established and funded by the Institute for the Study of Bird Populations, that may provide sufficient baseline information to develop a neotropical bird management plan near the end of the 1995-99 INRMP period—if the Institute can secure adequate funding to continue the program.

Certainly, the inadequacy of efforts to address nongame wildlife population management is disappointing. More disconcerting is the complete and total failure of the INRMP in addressing ecosystem management Principle Two in any substantive fashion. Principle Two enjoins installations to "administer with consideration of ecological units and time frames." In its discussion of ecosystem management units (section 10-5), however, the INRMP asserts that "it is difficult to combine the two existing special area designations (Training Areas and Hunting Areas) into a single unit designation for ecosystem management purposes. Both designations use different portions of the installation to some degree, and both land management unit systems are designed specifically for their purposes." The plan goes on to say that "it might be ideal to create a single system based, for example, on drainages, but the effort does not seem worth the costs. The system of using Training Areas for military related natural resources management and forestry programs and Hunting Areas for recreational and wildlife related management programs works well. *The current system will be retained during 1995-99.*" In combination with the failure to develop stakeholder participation mechanisms (See section 5.3.2.2), one can only conclude that no attempt has been made to implement one of the most important ecosystem management principles. After all, the actual treatment of the

land is the ultimate indicator of the extent to which programs are integrated and ecosystem management is being implemented—in this regard, the INRMP clearly is inadequate.

Stakeholder Involvement and Collaboration

The failure to implement Ecosystem Management Principles Four, Five and Six provide perhaps the most glaring deficiency of the Fort Knox INRMP. For example, the plan undertakes no effort to "develop a vision of ecosystem health" and provides no "methods in which all parties can contribute to the achievement of desirable ecosystem dynamics" (Principle Four). In fact, this principle is never addressed or even mentioned and, consequently, there is no clear statement of a vision for Fort Knox and its ecological systems, desired future conditions, or goals and objectives for the ecological systems. The closest approximation to such a vision is the set of objectives for INRMP sections 12-22. However, these objectives are not linked to any overall vision, nor does the plan elaborate on any mechanisms that were used to establish the objectives.

The situation is comparable with respect to implementation of Ecosystem Management Principle Five. Clearly, priorities are established for implementing the INRMP (section 24-3a, b, and c). However, there is absolutely no discussion of the mechanisms used in setting these priorities. For example, it is unclear whether regional workshops (as described in Principle Five) were held in generating the lists of important projects and programs and prioritizing among them. Certainly, there is no mention within the INRMP of past or planned regional workshops. Nor do there appear to be any conflict resolution mechanisms planned or established. Perhaps most importantly, the priorities established in section 24-3 may be relevant for implementing the INRMP, but it is not clear that the same priorities would be established for implementing ecosystem management. While the INRMP appears to assume that the INRMP and ecosystem management are one and the same, it is not all clear that this is the case—in fact, as there is no attempt to establish ecosystem objectives, it is impossible to determine compatibility between those objectives and the natural resources management objectives of the installation. And, of course, without implementing Principles Two or Four (discussed above), it is impossible to determine the level of compatibility between the installation objectives and the development objectives of the municipalities, counties, and other jurisdictions in the region surrounding Fort Knox. As the activities planned and implemented in the region surrounding Fort Knox are bound to impact heavily upon the area controlled by the installation, the failure of the INRMP to consider regional development plans in any way whatsoever is a critical deficiency of this plan.

The situation with respect to Ecosystem Management Principle Six is somewhat more complex. Fort Knox cooperates with many partners in the development and implementation of programs and projects described in the INRMP. Sections 5-3 to 5-7 describe relationships with federal agencies, state agencies, universities, contractors and other interested parties. However, almost all of these relationships are contractual (e.g., Colorado State University is assisting in implementing the Land Condition Trend Analysis program; The Nature Conservancy is providing prescribed burning training) or statutory (e.g., the U.S. Fish and Wildlife Service and the Kentucky Dept. of Fish and Wildlife Resources are signatories of the INRMP under the Sikes Act).

More generally, one important policy goal of the INRMP involves a commitment to "involve the surrounding community in the Fort Knox natural resources program" (section 1-2a). This goal is mirrored in a similar statement that "during the 1995-99 period, Fort Knox will make efforts to forge more partnerships with neighbors and organizations interested in managing ecosystems that extend beyond installation boundaries" (section 23-2). Clearly, this is a critical component of ecosystem management, and particularly significant for Fort Knox, as most of its neighbors are private landowners. And yet, the INRMP specifically states that "it is unlikely that Fort Knox will emphasize efforts to work with its private landowner neighbors until [takings] issues are better resolved at national and state levels" (sections 23-2). Similarly, the INRMP dismisses efforts to develop partnerships with its urban neighbors, since "ecosystem management partnership activities with these towns that cost money from them are likely to be difficult to implement" (section 23-2). Apparently, it is enough for the INRMP to state that "recognition and a willingness to deal with such potential conflicts are a part of the process itself" (section 23-2). Rather than establishing mechanisms to collaborate in creating cooperative solutions to biopolitical issues, the closest that the INRMP comes to fulfilling the commitment to forge partnerships with surrounding communities is through the awareness (i.e., public relations) activities described in section 18.

Scientific and Field-Tested Information

The extent of the INRMP's attempt to rest its ecosystem management approach on the "best science available" is the section providing the ecosystem status summary (section 9). The most glaring problem with this section is that it provides little information regarding "scientific understanding of ecosystem composition, structure and function" (Principle Seven). Instead, in keeping with the INRMP guidelines, the section on ecosystem status focuses on water quality, soil productivity, and biodiversity. Even in these narrowly defined areas, however, there is almost no data regarding baseline or trends. For example, the INRMP states that:

- "Today's trend in surface water quality is unknown" (section 9-2).
- "Trends in soil productivity are unknown" (section 9-3).
- "Biodiversity is difficult to quantitatively track with exception of game species and a few other species of high interest" (section 9-4).

Nor are there any clear plans to rectify this situation in the future. Of the projects listed in the prioritized research agenda (section 16-3), for example, those focusing on ecosystem composition, structure, and function are put off until 1999 or assigned no completion date.

Yet, in each case, the INRMP also makes completely unsupported statements regarding the current ecosystem status:

- "Recent decreases in mechanized training along with increased land restoration have probably been beneficial to surface water quality" (section 9-2).
- "Reduced forest harvest have [sic] probably improved overall soil productivity" (section 9-3).

- "Army occupation probably improved biodiversity, particularly in the early years" (section 9-4).

With regard to monitoring, the situation is very similar. While there are many plans for inventory and monitoring (section 12-7), they focus on harvest levels of game species while ignoring TES and "other nongame species." Overall, the most troubling aspect of the monitoring strategy is lack of linkage with evaluation efforts. Ecosystem Management Principle Eight emphasizes the "use of benchmarks to monitor and evaluate outcomes" through establishment of "specific, measurable objectives and criteria" tied to "clear, specific accountability systems." These criteria for successful monitoring strategies are completely lacking throughout the INRMP. In fact, with the exception of game harvest strategies, there are no benchmarks established by which to monitor the success of the management plans described in the INRMP.

Adaptive Management

Throughout the INRMP, an effort is made to implement ecosystem management through the installation's plans and programs (ecosystem management Principle Ten). Many examples can be found:

- Training Requirements Integration (TRI) will be used to rotate training lands and implement the forest management strategy, with a specific schedule attached (section 13-3).
- Mission siting will be used to insure sustainable land use (section 13-3b).
- Natural Resources personnel and the Range Division will cooperate in developing training restrictions to implement ecosystem protection measures and the wildfire program (sections 13-3c and 13-4b(3)).
- Special areas will be taken into consideration in siting training missions (section 13-5).
- Cantonment area management will be used to manage urban habitat for the goal of increasing biological diversity (section 14-4).
- Land Rehabilitation and Maintenance (LRAM) actions in drainage areas and creek crossings will serve to decrease erosion and sedimentation in streams and wetlands (section 14-5b).
- Specific efforts will be made to better coordinate Integrated Training Area Management (ITAM), Forestry and Fish and Wildlife personnel for implementing restoration projects (section 14-5c).

Benchmarks and feedback mechanisms are the two key attributes of adaptive management. Yet, as the above discussion of monitoring makes clear, there are no benchmarks established for evaluating the extent to which ecosystem management has been implemented successfully through installation plans and programs. Moreover, there are no feedback loops established by which plans and programs can be modified based upon implementation experience; nor are there mechanisms

established for periodic review of implementation. In fact, the only substantive mention of adaptive management in the document asserts that "research is often evaluation of applied management; this fits into the adaptive management aspect of ecosystem management" (section 16). Without further discussion, however, it is not clear how the results of such research will be used in an adaptive management context. In general, the INRMP clearly fails to establish an adaptive management context for implementation of ecosystem management on Fort Knox.

General Concluding Impressions

Overall, this INRMP bears only slight resemblance to ecosystem management as embodied in the general literature or the ecosystem management principles established by DoD. The INRMP claims to emphasize "an ecosystem management approach to natural resources management which is a departure from Fort Knox's traditional multiple-use approach" (p. 4). One might observe that, at its worst, the plan represents business-as-usual with the only real change being a repackaging to incorporate the buzzwords made relevant by the current focus on ecosystem management (e.g., biodiversity conservation; restoration of native ecological systems). In all fairness, such a judgment would be overly critical. At best, however, the plan appears to be a generally unsuccessful attempt to accommodate ecosystem management by slightly expanding the goals and objectives of existing natural resources programs and projects, while maintaining the traditional approach to natural resources management on the installation.

5.3.3 Fort Polk Integrated Natural Resources Management Plan

Ecological Approach

Fort Polk is fortunate to have the benefit of a recent study entitled "Natural Community and Sensitive Species Assessment on Fort Polk Military Reservation, Louisiana" (Hart and Lester 1993). The recommendations found in this report provide Fort Polk with a focal point for many of their ecosystem management efforts. Indeed, section 13-6 of the Fort Polk INRMP responds on a point by point basis to many of these recommendations. In many instances, Fort Polk has taken the guidance of this report very seriously in its ecosystem management planning and implementation efforts. For example, the forest management strategy largely is targeted at restoring the native longleaf pine ecosystem that once dominated the region. Similarly, the INRMP emphasizes the use of prescribed burning as a management strategy in forest ecosystem restoration. As longleaf pine systems are fire dependent, this is an appropriate management technique. In addition, the INRMP pays attention to recommendations regarding management of specific areas of unique natural significance.

In other instances, the recommendations of the Hart and Lester study have been largely ignored. For example, the admonition to "adopt uneven-aged forest management techniques" as a means for restoring the longleaf pine ecosystem has been disregarded since "these techniques would result in the loss of a profitable forestry operation on Fort Polk" (section 13-6a). Similarly, the recommendation to "use native species to replant areas that are cleared" is circumvented with the comment that "Fort Polk is well aware of the problem associated with the use of quick growing, effective soil holding exotics versus the more difficult to grow native species" (section 13-6).

Admittedly, Fort Polk has undertaken an important effort toward addressing the issue of exotic species in restoration efforts through the establishment of the Satellite Plant Materials Center in cooperation with the Natural Resources Conservation Service (NRCS) (section 14-5f). Ultimately, however, the INRMP settles the exotic species issue by stating that "some of the most durable and easy to establish plant species with regard to land rehabilitation are not native to the Fort Polk area" and that Fort Polk "will continue to use non-native species if they do not pose a significant threat to overall biological diversity" (section 23-2).

As with the Fort Knox INRMP, one of the most significant deficiencies of this plan is its complete disregard of Ecosystem Management Principle Two. Actually, a strong possibility exists to use a watershed planning approach on Fort Polk, as watersheds currently are used as planning units for the LRAM program. Of 24 watersheds on the installation, watershed management plans have been completed for 11 through a cooperative relationship with the NRCS. The INRMP includes plans to update these management plans in 1996 and complete management plans for the remaining watersheds by 2000 (section 14-5a). Yet, in discussing ecosystem management units, the INRMP states that "it is difficult to use one common management unit for all purposes" (section 10-7). Despite the existing planning and management infrastructure established through the watershed focus of the LRAM program, the INRMP asserts that "it is often more critical that field personnel, troop units, recreationists, and others be able to easily identify area boundaries than it is to use more scientifically based boundaries. Besides, due to the difficulty in determining at what level ecosystems should be identified and managed, it would be extremely difficult to get agreement on such a common management unit designation that meets the needs of all users and managers" (section 10-7).

Stakeholder Involvement and Collaboration

Overall, the Fort Polk INRMP closely resembles the Fort Knox INRMP in its general ignorance of the collaborative process aspects of ecosystem management. For example, the INRMP lacks any discussion of a vision of ecosystem health or a process for developing such a vision. Once again, then, the plans and programs described in the INRMP are not linked to the set of overarching goals and objectives that such a vision would provide. Similarly, implementation priorities are set, but there is no indication regarding how these particular priorities were established or ordered. In the case of Fort Polk, conflicts between certain priorities seem to have arisen—between Hart and Lester's recommendation to "adopt a 1-5 year fire regime seasonally weighted towards late March through mid-June" and the production of an important game species (turkey) during the early part of that timeframe. Ultimately, the conflict is resolved in favor of turkey production (sections 13-6b, 15-2b(5)), but nothing indicates how this decision was arrived at or what mechanisms exist for resolving such conflicts.

As with the Fort Knox INRMP, the more troubling aspect in regard to these elements of ecosystem management involves the failure to establish partnerships or collaborative and coordinated approaches to work towards ecosystem health. Policy goals in this regard are evident:

- "Since these ecosystems often go beyond installation boundaries, management of Fort Polk's natural resources will include more emphasis on partnerships with its neighbors" (p. 4).

- "Involve the surrounding community in the Fort Polk natural resources program" (section 1-2a).
- "Ensure the Fort Polk natural resources program is coordinated with other agencies and conservation organizations with similar interests" (section 1-2a).
- "During the 1996-2000 period, Fort Polk will make efforts to forge more partnerships with neighbors and organizations interested in managing ecosystems that extend beyond installation boundaries" (section 23-3).

However, INRMP implementation in this area appears to directly contradict these statements. Similar to Fort Knox, the only partnership activities appear to be through INRMP signatory status and contractual arrangements with other agencies and organizations. Indeed, the INRMP states that "the degree to which Fort Polk uses other agency partnerships is dependent upon funding" (section 11-4). There is no evidence that Fort Polk plans to undertake efforts to establish partnerships in the sense described by ecosystem management principles. As with Fort Knox, there are statements to the effect that Fort Polk intends to ignore such partnerships and collaborative relationships: "it is unlikely that Fort Polk will emphasize efforts to work with its private landowner neighbors until these issues [takings] are better resolved at the national and state levels" (section 23-3). More troubling (and, once again, exactly the same as with the Fort Knox INRMP), is the statement that "Other neighbors are urban. Urban priorities are often very different than ecosystem needs" (section 23-3). This statement appears to reflect a fundamental misunderstanding of ecosystem management as described by DoD ecosystem management principles.

Scientific and Field-Tested Information

The deficiencies of the Fort Polk INRMP in this regard are exactly the same as those found in the Fort Knox INRMP (including identical wording in many sections). For example, baseline and trend data for the three areas of greatest concentration within the INRMP are unclear at best:

- "Lack of consistent water quality monitoring" (section 9-2).
- "Trends in soil productivity are unknown" (section 9-3).
- "Biodiversity is difficult to quantitatively track with the exception of game species and a few other species of high interest" (section 9-4)

Despite the lack of data, however, completely insupportable statements are made once again regarding trends:

- "During the last few years it is likely that water quality has been improving." In fact, the document even admits that this statement is "largely speculation" (section 9-2).
- "It is highly likely that soil losses have significantly dropped in recent years" (section 9-3).
- "Biodiversity has improved since Army acquisition" (section 9-4).

As with the Fort Knox INRMP, the Fort Polk INRMP monitoring component suffers from critical deficiencies. It is weighted heavily towards a focus on population and harvest levels of game species, with little regard for measures of ecosystem composition, structure, and function. Indeed, the only non-game inventory and monitoring efforts planned for the INRMP period appear to be those planned (and, in most cases, funded) by institutions other than Fort Polk: monitoring of neotropical migrants undertaken by the Institute for Migratory Bird Studies and the Stephen F. Austin University (section 12-4c); a study of aquatic and terrestrial ecosystems undertaken by the Stephen F. Austin University in 1994-96 (section 12-4c); and an inventory of wetlands by the U.S. Fish and Wildlife Service (section 14-7). As discussed above, the monitoring activities are not linked to an overall set of goals and objectives for the region, or even the immediate area encompassed by Fort Polk. There are no benchmarks established to which monitoring efforts can be tied in evaluating outcomes of management actions.

Adaptive Management

The Fort Polk INRMP takes significant positive steps towards implementing ecosystem management actions through installation plans and programs. For example:

- Training Requirements Integration is used to site activities in areas best suited to sustain them (section 13-3).
- Environmental awareness is integrated into several installation training programs (section 13-2c).
- The forest management and fire management programs are integrated in using fire as a forest ecosystem management and restoration tool (section 13-4b(2)).
- Management plans are developed for areas around RCW nesting sites and cavity trees as well as several unique and special areas, such as remnant prairies, pitcher plant bogs, and wetlands at the headwaters of rivers originating on Fort Polk (sections 13-5a, 13-5c(1), 13-5d, 13-5e).

However, as mentioned above, there is no effort to link monitoring efforts to these management actions. In other words, adaptive management is missing from this document as well. In fact, the only real statement regarding adaptive management in this INRMP seems an admission that adaptive management will not be undertaken on Fort Polk. Responding to a Hart and Lester suggestion that Fort Polk "establish a research and monitoring program to measure the effects of management practices on ecosystems," the document states that "Adaptive management requires such feedback, but the matter of cost effectiveness must be considered" (section 13-6). Thus, it is unclear how management plans and programs will be evaluated or how information gathered through monitoring and research will be used to inform future management actions.

General Concluding Impressions

Because of the correspondence of the two plans, this analysis generally focused on the areas in which the Fort Polk INRMP is unique. As with the Fort Knox INRMP, this plan does not reflect implementation of ecosystem management as set forth by DoD principles. In fact, due to the striking

similarity of the two documents—complete with identical language in many sections—most of the observations regarding the Fort Knox INRMP apply to the Fort Polk INRMP as well.

5.3.4 The Camp Clark Conservation Plan

Ecological Approach

Both the Fort Knox and Fort Polk INRMPs include sections identifying "ecosystem management units." In contrast, the Camp Clark INRMP (Brandt 1996) never explicitly addresses the issue of ecologically defined spatial units or time-frames for management. Yet, the Camp Clark plan actually comes much closer to designing and adopting an ecologically defined management approach than either of the INRMPs discussed above.

In a unique approach, Camp Clark natural resource managers have taken the natural communities existing on the installation as the organizing framework for both the INRMP and their management efforts. The geographic area of Camp Clark is defined by four distinct natural community types: sandstone savanna; dry-mesic sandstone/shale prairie; wet-mesic bottomland forest; and dry sandstone forest. Each of these natural communities is defined by particular assemblages of plants and animals; geological, hydrological, and other physical features; and endemic natural disturbance patterns. The Camp Clark INRMP explicitly attempts to recognize the requirements of each natural community necessary to maintain functioning ecological systems, and the limitations of each system in relation to the types of activity it can support.

Following from this ecological and geographical characterization of the Camp Clark land, the INRMP makes specific recommendations geared to addressing the issues involved in managing to maintain specific natural communities, including the habitat needs of TES within the communities, as well as other lands and types of ecological systems (e.g., wetlands and riparian areas) (section IV.C.1-7, 11). So, while this plan does not specifically designate ecosystem management units, the design and organization of the Camp Clark INRMP is more consistent with DoD Ecosystem Management Principles One and Two than either of the plans discussed so far.

A second important contrast between the Camp Clark and Fort Knox/Fort Polk INRMPs involves the levels and types of attention paid to DoD Ecosystem Management Principle Three. The Fort Knox and Fort Polk plans dedicate a substantial proportion of their overall text to the issues of hunting and fishing. In fact, this is a theme that runs through nearly every section of those plans, from wildlife population management to law enforcement and public awareness. The Camp Clark INRMP, on the other hand, includes only a few paragraphs on hunting and fishing, with the bulk of the hunting discussion relegated to Appendix I. This constitutes an almost direct reversal of the proportions dedicated to these subjects. While giving only superficial attention to hunting and fishing, the Camp Clark plan focuses on training and other mission essential installation activities, specifically relating the siting and timing of such activities to land capabilities (section IV.A.1-2). This is another significant and substantial departure included in the Camp Clark INRMP.

Stakeholder Involvement and Collaboration

The natural communities orientation of the plan, described above, is a significant departure for another reason—in keeping with DoD Ecosystem Management Principle Four, it constitutes an attempt to develop, and gear management toward, a "vision of ecosystem health." By using the historic ecosystem and natural community types on the installation as the framework for structuring the plan, Camp Clark has established a vision of ecosystem health. In essence, the plan states that the health of the installation's land is tied to the health of the four major natural community types found within its boundaries, and that installation activities will be managed so as to sustain those natural communities. In this way, the Camp Clark plan adheres somewhat more closely to the DoD conception of ecosystem management.

Apart from this one aspect, however, the Camp Clark INRMP is negligent in the area of stakeholder involvement and collaboration. While the plan provides a vision of ecosystem health, issues are never addressed regarding how that vision was created. Certainly, there is no evidence of significant collaboration in developing the vision. In fact, there is no evidence of any significant "across the fenceline" activity at all. There are goal statements in this area—for example, that the installation will be managed in coordination with other state and federal agencies in Missouri's Coordinated Natural Resource Management Program (p. ii). And, of course, the U.S. Fish and Wildlife Service and the Missouri Department of Conservation are required signatories to the plan under the Sikes Act. However, there is no evidence, including past actions or future plans, to indicate that the Camp Clark INRMP will implement the stakeholder involvement, collaboration, and coordination aspects of ecosystem management. As with the Fort Knox and Fort Polk INRMPs, this constitutes a substantial and important gap between DoD's statement of ecosystem management principles and their implementation.

In keeping with use of natural communities and ecological systems as the organizing framework, the Camp Clark INRMP approach to characterizing the installation's natural resources focuses on ecosystem composition, structure, and function. The INRMP includes data on many parameters of interest for understanding the installation and its management needs:

- Soils data, including actual and potential erosion, and the limitations of particular soils in supporting various installation activities (section III.B.1-2)
- Delineation of wetlands (section III.B.3)
- TES, including locations of sightings and potential habitat (section III.B.8)
- Delineation of vegetation, complete with historical baseline data, status, and trends (section III.B.6)
- Delineation of installation biodiversity, also with baseline data, status, and trends (section III.B.5)
- Wildlife status and trends, broken out by type of organism (including insects) rather than the game vs. nongame categories used in the Fort Knox and Fort Polk INRMPs (section III.B.7a-g)

In fact, the types of data and the obvious efforts to organize and present it in a manner consistent with the needs of an ecosystem management approach is probably one of the strongest aspects of this INRMP.

However, the INRMP is conspicuously deficient with respect to establishing benchmarks for evaluating management and a monitoring scheme to track implementation of the INRMP. In fact, the only explicit discussion of monitoring evident in the document involves monitoring of stream banks by training site personnel (section IV.C.7) to track erosion. In this respect, the Camp Clark INRMP is weaker than either the Fort Knox and Fort Polk plans. While those plans primarily focused on game-oriented end points for monitoring, a monitoring scheme did, in fact, exist.

Adaptive Management

Since monitoring is a critical component of adaptive management, the Camp Clark INRMP does not provide the capacity to implement an adaptive management strategy. Even if benchmarks had been established to judge performance, there would be no way to evaluate outcomes without information derived from monitoring. And, in fact, adaptive management is never mentioned in the INRMP. Given these deficiencies, the Camp Clark INRMP is as weak as the Fort Knox and Fort Polk INRMPs with regard to adaptive management.

With regard to DoD Ecosystem Management Principle Ten, on the other hand, the Camp Clark plan includes some significant sections not included in the INRMPs discussed above. For example, the Camp Clark INRMP clearly details the specific natural resources management responsibilities of various installation personnel (section IV.G and H). In particular, however, the section entitled "Matching Military Training Load with Environmental Constraints" (section IV. A.1-2) is an important innovation. This section examines training activities undertaken at Camp Clark, categorizes them according to their potential impact on the environment and natural resources, and recommends precautions and mitigation measures. The section matches Camp Clark's extensive databases for soils, vegetation, wildlife, TES and other parameters with the types of activities unique to this particular installation. This exercise enables Camp Clark managers to suggest siting installation activities on lands that are best able to support them over the long term. In ef fect, the INRMP includes a specific and detailed description regarding how installation activities will be administered in a manner that attempts to reconcile training needs with the actions necessary to maintain functioning native ecological systems. This is obviously a fundamental element of ecosystem management on Army lands, and the Camp Clark INRMP approach is an improvement over the attempts included in the Fort Polk and Fort Knox INRMPs to achieve the same goal.

General Concluding Impressions

The Camp Clark INRMP represents an improvement over the Fort Polk and Fort Knox INRMPs in some important and significant respects:

- The installation is characterized by, and management is geared toward, an understanding of the installation's natural communities, rather than its administrative components. So, while Ecosystem Management Principle Two is never explicitly addressed, the

plan approaches the issues of management and siting of activities on the basis of ecological units. This is a very different approach from the Fort Knox and Fort Polk INRMPs and addresses the central issues involved in integrating natural resources management with installation activities.

- Training and other installation activities are delineated and sited according to their potential impacts and the capacity of the land to sustain them.
- The plan includes a thorough range of data, complete with efforts to develop accurate historic baseline data, as well as current status and trends.
- In its treatment of wildlife and faunal biodiversity, the plan actually delineates according to types of organisms and species, rather than game vs. nongame species.

Still, the Camp Clark INRMP demonstrates many of the same deficiencies as the Fort Knox and Fort Polk INRMPs:

- The INRMP does not address stakeholder participation and collaboration aspects of ecosystem management. In this area, it actually appears weaker than either of the other plans.
- Basically, discussion of monitoring is absent, making this plan weaker than the Fort Knox or Fort Polk INRMPs in this respect. Moreover, there is no effort to establish a strategy for adapting management actions based upon evaluation of outcomes and feedback.

Despite the strengths discussed above, these weaknesses in key areas mean that the Camp Clark INRMP really cannot be seen as an adequate vehicle for implementing ecosystem management as embodied in the DoD ecosystem management principles.

5.3.5 Bioregional Planning

Bioregionalism is an approach to natural resources and land management that has gained increasing attention over the last two decades, and greater credibility in the last few years. It is as much an approach to governance as it is a way to manage land and natural resources. With roots in "deep ecology," it is seen fundamentally as a philosophy, or way of life, by many proponents. However, it also has scientific underpinnings that can be traced to emerging understanding of the multi-scalar nature of ecological systems and processes (Levin, 1992). In this sense, bioregionalism is related to the "greater ecosystem concept" and other conceptions of ecosystem-based approaches to management (Slocombe, 1993a). For those emphasizing the technical aspects, it is less a philosophical approach than a new means for making and implementing resource management decisions.

Regardless of which view one adheres to, a region can be defined along multiple dimensions—biological, physical, socio-cultural and economic. The biological and physical dimensions correspond to the observation that one can identify shared climatic and ecological characteristics in an area. In other words, we can see distinct climate, topography, soil, watersheds,

wildlife, vegetation, natural disturbance regimes and other aspects that reflect the unique character of a place. An oft-quoted definition focusing on this set of attributes sees a "bioregion" as "a place defined by its life forms, its topography and its biota, rather than by human dictates; a region governed by nature, not legislature" (Sale, 1985). There is a fairly rich literature regarding efforts to use such criteria in creating maps of "ecoregions" for North America and other areas of the world (Udvardy, 1975; Bailey, 1983; Bailey, 1995).

However, physical and biological characteristics also are modified by human action. And, for many, the nature of human action is structured by the physical and biological attributes of a place. For example, traditional economic pursuits are interwoven with, and constrained by, the nature of the land and resources in an area. In this view, communities themselves are defined not only by shared social and cultural attributes, but by physical and biological characteristics as well.

Ultimately, though, regions are in the eye of the beholder. For example, watershed boundaries can be objectively defined; depending upon the issue of interest, however, a single watershed may not cover a large enough area to be relevant. Managing large ungulates or predators, for example, may entail many watersheds nested together. Perhaps the best way to understand regions, then, is as a human construct resulting from the interaction of natural and socio-cultural factors.

For land and natural resources management purposes, the important facts are that ecosystem management is based upon a regional approach; bioregionalism has been identified in some important areas as the means for implementing ecological approaches to management (e.g., California's Coordinated Regional Strategy for Conserving Biological Diversity); and, finally, it is at the regional and local levels that conflicts between environmental conservation, development planning and other objectives most often arise. If we are to implement ecological approaches to management, and address these conflicting demands for use of land and natural resources, we must create and implement integral, comprehensive and forward-looking planning processes that fully integrate environment and development planning (Slocombe, 1993b). This section examines two cases for lessons on how we can progress toward this goal.

5.3.6 Mojave Desert Ecosystem Initiative

Background

The California Desert is an enormous area covering over 25 million acres, and composed of portions of three major deserts—the Great Basin, Mojave and Colorado (or Sonoran) deserts. The Mojave Desert ecosystem of California is a 25,000 square kilometer piece of land wedged in between urbanized coastal southern California on the west, the Colorado River on the east, and the Sierra Nevada and Great Basin to the north. In addition, the Mojave Desert extends across state boundaries and includes portions of Nevada, Utah and Arizona. This high desert ecosystem is characterized by scant rainfall, hot summers and fragile desert vegetation within rocky valleys separated by barren mountains. Federal agencies manage nearly 80% of the land resources in the California portion of the Mojave Desert.

The California Desert region has a history of bioregional planning that spans more than 15 years. In 1976, Congress created the California Desert Conservation Area. The California Desert Plan, completed in 1980 to implement congressional mandates, divided two of these deserts into component ecosystems to manage wildlife resources. Under this scheme, the Mojave ecosystems included the Northern, Central, Western and Eastern. The process involved in designing this plan took over four years and generated more than 100,000 public comments. The result was one of the first ecosystem management plans produced on a landscape scale.

In 1991, the state of California adopted a bioregional approach for planning and managing all of its natural resources. By mid-1992, twenty-five county, state and federal agencies had signed a Memorandum of Understanding, referred to as the "Agreement on Biological Diversity," to implement California's Coordinated Regional Strategy to Conserve Biological Diversity. This agreement adjusted ecosystem boundaries, dividing the area up into Northern, Eastern and Western Mojave Desert ecosystems for planning purposes.

In the context of this planning and management scheme, the Bureau of Land Management took the lead in developing the West Mojave Coordinated Ecosystem Management Plan, along with the California Department of Fish and Game, U.S. Fish and Wildlife Service, National Park Service, DoD installations (Fort Irwin National Training Center, China Lake Naval Weapons Center, Edwards Air Force Base, Twenty nine Palms Marine Corps Base) and county and city governments. This plan was intended to set the standard for managing the habitat of desert tortoise and other sensitive species on public and private lands, and was considered the first major planning effort resulting from the Agreement on Biological Diversity.

Along with these state level bioregional efforts, more general ecosystem management developments were occurring at the national level which would impact the Mojave Desert ecosystem. The most significant developments were the passage of the California Desert Protection Act (CDPA) and the release of Vice President Gore's National Performance Review (NPR) report on "Reinventing Government." The CDPA created 69 new wilderness areas for BLM, totalling 3.6 million acres, and expanded national parklands by four million acres, designating Joshua Tree and Death Valley as national parks and creating the Mojave National Preserve. The NPR contained recommendations with important implications for land and resource management. Two recommendations stand out: 1) in general, the NPR recommended development of "a proactive economy and a sustainable environment through ecosystem management"; 2) recommendation DOI:06 suggested that the Department of the Interior (DOI) develop coordinated management plans on an ecosystem basis for selected areas, including "an area where there already is ongoing work to forge ecosystem-based management approaches and include all federal agencies with land and resource management responsibilities in the area."

These recommendations set two processes in motion with direct impacts on the Mojave Desert ecosystem. The first process involved the establishment by the White House of an Interagency Ecosystem Management Task Force to implement the general NPR recommendation regarding ecosystem approaches to environmental management. The Task Force undertook to explore and evaluate implementation of ecosystem management through regional ecosystem-based initiatives. In March 1994, the Mojave Desert was identified as the site for a "new initiatives" case study. DoD

was designated as the lead agency for the Mojave Desert Ecosystem Initiative, with the Department of the Army tasked as the Executive Agent. The second process involved Department of Interior efforts to implement recommendation DOI:06. In light of the planning efforts already underway in the context of the West Mojave Coordinated Management Plan and related bioregional planning efforts under the Agreement on Biological Diversity, the DOI designated the California Desert in November 1994 as an Innovative Management Laboratory as one component for implementing DOI:06.

These various developments, including ongoing state level bioregional planning ventures (e.g., BLM's West Mojave Coordinated Management Plan) and efforts to implement the NPR created a situation in which two major bioregional planning initiatives had been undertaken in the same region by different Cabinet-level departments and their lead agencies. Throughout 1995, efforts were made to officially link the two projects in order to create one coordinated ecosystem management effort. Attempts to link the projects focused on two fronts: 1) DoD becoming a signatory to California's Agreement on Biological Diversity; 2) and development of a Memorandum of Agreement between DoD and DOI for the California Desert Ecosystem Initiative. For a variety of reasons, including strong opposition from members of the California congressional delegation and other members of Congress, DoD never signed either agreement. The result is that the two efforts have proceeded as separate entities, though linked and coordinated.

The discussion below focuses exclusively on the DoD Mojave Desert Ecosystem Initiative (MDEI), though linkages and contrasts between DoD and DOI projects will be discussed where appropriate. It is important to note at the outset that the MDEI is not a management strategy or plan, but rather a tool to support management decisions. Given this fact, certain categories of DoD ecosystem management principles are not particularly useful in analyzing the MDEI (e.g., Principles Nine and Ten dealing with adaptive management and implementation).

Ecological Approach

From the outset, DoD was adamant that the MDEI be designed to encompass a unit defined according to ecological criteria (Principle Two). In April 1995, Deputy Under Secretary of Defense Goodman established an important policy guideline for the MDEI: "The Mojave Desert Initiative encompasses the entire Mojave Desert, without regard to political boundaries. This is fundamental to comprehensive ecosystem planning" (Goodman 1995). Following this decision, the Mojave Desert ecosystem was defined to include the Mojave region of California, as well as portions of southern Nevada and Utah, and western portions of Arizona. This became a somewhat contentious issue in early attempts to craft a relationship between DOI and DoD. DOI bioregional planning efforts concentrated exclusively on the California regions of the Mojave, with the primary focus on the western Mojave, due to the mature nature of planning efforts in that area. As late as summer 1996, however, DoD maintained a more ecologically defined planning focus, with MDEI funding proposals citing the project field location as "the Mojave Desert in California and, as required, in Nevada, Utah and Arizona."

The MDEI encompasses an important area in terms of diversity of species and ecological systems. In the West Mojave (as defined by BLM), there are 20 species that are listed or proposed for listing as threatened or endangered, 46 species that are candidates for listing, and an additional 48 special status species that are sensitive or rare. In addition, the area includes 33 natural vegetation communities and 20 natural landforms.

MDEI documents consistently emphasize the importance of both maintaining and improving the sustainability and native biological diversity of ecosystems (Principle One). For example, early descriptions of the project note that: "The Mojave Desert has more than 2,000 species of plants. Although many of these are shared with deserts of the north and south, about a quarter of the species are endemic to the Mojave Desert; that is, they occur nowhere else in the world. Animal species are also diverse in the Mojave Desert. Two of the more well-known species of the Mojave Desert are the desert bighorn sheep and the desert tortoise, California's state reptile."

At the same time, however, MDEI descriptions recognize the need to support sustainable human activities (Principle Three). The project was motivated in part by the realization that competition for the Mojave Desert has increased as diverse groups seek conflicting goals, such as establishing and expanding national parks, creating wilderness areas, protecting threatened and endangered plants and animals, developing recreational areas, and expanding economic development. Competition between such interests and goals is bound to increase, given projections for a tripling of the population over the next 20 years, resulting in increasingly fragmented conservation and development of the Mojave Desert.

For DoD, a primary issue is the impact on the military mission of increasing resource pressure and ecosystem fragmentation. In short, the primary threat is that developments and events in the areas surrounding DoD installations in the region will place the burden of habitat and species protection on DoD. Recognizing this possibility, another MDEI policy guideline established by Ms. Goodman states that "Military lands cannot be set aside as perpetual environmental preserves. While conservation is, and shall continue to be, practiced on our installations, we must maintain the flexibility to adapt our national defense mission to political and technological developments" (Goodman 1995). Thus, a fundamental element of the MDEI is providing the capacity to sustain the human activity of greatest importance to DoD—training and testing to fulfill the military mission.

Stakeholder Involvement and Collaboration

As discussed in the background section, the record in this area is not at all clear-cut or simple. With regard to federal interagency collaboration, for example, agencies in the region failed to forge cooperative management relationships through official means (Memoranda of Agreement or Understanding) and DoD never signed onto the California Agreement on Biological Diversity. Of course, this was partly political, given the opposition of Californian members of Congress. However, the sometimes contentious nature of relationships between DoD and DOI agencies also hindered cooperation. As discussed in section 4.2.1, for instance, there was some disagreement over the appropriate boundaries for bioregional ecosystem planning and management efforts. And, after months of effort, DoD and DOI agencies failed to finalize a joint proposal to secure Legacy Program funding as another route to formalize interagency collaboration on the MDEI. Perhaps

one of the more difficult relationships, however, was between the BLM and the Army Corps of Engineers (LA District) (COE). Initially tasked with developing an implementation plan for the DoD MDEI, the COE failed to consult the BLM, despite years of bioregional planning experience in the Mojave Desert region, and brashly tried to assume leadership of ecosystem management in the region.

Despite these difficulties, the MDEI does have a strong record of involvement and collaboration with agency and organizational stakeholders. This element is particularly strong with regard to inter-service collaboration among the DoD installations in the Mojave region. For example, the FY95 and FY96 Legacy proposals funding the MDEI list Army as lead service, but include Navy, Air Force and Marine Corps installations as direct collaborators. More importantly, the list of official partners on the FY96 Legacy proposal is more extensive, including BLM, National Biological Service, National Park Service, U.S. Geological Survey, Bureau of Mines and Utah State University. In addition, other federal, state and local agencies and universities are cited as contributors, though not official partners. As with the other cases discussed in this paper, it is not at all clear if, or how, private landowners or other members of the general public are involved in the MDEI.

With regard to collaborative efforts, the most important aspect involves the contribution of the MDEI in developing a vision of ecosystem health. In effect, this is the primary objective of the MDEI, in its present form. The MDEI is not a management process, but rather a tool to enable more accurate modeling of Mojave Desert ecological systems and facilitate decision making about their use and management. The MDEI mission statement emphasizes two key aspects: 1) MDEI aims to design a scientific database that can yield the data necessary for land management agencies to base their decisions on fact; 2) MDEI is being implemented in a manner that encourages stakeholder participation in the design and construction of the database, as well as its use in management decisions. Ultimately, the MDEI is a collaborative process to create a database that can yield a thorough, multidisciplinary vision of ecosystem health upon which to base informed management decisions.

The Desert Managers Group (DMG) and the Science-Data Management Interagency Working Group (SDMIWG) are the primary organizational mechanisms for collaborating on design of the MDEI database and efforts to make it useful and accessible to land managers. The DMG consists of staff of the NPS, BLM and FWS at the state, district and individual park levels. Commanders of the five DoD installations in the region also sit as members, though in an ex-officio capacity. As the name implies, members of this group are the primary federal land managers in the region. The DMG is directed by seven mission statements:

1. Utilize an integrated ecosystem approach to planning and management of natural and cultural resources and values.
2. Provide the scientific understanding and technologies needed to support the DMG in its bioregional planning and integrated ecosystem management efforts.

3. Conserve and protect the California Desert Resource Base through collaborative resource stewardship.
4. Provide a diversity of high-quality, appropriate recreational opportunities, programs and experiences for visitors to the California Desert.
5. Develop a unified public outreach program to encourage awareness, appreciation and conservation of the California Desert natural and cultural resources.
6. Promote restoration of desert lands through collaborative efforts in education, research and practical application.
7. Make logical and efficient use of federal funds.

The SDMIWG consists of scientific staff from DoD and DOI agencies that manage land in the Mojave Desert, as well as from the two DOI science agencies—the NBS and the U.S. Geological Survey. The DoD coordinator for the MDEI, a technical staff person from the DA National Training Center, co-chairs this group with a member of the NBS. The goal of the SDMIWG is to fulfill the second mission directive of the DMG—to provide the scientific understanding and technologies needed to support the DoD/DOI Desert Managers Group in its bioregional planning and integrated ecosystem management efforts. In effect, the SDMIWG has been tasked with undertaking an integrated assessment of the region, providing the scientific and technical information necessary to create a vision of regional ecosystem health. The group's first charge was to develop the FY95 Legacy funding proposal to establish the MDEI, which has become the tool for undertaking the regional integrated assessment.

Scientific and Field-Tested Information

The MDEI first and foremost represents DoD's commitment to utilization of peer-reviewed science to support land management decisions. The project goal is development and implementation of a database which will facilitate collection, storage, transfer, sharing and analysis of information regarding inventories, resource assessments, scientific documentation and land management by all federal, state and local agencies and other interested parties. Ultimately, a queryable computer database will be developed and deployed to provide land managers and resource specialists the ecosystem-wide tools for informed decision making. As such, it represents one of the first DoD-led attempts to create a regional scale database that can be utilized to affect dynamic, sustainable land management decision-making.

In order to accomplish this goal, the MDEI will be implemented in phases over several years. The first four phases are intended to establish the framework and supply the requisite data on elevation, landforms and vegetation communities. A central component at this stage is establishment of a Geographic Information System to develop a distributed database through a central server utilizing the World Wide Web and allowing electronic communication among the participants. The system will be populated with existing electronic data, and an annotated bibliography will be an initial product. The search for previously completed studies required contact with federal, state and local agencies, as well as private parties, data clearinghouses, universities, colleges and other agencies with potentially pertinent data. Analysis of data applicability has utilized relevant subject matter

experts, with the expected product being a prioritized list for recommended digitization that will be submitted to the DMG. The managers will evaluate the list and select data by recommendation, relative importance and financial capabilities. Once identified, these data sets will be documented, evaluated, metadata prepared and integrated into a database design capable of supporting management needs of participating agencies.

Following assessment of existing scientific research and information, data gaps will be identified. Results of the literature review and data shortfall analysis, along with archival photography, will be used to identify needed biological, physical, cultural and historical information. Efforts will center around adding biological data layers (particularly threatened, endangered and candidate species), information on historical trends, cultural and archaeological resources, meteorological data and important desert micro-habitats such as dunes, springs, wetlands and riparian areas. These remaining data layers will be populated through use of remote sensing, coupled with a multidisciplinary approach to ground truthing.

General Concluding Impressions

As stated in the background discussion above, the MDEI itself does not have a management component and, so, constitutes only one component of ecosystem management. However, the MDEI is a particularly crucial component of ecosystem management, providing a tool to enable more accurate modeling and facilitate better land and resource management decision-making. MDEI is primarily an effort to improve scientific understanding of a region, and thereby provide a firm basis for land and resource management, by reducing data gaps through an integrated assessment approach. With regard to DoD ecosystem management efforts, the MDEI is important for several reasons:

1. It is an attempt to provide uniform data coverage across an entire scientifically-defined ecoregion, regardless of political or administrative boundaries.
2. It is strictly about data collection, interpretation, documentation and sharing.
3. It provides an important model for the sharing, integration and use of data for management purposes by a broadly varied group of participants.

While the MDEI does not have management responsibilities, it is intended for use by those who do. The DMG and the SDMIWG provide the linkage between the MDEI and actual land and resource managers that can utilize MDEI-generated information in decision-making. Section 5.3.7.3 established that the MDEI is the primary project and goal of the SDMIWG. The SDMIWG reports directly to the DMG, a body composed of agency representatives with land and resource management responsibilities. This relationship means that the MDEI is a product of exchange and interaction between the scientific/technical community and the managers, and that the resulting MDEI data and decision support tool (i.e., the database and integrated assessment created by the MDEI) are used to create bioregional plans for the Mojave Desert ecosystems. These bioregional plans are then used as inputs in developing site-specific management plans (e.g., INRMPs, national park general management plans, and TES recovery plans). Created by agreements that DoD has not signed, and functioning within the California Coordinated Regional Strategy to Conserve Biological Diversity, the DMG provides the management forum through which the MDEI can be employed to effect bioregional planning and decisions. Thus, despite the failure of DoD to officially participate,

unofficial membership of DoD representatives on the DMG provides the MDEI with an outlet for informing management decisions.

5.3.7 Alternative Futures for the Region of Camp Pendleton, California

This project was sponsored by the Strategic Environmental Research and Development Program (SERDP) through an interagency agreement to the EPA's National Health and Environmental Effects Research Laboratory, Western Ecology Division. The study (BRC 1996) aims to provide DoD with new assessment and management tools to conduct training and testing activities in a sustainable manner. The document explores the impact of urban growth and change in the rapidly expanding area between San Diego and Los Angeles on the biodiversity of the region. Integrating ecosystem parameters across arbitrarily drawn boundaries, the study provides information regarding species and other environmental issues, socioeconomic considerations, planning options and possible consequences related to biodiversity. The overall project, of which the study is one important component, is meant to enable DoD to most effectively carry out its mission in the context of regional management of biodiversity and related environmental resources.

The SERDP Camp Pendleton report is not intended explicitly as an ecosystem management implementation document, and the project itself is not geared to ecosystem management as such. Therefore, it cannot be evaluated using the same criteria employed in analyzing the INRMPs—the degree of strict adherence to the DoD ecosystem management principles. It will be discussed with attention to the lessons it can convey about resolving difficult issues relevant to implementing specific ecosystem management principles.

Ecological Approach

The Camp Pendleton project explicitly focuses on biodiversity conservation and related aspects of environmental planning. In fact, the stated intent of the project is to "examine the connections between urban, suburban, and rural development and the consequent stresses on native habitats and biodiversity" (p. 1). The study poses an important question: How will the urban and suburban growth and change which is forecast and planned in the rapidly developing area located between San Diego and Los Angeles influence biodiversity? This question is particularly relevant for Camp Pendleton, as it constitutes the largest unbuilt segment of land on the southern California coastline. Given its position and degree of unbuilt land, Camp Pendleton is central to maintaining the long term biodiversity of the region. For example, Camp Pendleton currently comprises 23% of regional habitat for the California Gnatcatcher, a federally listed endangered species; if development in the region progresses according to current planning documents, that will increase to about 35% (p. 131). In essence, Camp Pendleton plays a key role in the connectivity of the region's ecosystems and, over the long term, faces the risk of becoming a habitat island for species such as the gnatcatcher. Such a situation will place increasing pressure on the installation.

Given this context, the Camp Pendleton project does not focus exclusively on biodiversity and related conservation issues, but also is directly concerned with DoD Ecosystem Management Principle Three—supporting sustainable human activities. The principal mission of Camp Pendleton is to train Marines for combat. The danger is that "lack of coordinated off-base landscape management

for conservation and habitat protection, especially as these relate to developable land, may in the long run overwhelm Camp Pendleton's ability to manage for both training and habitat concerns" (p. 131). The purpose of the regional approach to landscape planning and biodiversity conservation developed in this project is to maintain the health of ecological systems to enable sustainable human use of the land, including fulfilling the installation's training mission. The project attempts to answer several questions of critical importance in this regard:

- From a DoD perspective, "Can appropriate management of biodiversity and landscape planning allow the military to more effectively manage its property and efficiently fulfill its mission?" (p. 9)
- From the Camp Pendleton perspective, "How might issues of biodiversity affect or influence land management activities of the Camp?" and "How might future development or conservation `upstream' from Camp Pendleton influence hydrology, ecosystems, and biodiversity on the base and thus potentially influence its primary mission of training?" (p. 9)

These issues are not limited to Camp Pendleton, but concern all DoD lands regardless of the service branch. The unique approach to resolving these issues makes the Camp Pendleton project relevant to all DoD lands, including the Department of the Army. In fact, the approach taken to Ecosystem Management Principle Two is one of the most important aspects of this case. Camp Pendleton itself covers a 49,587 hectare area, with a 27km stretch of largely unbuilt coastline. Recognizing the importance of the region surrounding the installation, however, the project defines the relevant area according to large-scale land-use patterns and hydrological regimes. As a result, the project focuses on an 80km x 134km rectangular area encompassing the watersheds of five rivers that flow through or are immediately adjacent to Camp Pendleton. The geographical focus area includes parts of Orange, Riverside and San Diego counties, with a 1990 population of 1.1 million people.

In addition to increasing the geographical scale utilized in understanding and planning for conservation and use of Camp Pendleton's land and natural resources, the project employs a comprehensive approach to characterizing the region. Fourteen separate sets of characteristics are employed in developing an overall portrait of the existing landscape: physiographic provinces; land use and population; protection and management (i.e., land use conservation status); regional plans; topography; soils; hydrology; natural disturbance regimes (fire); vegetation; landscape ecological patterns; potential habitat for regional TES; species richness; and presence of visually preferred landscape characteristics. In effect, then, the project situates Camp Pendleton in the context of the overall regional landscape and employs an extraordinarily comprehensive set of variables in characterizing that landscape.

Stakeholder Involvement and Collaboration

In this area, the project investigators begin by establishing some critical caveats: the project involves independent research and does not intend to provide consulting services or advice to any regional stakeholders, including Camp Pendleton; assumptions and conclusions are based upon

publicly available documents, and the researchers have not met widely with private stakeholders or local governments. These important qualifying remarks establish up front that the project neither claims nor intends to fulfill DoD Ecosystem Management Principles Five and Six. As mentioned earlier, however, this project is not intended as an explicit ecosystem management effort, and does not claim to provide a means for implementing the DoD ecosystem management principles.

The most important aspect of this project for the purposes of this analytical category is its relevance to the substance of DoD Ecosystem Management Principle Four: developing a vision of ecosystem health. The analytical framework utilized by the project accomplishes two objectives: it characterizes the regional context, including ecological systems (described above), and it develops several alternative scenarios or visions of desired future conditions for the region. Scenarios are developed by asking six questions:

1. How should the state of the landscape be described—in content, space and time?
2. How does the landscape operate? What are functional and structural relationships among its elements?
3. Is the current landscape working well?
4. How might the landscape be altered—by what actions, where, and when?
5. What predictable differences might the changes cause?
6. How should the landscape be changed?

Several types of models (representation, process, evaluation, change, impact and decision) are employed to answer these questions. For example, representation and evaluation models are built by gathering and analyzing data on the 14 sets of characteristics discussed above. Change and impact models are developed by examining the potential ramifications for the landscape if regional development plans are implemented. Both the questions and the models used to answer them can be employed at the regional or sub-regional scale. In fact, the study develops scenarios at four scales: regional; sub-watershed; in the context of a residential development; and, with reference to several site-specific habitat improvement projects. Based upon the answers to these questions, Camp Pendleton and other institutions with land and resource management authority can make decisions with a more complete understanding of their implications for biodiversity and other issues of interest.

Scientific and Field-Tested Information

An important aspect of this project, mentioned briefly above, is the extensive use of process models in characterizing the landscape and understanding ecosystem composition, structure and function. Several types of models, focusing on various attributes, are used to characterize the study area and assess the potential impacts of alternative scenarios on biodiversity. These include soils, hydrology and natural disturbance regimes. In addition, regional biodiversity is characterized and understood by employing three types of models at scales from regional to specific habitat: single species potential habitat (for state and federally listed TES); species richness; and landscape

ecological pattern. By employing such models and the best available data, the project has developed a thorough and sophisticated portrait of the entire region, enabling a complete understanding of the role of Camp Pendleton within the landscape.

General Concluding Impressions

The Camp Pendleton project and the approach it represents shed light on many general issues confronted in any attempt to use the DoD ecosystem management principles to manage land and natural resources. In particular, the project provides valuable lessons for several issues involved in the earlier stages of ecosystem management:

- Its use of 14 different attributes, including socioeconomic, physical, biological and other types of parameters, to characterize the region and its ecological systems is an important aspect of this project. Management decisions will be better informed as the picture of the landscape becomes more thorough and sophisticated.
- Similarly, the project holds important lessons for defining a regional context for planning and implementing ecosystem management. In particular, the project uses physical and biological parameters—in this case, watersheds—to define a geographical planning context larger than Camp Pendleton alone. Understanding the administrative and legal jurisdictions within the geographically defined region, as well as their development plans, and incorporating those considerations in the project is a critically important innovation.
- An extremely difficult ecosystem management issue involves development of a vision of ecosystem health. The planning framework established by this project provides a general template, applicable to any region of the country and useful at many scales, to develop a vision of desired future conditions.

Finally, the project employs several types of models in understanding not only what the landscape looks like, but how it functions. This integration of socioeconomic, physical and biological models to provide a complete picture of a functioning regional landscape demonstrates use of cutting-edge science, as well as an invaluable decision-making tool.

5.4 Findings

5.4.1 Ecosystem Management Implementation Issues

The following discussion compares the cases of ecosystem management implementation examined in this study. While not cases of ecosystem management, strictly speaking, analysis of the Camp Pendleton and Mojave Desert Ecosystem Initiative (MDEI) cases have been instructive in elaborating ecosystem management implementation issues and demonstrating creative approaches to addressing those issues. However, DoD policy stipulates that INRMPs are the mechanism through which ecosystem management will be implemented on DoD and Army lands. Thus, it makes sense to focus primarily on the shortcomings of INRMPs, as presently conceived, as a mechanism for implementing ecosystem management. Lessons are drawn from the Camp Pendleton and MDEI

cases, as well as analysis of the three INRMP cases, to examine the current INRMP approach and shortcomings inherent in that approach. In keeping with the discussion throughout this paper, the DoD ecosystem management principles are used as the organizing framework for analysis.

General Observations

- Within the INRMP Preparation Guidelines (5/95 and 5/96 drafts), ecosystem management is considered a component of the INRMPs (e.g., a chapter heading) rather than the INRMPs being seen as an implementation mechanism for ecosystem management.
- The INRMP Preparation Guidelines (5/95 and 5/96 drafts) provide a blueprint or template for writing a document, but do not provide the process(es) necessary for implementing ecosystem management. In effect, the Guidelines constitute an outline of the plan's required substantive content (e.g., chapter headings and subheadings) with no guidance on the processes to be used in developing substantive content.
- In contrast, the Camp Pendleton project elaborates a general process for addressing several important ecosystem management implementation issues. While incomplete, this model could be linked with other process models (e.g., public participation and adaptive management models) to create a complete ecosystem management process. At the very least, it illustrates the general direction toward which INRMPs must evolve if they are to be effective mechanisms for implementing ecosystem management.
- The INRMPs are ineffective in identifying the capabilities of installation land, natural resources and ecological systems and linking these to training and land use needs. (It should be noted that the Camp Clark INRMP makes a strong effort in this direction).

Ecological Approach

- In general, the INRMPs do not identify or design a planning or management unit that is defined according to physical/biological criteria and extends beyond installation boundaries. The Camp Clark INRMP is somewhat exceptional in this regard, due to its use of natural communities as an organizing framework. Like the Fort Knox and Fort Polk INRMPs, however, it too fails to delineate a planning unit that extends "beyond the fenceline," or a planning framework that considers issues outside of installation boundaries.
- INRMPs do not consider or understand the regional context (e.g., the planned or proposed actions of adjacent administrative jurisdictions) and plan management actions within that context. The planning areas considered in the MDEI and the Camp Pendleton project, and the processes used to delineate them, are very instructive in this respect.

Stakeholder Involvement and Collaboration

- No efforts have been made, nor processes developed, for soliciting and incorporating the participation and involvement of parties "across the fenceline." This observation holds true for all cases considered in this study.
- The INRMPs do not include efforts to develop a "vision of ecosystem health." No process exists for establishing desired future conditions for installation ecological systems and natural resources. Thus, plans contain no overall set of goals and objectives to works towards and no endpoints that can be linked to management actions.
- Both the MDEI and the Camp Pendleton cases provide instructive models of how an installation might develop a vision of ecosystem health. The MDEI is stronger in terms of data collection, coordination and integration, while the Camp Pendleton case illustrates the importance of understanding the regional socio-economic and development context. If taken together, they could provide a comprehensive vision across multiple dimensions (social, physical and biological).
- The INRMPs do not establish mechanisms for prioritizing actions and resolving conflicts among contradictory goals. In part, this can be traced to the absence of a process for setting overall objectives.

Scientific and Field-Tested Information

- In their assessments and inventories, the INRMPs focus primarily on ecosystem composition (e.g., lists of species), ignoring the structure and function of the ecological systems, or how the systems work. The Fort Knox and Fort Polk INRMPs are particularly poor in this regard, while the Camp Clark INRMP natural communities approach demonstrates sensitivity to this concern.
- With the exception of Camp Clark, biological information focuses almost exclusively on game species and populations of other species of importance for economic or human use reasons.
- The INRMPs lack clear, tangible measures of success. No benchmarks have been established by which to monitor and evaluate outcomes. Regarding the implementation of ecosystem management, this is partly a function of the absence of an overall vision. However, few benchmarks are provided for the narrower purpose of monitoring and evaluating implementation of the INRMPs themselves.

Adaptive Management

No processes or mechanisms are established through which information on implementation, developed through field experience, can be fed back into the planning process. Again, this is partly due to the absence of processes in other areas (e.g., development of a vision; establishment of benchmarks; creation and implementation of monitoring strategies).

5.5 Implementation Recommendations

The above discussion demonstrates that many gaps still exist in using the INRMP approach for implementing ecosystem management. Such shortcomings do not mean that the INRMP approach, and the plans themselves, are inadequate tools for the task. On the contrary, all agencies and organizations engaged in implementing an ecosystem approach to management of land and natural resources are struggling with similar issues. For example, none of the federal agencies responsible for land and natural resource management have worked out a generalizable and widely accepted process for soliciting and incorporating stakeholder input. However, the shortcomings of the INRMP approach, and the plans it produces, reveal significant challenges that must be tackled before INRMPs become a viable tool for implementing ecosystem management on DoD lands. The list below is by no means exhaustive, but recommends ways to address some of the more serious issues confronting DoD and its natural resource managers as the INRMP approach evolves.

5.5.1 Develop a process-based approach for Integrated Natural Resources Management Planning.

- The INRMP Preparation Guidelines should provide installations with a generalizable, detailed and implementable planning process.
- DoD ecosystem management principles must be seen as the philosophical and conceptual framework within which natural resources planning is grounded, rather than a mandatory chapter in a document.
- Models for such a process-based planning approach do exist. For example, the DoD Biodiversity Management Strategy (Keystone Center, 1996) details a process that can be adapted for ecosystem management implementation that is geared specifically to the INRMP approach and DoD lands.

5.5.2 Develop a process for establishing and understanding the regional context of an installation.

- Boundaries for planning and implementing management actions must be established according to physical and biological criteria.
- Planning must acknowledge and account for the regional political, social, economic and cultural context. For example, planning must consider the current and proposed actions of other administrative entities with legal management jurisdiction within the regional boundaries. Approaches for such regional planning processes exist, such as the model employed by the Camp Pendleton project.

5.5.3 Develop a process for establishing a vision of ecosystem health.

- A vision for the planning region must establish desired future conditions for ecological systems and natural resources.

- The process must set clear goals and objectives for achieving the desired future conditions.
- The Camp Pendleton case demonstrates a readily available and adaptable model for such a visioning process.

5.5.4 Develop collaborative processes for stakeholder involvement in installation INRMP development.

- Such a process must provide a means for explicitly identifying all potential stakeholders with an interest in the region.
- Mechanisms for soliciting and incorporating input must be included.
- The principles underlying such processes, and the issues involved in their development and implementation, are described in Bourne (1996).

5.5.5 Identify and utilize biological and physical process models in understanding the structure and function of ecological systems on installations and in the surrounding regions.

- Models for characterizing physical and biological processes (e.g., hydrology, soil erosion, species distribution) are available and should be used to assist in defining the planning context, and characterizing physical and biological systems within the planning region. The Camp Pendleton project utilizes such models (e.g., soil moisture, ecological models at several scales) to understand the structure and function of systems within the planning region. These models illuminate the implications for the installation of various regional development scenarios.

5.5.6 Develop standard, generalizable methods and tools for monitoring progress and evaluating outcomes.

- A broad suite of indicators must be developed for use in monitoring and evaluation, in order to measure success. Indicators of many types are necessary: for example, those useful for assessing the state of ecosystem "health", as well as others that can be employed in evaluating the impact of natural resources planning and management actions on installation mission and readiness.
- Monitoring tools and methods must be identified and/or created.

5.5.7 Identify or develop standard, generalizable adaptive management mechanisms and tools.

- Installations must manage to learn. Implementation of management actions must be considered a learning strategy, and knowledge gained from management must be used as input for planning future management actions.
- Research must be linked to management.
- Expected effects of management actions must be recorded, management actions must monitored, and results evaluated.
- Installations must establish an institutional feedback loop linking the vision of ecosystem health, management objectives and actions based upon that vision, monitoring and evaluation of management actions, and knowledge gained from monitoring and evaluation.

BIBLIOGRAPHY

Army Environmental Center (Conservation Branch). Integrated Natural Resources Management Plan: Preparation Guidelines (Draft; for discussion at the INRMP-EA coordination meeting), Edgewood, MD, May 11, 1995.

Army Environmental Center (Conservation Branch). Integrated Natural Resources Management Plan: Preparation Guidelines (Interim Final). Edgewood, MD, May 9, 1996.

Army Regulation 200-3. Natural Resources—Land, Forest and Wildlife Management, February 1995.

Army Regulation 420-74. Natural Resources—Land, Forest and Wildlife Management, February 1986.

Bailey, Robert G. *Delineation of Ecosystem Regions*. Environmental Management 7(4): 365-373, 1983.

Bailey, Robert G. Description of the Ecoregions of the United States (2nd edition). Washington, D.C. USDA Forest Service, 1995.

Biodiversity Research Consortium. Biodiversity and Landscape Planning: Alternative Futures for the Region of Camp Pendleton, California. Corvallis, OR: Biodiversity Research Consortium, 1996.

Brandt, Donna K. Camp Clark Conservation Plan, 1996-2000 (Integrated Natural Resource Management Plan) (draft). Camp Clark, MO: Missouri National Guard, 1996.

Brown, R. Steven and Karen Marshall. *Ecosystem Management in State Governments.* Ecological Applications 6(3): 721-723, 1996.

Brown, Gerald C. Director, Environmental Programs. Office of the Assistant Chief of Staff for Installation Management. Memorandum: Development of Army Policy and Program for Ecosystem Management, 29 June 1994.

Bourne, R. Gregory. Collaborative Planning and Ecosystem Management (Draft). Atlanta, GA. Army Environmental Policy Institute, 1996.

Christensen, Norman L., Ann M. Bartuska, James H. Brown, Stephen Carpenter, Carla D'Antonio, Robert Francis, Jerry F. Franklin, James A. MacMahon, Reed F. Noss, David J.Parsons, Charles H. Peterson, Monica G. Turner and Robert G. Woodmansee. The report of the Ecological Society of America Committee on the Scientific Basis of Ecosystem Management. Ecological Applications 6(3): 665-691, 1996.

Fort Polk and Joint Readiness Training Center. Environmental and Naural Resources Management Division, Directorate of Public Works. Draft Fort Polk Integrated Natural Resources Management Plan. Fort Polk, LA. Environmental and Naural Resources Management Division, Directorate of Public Works, 1995.

Goodman, Sherri W. Deputy Under Secretary of Defense (Environmental Security). Memorandum on Department of Defense Ecosystem Management Principles. 8 August, 1994.

Goodman, Sherri W. Deputy Under Secretary of Defense (Environmental Security). Memorandum: Mojave Desert Ecosystem Initiative. 25 April 1995.

Haeuber, Richard. *Setting the Environmental Policy Agenda: The Case of Ecosystem Management*. Natural Resources Journal 36(1): 1-28, 1996.

Hart, B.L. and G.D. Lester. Natural Community and Sensitive Species Assessment on Fort Polk Military Reservation, Louisiana. Baton Rouge, LA. Louisiana Department of Wildlife and Fisheries, 1993.

Interagency Ecosystem Management Task Force. The Ecosystem Approach: Healthy Ecosystems and Sustainable Economies. Volume I- Overview. Washington, D.C., 1995.

John, DeWitt. Civic Environmentalism: Alternatives to Regulation in States and Communities. Washington, D.C. CQ Press, 1995.

Keystone Center. Keystone center policy dialogue on a Department of Defense (DoD) Biodiversity Management Strategy. Keystone, CO. The Keystone Center, 1996.

Levin, Simon. *The Problem of Pattern and Scale in Ecology*. Ecology 73(6):1943-1967, 1992.

Moote, M.A., S. Burke, H.J. Cortner and M.G. Wallace. Principles of Ecosystem Management. Water Resources Research Center, University of Arizona, Tucson, AZ. 14pp., 1994.

Morrissey, W.A., J.A. Zinn and M.L. Corn. Ecosystem Management: Federal Sector Activities. CRS Report 94-339 ENR. Library of Congress, Congressional Research Service, Washington, D.C., 1994.

President's Council on Sustainable Development. Sustainable America: A New Consensus for Prosperity, Opportunity, and A Healthy Environment for the Future. Washington, D.C. GPO, 1996.

Sale, Kirkpatrick. Dwellers in the Land: The Bioregional Vision. San Francisco: Sierra Club Books, 1985.

Slocombe, D. Scott. *Environmental Planning, Ecosystem Science, and Ecosystem Approaches for Integrating Environment and Development*. Environmental Management 17(3): 289-303, 1993a.

Slocombe, D. Scott. *Implementing Ecosystem-based Management*. BioScience 43(9): 612-622, 1993b.

Udvardy, M.D.F. *A Classification of the Biogeographical Provinces of the World*. Occasional paper 18. Morges, Switzerland: International Union for the Conservation of Nature and Natural Resources, 1975.

U.S. Army Armor Center, Fort Knox. Environmental Management Division. Directorate of Public Works. Draft Fort Knox Integrated Natural Resources Management Plan. Fort Knox, KY. Environmental Management Division. Directorate of Public Works, 1995.

U.S. Department of Defense Instruction 4714.3. Environmental Conservation Program. 3 May 1996.

Walker, Lewis D. Deputy Assistant Secretary of the Army (Environment, Safety and Occupational Health). Memorandum: Conservation Policy, 3 July 1995.

Walsh, Peter. Assistant Deputy Under Secretary of Defense (Environmental Quality). Memorandum: Environmental Security—Draft Instruction for Environmental Conservation. 9 May 1995.

Yaffee, Steven L. *Ecosystem Management in Practice: The Importance of Human Institutions*. Ecological Applications 6(3): 724-726, 1996.

Chapter 6. NEPA and Ecological Management: An Analysis with Reference to Military Base Lands

6.1 Introduction

Ecological management involves managing lands, ecosystems, and watersheds on a large scale over long periods of time. The federal government has adopted an ecosystem management approach to guide federal agencies with land or natural resource management responsibilities. The Department of Defense (DoD) has endorsed this ecosystem management approach (Goodman 1996). Relatedly, some federal agencies have embraced watershed approaches to restore and protect aquatic ecosystems and resources. State and local governments and diverse interest groups have also endorsed ecosystem- and watershed-based approaches to natural resource management. Both approaches share the idea that resource management decisions should be made within scientifically—rather than geopolitically—defined boundaries, considering the full range of resource values and impacts. By contrast, resource management policy historically focused primarily on single resources and the impacts of discrete decisions on immediately affected resources.

Because the National Environmental Policy Act (NEPA) is a significant legal factor in federal decision processes with environmental implications, NEPA is assuming a major role in federal ecological management initiatives. As interpreted by the courts and implementing regulations, NEPA can be employed to promote ecological management practices. In fact, NEPA processes are being used in several federal ecosystem and watershed initiatives.

This study will examine how NEPA can be used to facilitate federal ecological management efforts, with a particular focus on DoD military base lands. It will also note how adoption of ecological management practices can help agencies to implement NEPA more fully and effectively. First, the report will define the concept of ecological management, and identify principles developed to define the related concepts of ecosystem and watershed management. Second, it will review the statute, implementing regulations, relevant court decisions, and related statutes, including the Sikes Act as they relate to ecological management. Third, it will examine how NEPA can be employed to advance each of the seven identified ecological management principles. Finally, the study will conclude with specific recommendations for how federal agencies, particularly DoD facilities, can best employ NEPA to facilitate ecological management, and how agencies can utilize ecological management practices to better implement NEPA.

6.2 Ecological Management Principles

Natural resource policy is in transition. In the past, natural resource and environmental policy has focused on the impacts of individual decisions and actions on a relatively discrete area or narrow range of resources. More recently, federal and state agencies have begun to realize that such narrow approaches fail to account for the cumulative ecological impacts of a wide range of actions over long periods of time (National Research Council 1992). Increasingly, agencies are beginning to adopt ecological management approaches that reflect these spatial and temporal connections. Substantial public support, ranging from diverse interest groups to individual citizens, exists for

this policy shift (Proceedings, Watershed '96; Adler 1995). At this point, however, such programs are still in their early, often experimental stages.

The federal agencies, along with many state and local agencies, have adopted ecosystem management as an operative policy (Congressional Research Service 1994). The related concept of watershed management has also been widely embraced by federal, state, and local agencies as an operative policy for ensuring the ecological integrity of the nation's water resources (Proceedings, Watershed '96; Naiman 1992; Adler 1995; EPA 1996). The concepts of ecosystem and watershed management are inherently related; both concepts share many similar characteristics and are oriented toward ensuring healthy, diverse, and sustainable ecological systems. As a practical matter, given the inherent connections between these two concepts, they can appropriately be merged together under the doctrine of ecological management.

The concept of ecological management is best understood and defined in terms of general principles. Indeed, the underlying concepts of ecosystem and watershed management are themselves being defined in this manner (Interagency Ecosystem Management Task Force 1995a; Adler 1995; Moote et al. 1994; Grumbine 1994). For the most part, these defining principles reflect the dynamic nature of ecosystems and are designed to sustain healthy biological resources into the future (Ecological Society of America 1995). Yet because natural resource policy cannot rest entirely on biological science, ecological management principles must acknowledge the important human role in ecosystems and incorporate social values into managerial priorities and processes (Interagency Ecosystem Management Task Force 1995a; Moote et al. 1994). In other words, ecological management contemplates natural resource policies that are framed at appropriate spatial and temporal scales to meet legitimate human needs while protecting and restoring the integrity of underlying ecological resources, systems, and processes.

Drawing upon ecosystem and watershed management concepts, seven important principles can be identified as the key elements of ecological management. These seven principles are interrelated and provide a basis for integrating critical scientific insights and human value considerations into a coherent and workable policy. The following paragraphs define and briefly describe these seven principles.

First, wherever possible, common ecological management goals should be socially defined through a collaborative vision process that involves all interested participants and incorporates ecological, economic, and social considerations (Moote et al. 1994; Cortner et al. 1994). This principle acknowledges that ecological management goals should reflect the prevailing social consensus, established jointly by everyone with an interest in the affected ecosystem or watershed. It ensures that human concerns will be integrated with biological considerations in establishing basic management goals. Some minimum ecological management goals, however, are defined or constrained by existing legal requirements, such as those contained in the Endangered Species Act and the Clean Water Act. Collaborative processes should be used to seek consensus, but authorized officials may sometimes have to break impasses in accordance with relevant statutes and regulations. They also may have to reconcile divergent national, regional, and local goals. Ecological management goals should be specific, using numeric or other objective performance criteria wherever possible,

and should focus on environmental outcomes (or results) rather than bureaucratic outputs. In addition, the participants should establish binding and enforceable commitments to implement management goals.

Second, given that most ecosystems and watersheds transcend conventional geopolitical boundaries, ecological management requires coordination among federal, state, tribal, and local entities as well as collaboration with other interested parties, including private property owners, consumptive and nonconsumptive resource users, and the general public (Shannon 1993; U.S. General Accounting Office 1994). Interagency coordination ensures that all government agencies with ownership or management responsibilities for the affected lands, waters, or other resources are involved in the decision-making process and are committed to coordinating management activities to maintain ecosystem integrity. The requirement of broad collaboration also ensures that everyone with an interest, economic or otherwise, in the affected ecosystem or watershed has an opportunity to participate in ecological management decisions. Not only does this principle acknowledge that ecosystem management requires social consensus, but it also reflects the fact that ecosystems and watersheds are expansive management units that affect, and are affected by, large numbers of people.

Third, ecological management policies and decisions should be based upon integrated and comprehensive scientific information that addresses multiple rather than single resources (Moote et al. 1994; Grumbine 1994). In particular, ecological management programs should be based on comprehensive regional (ecosystem- or watershed-wide) resource inventories and evaluations that catalogue the status and health of resources, their potential future (restored) health, existing and possible future sources of impairment, and restoration and protection strategies. This principle highlights the important role that scientific assessment and knowledge plays in understanding ecological processes and, therefore, in establishing effective management goals. It also emphasizes that ecological management differs from conventional natural resource management by focusing on all ecosystem resources, not one or two resources that are commercially valuable.

Fourth, ecological management seeks to maintain and restore biodiversity and ecosystem integrity (Grumbine 1994; Keiter 1994). Biodiversity means "the variety and variability among living organisms and the ecological complexes in which they occur" (Office of Technology Assessment 1987). Biodiversity conservation focuses on maintaining and restoring diversity at the ecosystem, species, and genetic levels (Ibid.). Ecosystem integrity adds the idea of protecting and restoring the structure, function, and resilience of ecological systems and services, which transcends protection of individual species (Karr 1991). While biodiversity can be measured in terms of species diversity and richness, habitat quality and ecosystem integrity require more sophisticated measures. Techniques such as biological water quality criteria (or biocriteria) (Davis and Simon 1995) are being developed to assess the health of whole aquatic ecosystems. In a related development, scientists have begun to identify the types of ecosystems that must be preserved to ensure the survival of a full complement of native species (Noss and Cooperrider 1994). Moreover, scientists have begun to identify the types of research that are necessary to ensure sustainable and healthy ecosystems (Ecological Society of America 1995, Lubchenko et al. 1991).

Fifth, ecological management involves management on large spatial and temporal scales that correspond to ecosystems and watersheds (Naiman 1992; National Research Council 1992).

Because ecological processes are in a constantly fluctuating, or nonequilibrium, condition, large scale management is designed to accommodate the dynamic and sometimes unpredictable nature of natural processes. Whether ecological change is the result of natural or man-induced causes, this principle ensures that relevant ecological impacts are assessed. It is designed to promote and ensure ecosystem and watershed integrity and resiliency. Moreover, it should enable resource managers to account for the cumulative impacts of past, ongoing, and future activities within the ecosystem or watershed (Keiter 1994; Cortner 1994).

Sixth, given the finite nature of public funds and other resources, ecological management allows agencies, within the boundaries of relevant legal requirements, to engage in careful targeting to select achievable solutions and to allocate resources efficiently (Adler 1995). This principle acknowledges that resource managers will have to make difficult choices in expending limited budgets; it encourages managers to direct funds to projects that are either mandated by law or likely to yield the largest benefit. For example, after setting goals for habitat restoration, planners can order projects based on potential benefits, likelihood of success, cost and other factors to implement the best projects first. Additional projects can be implemented sequentially until program goals are met.

Seventh, ecological management requires an iterative, adaptive management approach to account for changing goals and values and new information concerning ecological conditions. An adaptive management approach includes establishing baseline conditions, monitoring, reevaluation, and adjustment (Interagency Ecosystem Management Task Force 1995a; Lee 1993). Because management decisions often have to be made before all ecological and other consequences are fully understood, adaptive management enables managers to make and implement decisions while reassessing initial assumptions and readjusting as necessary. Decisions are seen as experimental rather than final in nature. Adaptive management also recognizes that public values may change over time, and that managers must constantly reassess whether the current policy accurately reflects these values. In short, adaptive management is designed to accommodate the uncertain nature of ecological and human change.

Significantly, DoD has generally embraced these principles in its approach to ecosystem management. A 1994 DoD memorandum defines ecosystem management in the following terms: "Ecosystem management of natural resources draws on a collaboratively developed vision of desired future ecosystem conditions that integrates ecological, economic, and social factors. It is a goal-driven approach to restoring and sustaining healthy ecosystems and their functions and values using the best science available. The goal is to maintain and improve the sustainability and native biological diversity of terrestrial and aquatic, including marine, ecosystems while supporting human needs, including the DoD mission" (Office of the Undersecretary of Defense 1994). A 1996 DoD Instruction includes a statement of ecosystem management principles and guidelines that provides, among other things, for maintaining native biodiversity, utilizing ecological boundaries and timeframes, developing a vision of ecosystem health, establishing management priorities, using the best available scientific information, employing adaptive management techniques, and developing coordinated approaches with other managers and interested parties (Department of Defense Instruction 1996). In short, DoD has adopted a principle-based approach to ecological management that is quite similar to the one outlined here.

6.3 Ecological Management, NEPA, and the Sikes Act

This section examines the National Environmental Policy Act to demonstrate how it can be employed to support ecological management policies and initiatives on DoD lands. It begins with a brief overview of relevant NEPA statutory and regulatory provisions, focusing on the EIS requirements. Next, it reviews the related NEPA concepts of programmatic EISs and tiering, which represent particularly effective means for federal agencies to undertake large-scale environmental assessments that cover expansive areas across jurisdictional boundaries over extended periods of time. Finally, it describes briefly the Sikes Act, which governs natural resources management on DoD lands, and related NEPA compliance issues.

6.3.1 Basic NEPA Provisions and Requirements

Enacted in 1970, the National Environmental Policy Act ("NEPA") (42 U.S.C. § 4321 et seq.) sets broad national environmental goals. According to Congress, NEPA's purposes are:

> *To declare a national policy which will encourage productive and enjoyable harmony between man and his environment; to promote efforts which will prevent or eliminate damage to the environment and biosphere and stimulate the health and welfare of man; to enrich the understanding of the ecological systems and natural resources important to the Nation; and to establish a Council on Environmental Quality (Ibid. § 4321).*

NEPA's most familiar and significant requirement is the Environmental Impact Statement (EIS). Section 102 of NEPA requires that a "detailed statement" be prepared by the responsible official for every "major Federal action[] significantly affecting the quality of the human environment." (Ibid. § 4332). An EIS must contain five elements. The agency must disclose: (i) the environmental impact of the proposed action; (ii) the unavoidable adverse affects of the proposed action; (iii) alternatives to the proposed action; (iv) the effect of the proposed action on the environment's long-term productivity; and (v) irreversible and irretrievable commitments of resources resulting from the proposed action (42 U.S.C. § 4332(C)).

In NEPA, Congress also created the Council on Environmental Quality (CEQ) to aid implementation of the statutory requirements. (Ibid. § 4342). In 1978, the CEQ adopted NEPA implementing regulations, which are binding on all federal agencies and thus judicially enforceable (40 C.F.R. § 1500.3; Andrus v. Sierra Club, 442 U.S. 347 (1979)). In addition, DoD has promulgated regulations and implementing procedures that govern how it implements NEPA and the CEQ regulations (32 C.F.R. Part 188 and Enclosure 1).

An EIS is essentially a document intended to help federal officials make responsible and fully-informed decisions and to inform the public about those decisions and their environmental consequences (40 C.F.R. § 1502.1). The CEQ regulations provide that an EIS "shall provide full and fair discussion of significant environmental impacts and shall inform decision-makers and the public of the reasonable alternatives which would avoid or minimize adverse impacts or enhance the quality of the human environment" (Ibid). An agency drafting an EIS must consider and compare

a range of alternatives to the proposed action, including "the alternative of no action (Ibid. § 1502.14(d))." An EIS must "be supported by evidence (Ibid. § 1502.1)," and agencies must "insure the professional integrity, including scientific integrity, of the discussions and analyses" in the EIS (Ibid. § 1502.24). Agencies must collect and present new information if it is "essential to a reasoned choice among alternatives," but agencies are entitled to rely on "existing credible scientific evidence" where the costs of compiling new information would be exorbitant or the means of obtaining the information are not known (Ibid. § 1502.22). Thus, an EIS must assess the effects of the proposed action, as well as a range of alternatives, based on credible, available evidence.

Two other aspects of the EIS process are particularly relevant to ecological management. First, NEPA requires the use of a comprehensive, inclusive process of consultation that promotes the consideration of diverse views. The CEQ regulations establish detailed opportunities for public notice and comment throughout the NEPA process, and impose an obligation on agencies to consider and to respond to such comments fully (40 C.F.R. §§ 1501.5, 1501.6, 1502.9, 1502.25, 1506.6, pts. 1503-1504). An agency preparing an EIS also must consult with any federal agency with jurisdiction or special expertise regarding an environmental impact (42 U.S.C. § 4332(2)(C)). Comments from interested federal, state and local agencies must be forwarded to CEQ and made available to the public, and they must be considered in the agency decision-making process (Ibid). Second, NEPA and its implementing regulations require the consideration of a wide range of environmental impacts from a broad perspective. Agencies must consider the direct impacts of a project, as well as its indirect, secondary and cumulative impacts (40 C.F.R. §§ 1502.16, 1502.20, 1508.7, 1508.8, 1508.25, 1508.28; Kleppe v. Sierra Club, 427 U.S. 390 (1976); LaFlamme v. FERC, 852 F.2d 389 (9th Cir. 1988); Thomas v. Peterson, 753 F.2d 754 (9th Cir. 1985)).

In addition, the CEQ regulations require each federal agency to adopt supplemental NEPA implementing regulations, which establish the basic procedural requirements governing that agency in meeting its NEPA obligations (40 C.F.R. § 1507.3). The Department of Defense's NEPA implementing regulations are codified at (32 C.F.R. § 214).

The Supreme Court has consistently interpreted NEPA to be a procedural statute. According to the Court, the NEPA process is intended to disclose the environmental impacts of a proposed action and a range of alternatives. Federal agencies, however, are not obligated to choose the least environmentally harmful alternative, only to disclose the impacts associated with each alternative. Indeed, the Supreme Court has noted that "NEPA merely prohibits uninformed—rather than unwise—agency action (Robertson v. Methow Valley Citizens Council, 490 U.S. 332 (1989))." At the same time, the Supreme Court has indicated that courts reviewing EIS challenges should not defer to an agency "without carefully reviewing the record and satisfying itself that the agency has made a reasoned decision based on its evaluation of the available information (Marsh v. Oregon Natural Resources Council, 490 U.S. 360, 378 (1989))." The courts have therefore been willing to enforce NEPA's procedural requirements and have often enjoined agencies to reassess the environmental consequences of a proposed action (Marble Mountain Audubon Society v. Rice, 914 F.2d 179 (9th Cir. 1990); Bob Marshall Alliance v. Hodel, 852 F.2d 1223 (9th Cir. 1988)). As a result, NEPA has become a principal means for ensuring environmentally accountable decisions.

6.3.2 Programmatic EISs and Tiering

The programmatic EIS and the related tiering process represents an effective and efficient NEPA compliance procedure, and can be used to facilitate ecological management goals. Although NEPA itself contains no mention of the programmatic EIS, the Supreme Court has endorsed the concept: "When several proposals for ... actions that will have cumulative or synergistic environmental impacts ... are pending concurrently before an agency, their environmental consequences must be considered together. Only through comprehensive consideration of pending proposals can the agency evaluate different courses of action" (Kleppe v. Sierra Club, 427 U.S. 390, 410 (1976)). The CEQ regulations, which encourage federal agencies to tier their EISs, can also be interpreted to support the programmatic EIS concept (40 C.F.R. § 1508.20). Moreover, the CEQ regulations define the "federal action" that triggers the EIS requirement as: (i) adoption of an official policy; (ii) adoption of formal plans upon which future agency actions will be based; or (iii) adoption of programs or systematic and connected agency decisions to implement a statutory program or an executive directive (40 C.F.R. § 1508.18(b)(1)-(3)). Thus, federal agencies can utilize programmatic EISs to look beyond the impacts of a particular project, and to focus instead on a policy or program to implement several similar projects (Porterfield 1994, Cooper 1993). However, the decision of whether to prepare a programmatic EIS is initially committed to agency discretion and will only be judicially overturned on arbitrary and capricious grounds (Conservation Law Foundation of New England, Inc. v. Harper, 587 F.Supp. 357, 364 (D. Mass. 1984)).

Use of a programmatic EIS can save an agency time and resources. It allows agencies to "eliminate repetitive discussions of the same issues and to focus on the actual issues ripe for decision at each level of environmental review (40 C.F.R. § 1502.20)." Issues adequately addressed in a programmatic EIS need not be revisited in NEPA documents addressing subsequent, site-specific actions. Instead, site-specific actions may be "tiered" on the initial programmatic EIS. (40 C.F.R. §§ 1502.20, 1508.28). "[O]ne initial comprehensive study, which could be referred to and supplemented by less comprehensive individual studies for each parcel, would appear to reflect a better use of scarce resources" (Jones v. Lynn, 477 F.2d 885 (1st Cir. 1973)). As a practical matter, federal agencies often "tier" less complex environmental assessments to earlier programmatic EISs when reviewing specific project proposals.

Especially where a program is controversial, an agency can advantageously employ a programmatic EIS to address contentious issues. Once settled in the programmatic EIS, these contentious issues ordinarily will not need to be revisited in subsequent EISs for particular projects. In the military context, for example, if the dangers of transporting nuclear weapons can be addressed in a programmatic EIS, these dangers need not be re-addressed through NEPA during subsequent siting decisions (Weinberger v. Catholic Action of Hawaii, 454 U.S. 139 (1981)). However, NEPA will still require careful environmental analysis of the siting decision itself.

Tiering can be used in two ways. One proceeds from the broad, programmatic phase to one or more site-specific actions. The other proceeds from an early stage in a site-specific project to one or more later stages of the same project. First, tiering can be used to incorporate site specific EISs into a broad, programmatic EIS. In this instance, an agency prepares a broad, or programmatic EIS for an entire program or policy. When a subsequent, site-specific action is taken, the agency "need

only summarize the issues discussed in the broader statement and incorporate discussions from the broader statement by reference and shall concentrate on the issues specific to the subsequent action" (40 C.F.R. § 1502.20; see also 40 C.F.R. § 1508.28(a)). Because an EIS is required for each action (the program and the site-specific action), tiering streamlines the existing process because material found in the initial EIS need not be duplicated (Guidance Regarding NEPA Regulations, CEQ, 48 F.R. 34263 (1983)). The Forest Service, for example, often "tiers" individual timber harvest projects to the environmental analyses found in the EIS accompanying the Forest Plan.

Second, tiering can incorporate an EIS prepared at an early stage of a project into an EIS done at a later stage. "Tiering in such cases is appropriate when it helps the lead agency to focus on the issues which are ripe for decision and exclude from consideration issues already decided or not yet ripe (40 C.F.R. § 1508.28(b))." The regulations, for example, explain that an early EIS on project need and site selection may be tiered with a later EIS on environmental mitigation (Ibid.). One example of such tiering occurs when the Nuclear Regulatory Commission prepares one EIS at the construction license phase of a nuclear power plant process, and a second at the operating permit phase.

6.3.3 The Sikes Act

The Sikes Act, 16 U.S.C. § 670a et seq., establishes natural resource planning and management requirements for DoD installations. The Act authorizes DoD "to carry out a program of planning for, and the development, maintenance, and coordination of, wildlife, fish and game conservation and rehabilitation" pursuant to cooperative plans developed jointly with the Department of the Interior and appropriate state agencies (Ibid. § 670a(a)). Such cooperative plans must provide for fish and wildlife habitat improvements or modifications, range rehabilitation to support wildlife, off-road vehicle traffic control, and specific habitat improvement projects and protection for threatened or endangered fish, wildlife and plants (Ibid. § 670a(b)(1)). Plans must be reviewed "on a regular basis, but not less often than every 5 years (Ibid. § 670a(b)(2))." The plans may be funded and implemented through cooperative agreements with states, local governments, nongovernmental organizations, and individuals (Ibid. § 670c-1).

Like NEPA, the Sikes Act primarily establishes procedural mechanisms for sound environmental and natural resources planning and management. Unlike NEPA, however, the Sikes Act also establishes a general substantive standard for natural resources management on military reservations. In particular, military lands must be managed to:

1. Provide for sustained multipurpose uses of those resources; and
2. Provide the public access that is necessary or appropriate for those uses; to the extent that those uses and that access are not inconsistent with the military mission of the reservation (Ibid. § 670a-1(a)).

The Sikes Act is explicated by DoD regulations specifying how the law will be interpreted and implemented, including specific requirements for "Integrated Natural Resources Management" conducted under the Act (Ibid. Appendix).

Preparation of the Sikes Act-mandated INRMPs will require NEPA compliance. Clearly, most military base natural resource management plans will constitute a "major federal action significantly affecting the human environment," thus implicating NEPA considerations (42 U.S.C. § 4332(2)(C)). Other federal land management agencies, when preparing statutorily mandated resource management plans, adhere to NEPA legal requirements; these plans are ordinarily accompanied by an EIS that describes fully the potential environmental impacts, requiring the Forest Service to use NEPA procedures in preparing national forest management plans (16 U.S.C. § 1604(g)(1). Recent DoD documents similarly acknowledge that INRMPs must comply with NEPA (Army Environmental Center Conservation Branch 1996). Whether a full EIS will be required for each INRMP or whether an Environmental Assessment (EA) might suffice will depend on whether the plan (including related mitigation measures) will have a "significant" impact on the environment. Given the broad geographic and temporal scope of most ecological management plans, these plans generally will cross this threshold NEPA requirement and thus require preparation of an EIS. However, full NEPA compliance at this initial stage of ecological management planning, when combined with subsequent tiering opportunities, can produce later efficiencies (Army Environmental Center Conservation Branch 1996). These points, as well as specific requirements of the Sikes Act and its regulations, will be discussed further in Section 6.4 of this report.

6.4 Employing NEPA as an Ecological Management Tool

For federal agencies, the NEPA process can be a vital component of an ecological management approach (Interagency Ecosystem Management Task Force 1995b). Careful implementation of the NEPA process, including the use of programmatic EISs and tiering, can ensure that the seven principles of ecological management are incorporated into agency policies and decisions. The role that NEPA might play in implementing each of the seven ecological management principles is discussed below. This discussion also addresses how related natural resource management statutes, such as the Sikes Act and the Endangered Species Act, relate to NEPA processes, how proper NEPA compliance can advance DoD's natural resource management goals, and how adopting ecological management principles can enable DoD to better implement NEPA.

6.4.1 Creating a Shared Vision

Ecological management goals should, to the extent possible, be socially defined through a shared vision process incorporating ecological, economic, and social considerations. NEPA and its implementing regulations provide a single framework for agencies to involve affected interests, the public, and other federal, state and local agencies in the decision-making process. Through such involvement, agency officials should seek to identify principal points of agreement among interested parties and to design responsive ecological management policies.

The CEQ regulations require agencies to "[m]ake diligent efforts to" involve the public throughout the NEPA process (40 C.F.R. § 1506.6). Agencies are required to give constructive notice of the proposed action to the public through local media, and are encouraged to notify adjacent landowners directly (Ibid. § 1506.6(b)(3)). An EIS must be prepared early "so that it can serve

practically as an important contribution to the decision-making process and will not be used to rationalize or justify decisions already made" (Ibid. § 1502.5). The public and other agencies must be involved in project and EIS scoping (Ibid. § 1501.7), and in draft, final, and supplemental EISs (Ibid. §§ 1502.9, 1502.19). The agency has a duty not only to invite comments, but to consider and respond to them fully (Ibid. §§ 1503.1, 1503.4). Agencies are also required to hold public hearings where appropriate (Ibid. § 1506.6(c)).

In addition, agencies are required to assess the "[p]ossible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned (40 C.F.R. § 1502.16)." In the course of such an assessment, agencies have a opportunity to build valuable channels of communication with local government entities, identify potential points of conflict, and investigate possible solutions. Moreover, NEPA allows, and in some cases requires, cooperation among and between federal agencies. Similarly, the Sikes Act enables DoD to develop cooperative management plans and agreements with federal, state, and local governmental entities as well as nongovernmental organizations and individuals (16 U.S.C. §§ 670a, 670c-1). DoD regulations promote the use of both interagency cooperation and public participation in the development of the Integrated Natural Resources Management Plans (INRMPs) at military facilities (32 C.F.R. Part 190, App. A.2, A.4). These points are addressed more fully in the following section on interagency coordination.

Relatedly, the goals developed through an ongoing ecological management program may facilitate NEPA compliance for particular agency actions. While the existence of a separate ecological management program would not satisfy formal public notice and comment requirements of NEPA, combining the two public processes would improve and streamline overall agency procedures. Moreover, goals identified through an ecological management process can be used as one alternative to consider in the NEPA process (probably as the preferred alternative), rather than developing a new set of proposals from scratch.

However, NEPA has some limitations as a tool for developing ecological management objectives. First, simply going through the motions of the scoping and comment process will not assure a shared vision between the public and the agency. The process may not result in a brokered agreement between all parties, but may reveal several competing views. Moreover, NEPA compliance itself only requires agencies to consider public comments while still remaining the ultimate decision-maker. This suggests that agencies should view NEPA's scoping and comment process as a consensus-buildin opportunity. Interagency Ecosystem Management Task Force at 65. A true shared consensus among diverse interest groups may require the use of procedures and communication or dispute resolution techniques beyond those mandated for NEPA compliance. Broad-scale federal land and resource planning obligations, such as those reflected in the Sikes Act and its implementing regulations (16 U.S.C. § 670a et seq.; 32 C.F.R. § 190, Appendix A.1), can provide a vehicle for defining a vision or seeking consensus.

Second, NEPA's consultation requirements cannot override an agency's mission or other statutory requirements. While considering the views revealed in the shared vision process, the agency will ultimately have to make a policy decision consistent with its statutory mission and obligations. In the case of DoD lands, agency officials will have to reconcile the views emerging

from a shared vision process employing NEPA procedures with its primary military training and preparedness statutory responsibilities (32 C.F.R. § 190.4(b)), requiring that DoD natural resources "shall be managed to support the military mission, while practicing the principles of multiple use and sustained yield"; App. A.5.e (requiring INRMP to be compatible with Base Master plan); App. B.1.a (requiring INRMPs to support military activities and natural resources improvement). In addition, the agency may be required by statute to take specific actions requiring DoD compliance with the stricter of federal or local environmental laws (32 C.F.R. § 190.4(d)). If the Endangered Species Act is implicated, for example, the agency may have limited discretion. A shared vision advocating an agency action that would "take" an endangered species or its habitat would be of little value. Thus, while NEPA can be employed to define a shared ecological management vision, responsible agency decision-makers cannot ignore overriding legal constraints.

Third, NEPA's requirement that EISs be prepared only for discrete "major federal actions" may be inconsistent with the concept of adaptive management. Ecological management is an ongoing, iterative, adaptive process in which management goals are reevaluated over time to reflect changing conditions and values (Principle Seven). While this problem may be addressed through tiered EISs, it may be inefficient and undesirable to undertake a new NEPA process every time management goals are revised. Thus, while NEPA may be useful in identifying initial program goals, an advisory committee representing diverse interest groups may be a better approach to allow continued input into the ongoing process.

6.4.2 Facilitating Interagency Cooperation and Consultation

Cooperation among agencies is a key to successful ecological management. NEPA can play a vital role in developing lines of communication between agencies and in facilitating interagency coordination. NEPA requires agencies to "consult with and obtain the comments of any Federal agency which has jurisdiction by law or special expertise with respect to any environmental impact involved" (42 U.S.C. § 4332(C)). Thus, federal agencies with responsibility for, or a special interest in, the ecosystem or its resources should be involved early in the NEPA process. Early involvement should promote interagency understanding and coordination.

When two or more agencies are involved in geographically proximate activities, the CEQ regulations provide for designation of "lead" and "cooperating" agencies (40 C.F.R. §§ 1501.5 to 1501.6). Lead agencies are responsible for requesting the participation of cooperating agencies, incorporating the environmental analyses and proposals of cooperating agencies, and organizing the environmental analysis (Ibid. § 1501.6(a)). Upon the request of lead agencies, cooperating agencies are responsible for preparing analyses in their areas of special expertise (Ibid. § 1501.6(b)). Moreover, federal agencies with legal jurisdiction or special expertise in an area have a duty to comment on an EIS, or to make an affirmative decision that no comment is needed (Ibid. § 1503.2). Because lead agencies are not required to designate cooperating agencies, this approach to NEPA analysis may be underutilized in ecological management processes (Interagency Ecosystem Management Task Force 1995a). A conscious effort to employ the lead-cooperating agency relationship should improve interagency communication and promote better NEPA compliance.

At the same time, the existence of an ongoing interagency ecological management program will facilitate, if not satisfy, NEPA's interagency consultation and coordination requirements. To the extent that agencies and other participating entities are able to resolve issues as part of an ecological management process, there is little likelihood of complications or delays resulting from opposing agency comments at the NEPA stage of a process. There is even less likelihood that disputed issues will be elevated to CEQ. In addition, existing interagency consultations may automatically satisfy NEPA's procedural consultation requirements.

There are, however, limitations on the use of NEPA to promote collaborative interagency ecological management. The lead agency retains ultimate responsibility for the EIS and for the decision based on the EIS. (Ibid. § 1501.7(a)(4)). Agencies who disagree with a lead agency decision may "elevate" the matter to CEQ. (Ibid. Part 1504). But this CEQ procedure is not used frequently, and hardly promotes an ongoing, collaborative interagency relationship.

Interagency consultation is also important between federal and nonfederal agencies. The CEQ regulations require lead agencies to discuss "[p]ossible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned (40 C.F.R. § 1502.16(c))." According to the regulations, "[w]here an inconsistency exists between [State or local plans or laws and the proposed action] the [EIS] should describe the extent to which the agency would reconcile its proposed action with the plan or law (Ibid. § 1506.2(d))." These mandates plainly obligate federal agencies to consult and coordinate ecological management programs and initiatives with state and local entities. To exploit fully these possibilities, lead agencies should view these consultation provisions as opportunities instead of requirements.

In addition, other statutes contain interagency and intergovernmental coordination requirements and opportunities that can be implemented through NEPA processes. Under the Sikes Act and its implementing regulations, DoD officials are authorized to develop cooperative management plans for specific resources, namely fish, wildlife, migratory birds, and outdoor recreation, with the Department of the Interior and the states (16 U.S.C. §§ 670a, 670c-1; 32 C.F.R. Part 190). In particular, the DoD regulations require that INRMPs be "coordinated with appropriate federal, state, and local officials with interest and jurisdiction...." The Department of Defense also requires the Assistant Secretary of Defense (Manpower, Reserve Affairs, and Logistics) to "[m]aintain liaison with the Council on Environmental Quality, the Environmental Protection Agency, the Office of Management and Budget, other Federal agencies, and State and local groups with respect to environmental analyses for proposed DoD actions affecting the quality of the environment in the United States (32 C.F.R. § 188.5(a)(7))." Such standing relationships offer an excellen opportunity to promote meaningful interagency consultation.

However, as with the lead agency under NEPA, the Sikes Act provides that the facility commander retains ultimate control over whether to adopt cooperative planning requirements: "A cooperative plan shall be adopted by an installation commander only after ensuring its compatibility with the rest of the integrated natural resources management plan (32 C.F.R. Part 190, App. B.3.c)." Moreover, as discussed above, DoD must ensure that it complies with all applicable federal, state

and local laws and regulations, and fulfills its underlying military mission. By using the broad consultation and cooperative programs under NEPA and the Sikes Act, military base officials should be able to meet these requirements while balancing competing considerations. They also may find it particularly efficient and effective to integrate compliance with NEPA and the Sikes Act together with broader ecological management programs as part of a single, comprehensive natural resources process (Ibid. App. A.7). ("The environmental impact analysis for any proposed activity or project shall include an analysis of the compatibility of the proposal's impacts with affected natural resources management plans and objectives.")

6.4.3 Compiling Integrated and Comprehensive Scientific Information

Good ecological management programs rely on good science. In particular, ecological management requires comprehensive resource inventories and evaluations, identification of existing and possible future sources of ecological impairment, and development of protection and restoration strategies. With good scientific information, agencies should fully understand the consequences of management decisions and reach ecologically sound decisions.

NEPA also requires and promotes the use of good science to improve environmental decision-making. Consistent with the interdisciplinary focus of ecological management, NEPA requires all federal agencies to utilize a systematic, interdisciplinary approach which will insure the integrated use of the natural and social sciences and the environmental design arts in planning and decisionmaking which may have an impact on man's environment (42 U.S.C. § 4332(2)(A); see also 40 C.F.R. § 1502.6).

In addition, NEPA requires federal agencies to "identify and develop methods and procedures in consultation with [the CEQ] which will insure that presently unquantified environmental amenities and values may be given appropriate consideration in decisionmaking along with economic and technical considerations" (42 U.S.C. § 4332(B) (Caldwell 1982)).

These basic statutory requirements are augmented by the CEQ regulations. In implementing NEPA, agencies must use "high quality" information, "[a]ccurate scientific analysis," and "expert agency comments" (40 C.F.R. § 1500.1(b)). In preparing an EIS, agencies must "insure the professional integrity, including scientific integrity, of the discussions and analyses ...," and identify the scientific and other sources relied on in reaching conclusions (Ibid. § 1502.24). Where new information is essential to make a "reasoned choice among alternatives," it must be obtained unless the cost of doing so is exorbitant or the means to obtain it are not known (Ibid. § 1502.22). Finally, where an agency relies on an applicant or other third party for information, it must "independently evaluate the information submitted and shall be responsible for its accuracy (Ibid. § 1506.5)."

To demonstrate compliance with this requirement, agencies must disclose and describe the studies, data and methodologies used to reach a decision. Izaak Walton League of America v. Marsh, 655 F.2d 346 (D.C. Cir. 1981). The requirement that agencies use "good" science, however, should not be construed as requiring the use of any particular scientific theory or mode of scientific analysis. Indeed, courts will defer to reasonable agency conclusions on the applicability of scientific theories to the decision, so long as they are properly considered and the agency explains its decision

adequately. Sierra Club v. Marita, 46 F.3d 606 (7th Cir. 1995); Oregon Environmental Council v. Kuntzman, 817 F.2d 484 (9th Cir. 1987).

The NEPA process can be used as a focal point for collecting and evaluating the same scientific information that is useful in ecological management. Conversely, the scientific information and analysis prepared as part of ecological management efforts can be used to satisfy NEPA requirements. First, just as ecological management should begin with a comprehensive resource inventory and description, an EIS must include a description of the "affected environment (40 C.F.R. § 1502.15)." Although the EIS itself need only describe the affected environment "succinctly," (ibid)., a more detailed inventory and analysis conducted for purposes of ecological management will enhance the agency's understanding of the resource and therefore improve its NEPA decisions. However, the geographic scope of the "affected environment" will dictate the extent to which NEPA compliance can be coordinated with ecological management. By defining the "affected environment" for NEPA purposes according to natural boundaries and by using programmatic and tiered EISs that address cumulative impacts within these boundaries over time, agencies can improve both NEPA compliance and ecological management (Hunsaker 1993). At the same time, agencies may realize efficiencies and cost savings by avoiding duplication of effort.

Second, just as ecological management relies on a careful analysis of the existing and potential future sources of impairment within a region, NEPA requires a complete evaluation of the environmental consequences of proposed agency actions (40 C.F.R. § 1502.16). While ecological management targets the full range of impairments within the defined region over time, a site-specific EIS may only address the impacts of a single federal action or set of proposed federal actions. NEPA and its regulations, however, require agencies to address the direct as well as the indirect, secondary, and cumulative impacts of the proposed action combined with other existing and proposed federal and nonfederal activities (40 C.F.R. §§ 1502.16, 1508.7, 1508.8, 1508.25). Agencies can therefore maximize the coordination of NEPA with ecological management by using NEPA to the fullest extent possible in the assessment of combined sources of impairment.

Third, just as ecological management requires full evaluation of alternative protection and restoration strategies, NEPA requires agencies to consider a full range of alternatives to the proposed agency action, including a "no action" alternative. The differences between alternative protection/ restoration strategies and alternative proposed actions that may adversely affect the environment does not prevent agencies from using NEPA to achieve ecological management objectives. Because good ecological management must reconcile human activities with the need for ecological restoration and protection, the NEPA process can be used by agencies to assist in choosing the least harmful among several alternative means of meeting legitimate human needs within a defined ecological region. Moreover, the NEPA requirement that agencies identify, as part of their consideration of alternatives, "appropriate mitigation measures" to minimize or offset the effects of proposed actions can be used to promote ecological protection and restoration objectives (Ibid. § 1502.14(f).

The lead/cooperating agency relationship also presents agencies with anopportunity to use NEPA to develop integrated and comprehensive scientific data. In the context of this relationship, agencies can agree on common procedures, measurement techniques, and data formats. Not only

will this improve the EIS analyses, but it should also make future consultations and ecological management efforts between the agencies more efficient and productive.

The scope of the managed area and the number of affected agencies will affect the need for compatible data. Small ecosystems, and those managed by a single or a few agencies are less likely to have incompatible and duplicative data than larger ecosystems and those managed by a myriad of agencies. In the latter case, where an ecosystem is managed by many agencies, it is especially important that all parties engage in an effort to compile comprehensive and compatible data.

The Sikes Act encourages the use of comprehensive and coordinated scientific information. Under the Sikes Act, DoD can enter into cooperative plans with States and DOI (16 U.S.C. §§ 670a, 670c-1) which can include cooperative and coordinated research and data-gathering efforts (32 C.F.R. Part 190, App. A.5.d (use of compatible methodologies)). As under NEPA, the Sikes Act insists on the use of good science by requiring that plans be developed, monitored, reviewed and revised by natural resources managers with professional training (16 U.S.C. § 670a-1(b); 32 C.F.R. Part 190, App. A.3). Moreover, INRMPs must include "current inventories and conditions of natural resources" (Ibid., App. A.5.c). This requirement is similar to NEPA's requirement to study and describe the affected environment, and to the broader premise that ecological management be based on comprehensive resource inventories.

Significantly, DoD has begun just such a comprehensive compilation of data in Southern California. The Mojave Desert Ecosystem Initiative represents a cooperative effort, with the army as the lead DoD agency, between several DoD installations, the Department of the Interior, various state and local government agencies, and private parties to collect relevant scientific data to use in improving regional management. Currently, the Mojave Desert Ecosystem Initiative is working to establish a queryable database and to eliminate regional data gaps (National Training Center Mojave Desert Ecosystem Initiative Office 1996). The related but more narrowly focused West Mojave Desert Ecosystem Coordinated Management Plan is designed as an initial ecosystem-based, interagency planning effort. The ultimate goal of these efforts is to ensure the Mojave Desert remains a valued resource.

6.4.4 Maintaining and Restoring Biodiversity

Ecological management seeks to maintain and restore biodiversity and ecosystem integrity. While NEPA imposes no enforceable substantive mandates on agencies, it provides a tool which agencies can use to achieve these goals and to comply with substantive environmental requirements arising from other statutes, regulations, and treaties.

NEPA is not a substantively enforceable statute. NEPA states that federal policy, among other things, is to "create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of present and future generations of Americans (42 U.S.C. § 4331(a))." In 1978, in Vermont Yankee Nuclear Power Corp. v. N.R.D.C., 435 U.S. 519, the Supreme Court stated "NEPA does set forth significant substantive goals for the Nation, but its mandate to the agencies is essentially procedural." The Court confirmed this reading of NEPA in Robertson v. Methow Valley Citizens Council. In most instances, therefore, NEPA

merely requires agencies to comply with procedural requirements; it does not require agencies to reach particular outcomes.

Clearly, however, the intent of NEPA is to promote biodiversity and ecosystem integrity, among other environmental goals. One of NEPA's purposes is to "prevent or eliminate damage to the environment and biosphere....” (42 U.S.C. § 4321). Moreover, Congress has established a national environmental policy that aspires "to create and maintain conditions under which man and nature can exist in productive harmony....” (Ibid. § 4331(a)); and to "preserve important historic, cultural, and natural aspects of our national heritage....” (Ibid. § 4331(b)(4)). To achieve these goals federal agencies should seek to minimize impacts on biodiversity and ecosystem integrity to the maximum extent possible.

Proper NEPA implementation can assist ecological management efforts designed to protect and restore biodiversity and ecosystem integrity. This can be accomplished through complete environmental inventories that identify all species, habitats, and other elements of ecosystem structure that are at risk from a proposed action, and through rigorous evaluation of alternatives and mitigation strategies to develop plans and actions that enhance rather than impair biodiversity and ecosystem health. Conversely, to the extent that agencies have already identified the relevant biological resources, as well as restoration and protection strategies through ecological management programs, they will be better able to meet NEPA requirements and achieve NEPA goals.

In the case of DoD, biodiversity and ecosystem conservation is also promoted, if not required, under the Sikes Act and its implementing regulations. The Sikes Act requires management for the "sustained multipurpose use" of natural resources (to the extent not inconsistent with military missions) (16 U.S.C. § 670a-1(a)(1). While the word "multipurpose" implies a balancing of human and natural uses of an area, the term "sustained" implies the preservation of biological and other renewable resources. Indeed, DoD regulations interpret the Act as imposing such requirements: "[W]atersheds and natural landscapes, soils, forests, fish and wildlife, and protected species shall be conserved and managed as vital elements of DoD's natural resources program (32 C.F.R. § 190.4(c)).”

Similarly, the integrated natural resource management plans required by the Act and regulations must address issues that are integral to biodiversity and ecosystem protection. The Act requires INRMPs to address fish and wildlife habitat improvements, range wildlife benefits, traffic control for wildlife protection, and habitat improvements and protections for threatened and endangered species (16 U.S.C. § 670a(b)(1)). The DoD regulations require INRMPs to address such issues as land management, forest management, fish and wildlife management, and protection of special areas (32 C.F.R. § 190 App. B).

6.4.5 Managing at Large Spatial and Temporal Scales

Ecological management involves management at large spatial and temporal scales that correspond to ecosystems and watersheds. NEPA presents several opportunities for agencies to plan on large geographic scales as well as extended time frames (most of which have already been discussed above), which in turn can help to implement the principles of ecological management.

Similarly, the use of ecological management programs can help to ensure that NEPA documents will consider the full breadth of required issues.

In particular, the use of programmatic EISs, tiering, and cumulative impacts analysis enable agencies to plan on large geographic and time scales (Myslicki 1993). Geographically, tiering allows agencies to prepare programmatic EISs for spatially broad areas, such as "regional or basinwide program statements (40 C.F.R. § 1508.28(a))." Later proposals for localized actions can then be assessed for new issues, incorporating the programmatic EIS by reference (Ibid.). Temporally, tiering can be employed by preparing an initial EIS at an early stage of a project. At later stages, when other issues are ripe for decision, further NEPA analysis can be prepared, tiered to the earlier EIS. (Ibid. § 1508.28(b)). Significantly, DoD's NEPA regulations encourage the use of tiering to make the NEPA process more efficient (32 C.F.R. Part 188, Enclosure 1, § D.5).

The NEPA regulations, however, give agencies considerable discretion on how to tier EISs. Programmatic statements, for example, may be developed geographically to include all actions affecting the same region or body of water (40 C.F.R. § 1502.4(c)(1)). Alternatively, programmatic EISs may be prepared generically, according to similar types of actions in disparate regions (Ibid. § 1502.4(c)(2)). For example, DoD might prepare a programmatic EIS to address the environmental impacts of all Department activities within a defined region, in combination with other private and governmental actions. (Such regional planning could be conducted in conjunction with the Sikes Act's cooperative plans and agreements.) Or DoD might choose to prepare a programmatic EIS on a particular type of activity, perhaps a particular type of training exercise or the national deployment of a new weapons system, on a generic rather than regional basis. The degree to which the agency opts to prepare programmatic EISs geographically—as opposed to generically—will affect the usefulness of NEPA in implementing ecological management.

When an agency proceeds by a site-specific rather than programmatic EIS, the NEPA regulations require the consideration of a wide range of related and cumulative impacts. In defining the scope of an EIS, agencies must consider "connected actions," which are actions that have "cumulatively significant impacts," (Ibid. § 1508.25(a)(2)), as well as "similar actions" that should be evaluated together, including actions with common geography (Ibid. § 1508.25(a)(3)). In addition, the CEQ regulations direct agencies to discuss "[t]he environmental effects of alternatives, including the proposed action" (Ibid. § 1502.16). "Environmental consequences" include both direct and indirect effects (Ibid. § 1502.16(a)-(b)), as well as cumulative impacts. The definition of cumulative impact encompasses both temporal and spatial elements:

> *"Cumulative impact" is the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (Federal or non-Federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (Ibid. § 1508.7).*

Thus, agencies are compelled to consider the impacts of their actions as well as the actions of others over time. And agencies must consider that a series of minor actions over a broad geographic scale may together have a significant environmental impact (National Research Council 1992; Keiter 1990).

In short, the NEPA regulations effectively require agencies to adopt an ecological management perspective in assessing the spatial and temporal impact of plans and proposals. This approach to NEPA analysis of environmental impacts should assist agencies to implement ecological management principles (Hunsaker 1993). Conversely, the establishment of ongoing ecological management programs should facilitate compliance with NEPA's programmatic EIS, tiering, and cumulative impacts analysis requirements.

6.4.6 Targeting to Select Achievable Solutions

Faced with increasingly limited resources, agencies must employ their time, money, and personnel wisely to achieve the best results. Ecological management allows agencies to target the most important problems within a defined region, and to prioritize the best protection and restoration strategies. NEPA's rigorous requirement that agencies identify and consider a full range of alternatives, including alternative mitigation strategies, is a useful method for implementing a targeting strategy.

Application of NEPA's alternatives process to ecological management, however, may require some modification. Typically, in a NEPA process agencies consider a range of alternatives and choose one or more options to implement as a single decision. In ecological management, agencies may identify a large number of alternatives, all of which may be desirable at some time, though insufficient resources may mean it is impossible to implement all viable strategies at once. When this occurs, problems and solutions are rank-ordered according to importance, efficacy, cost-effectiveness, and similar criteria. Agencies then implement the "best strategies" first, continuing down the list until program goals are met. The NEPA process can be used to establish this type of prioritization process. Similarly, problems and strategies identified as part of an ongoing ecological management program can be used as feedstock for a required EIS. Under the Sikes Act, consistent with this concept of targeting, DoD is obligated to do just that: INRMPs should include "schedules of activities and projects" and "priorities" (32 C.F.R. Part 190, App. A.5.C).

6.4.7 Adaptive Management

Ecological management requires an iterative, adaptive management approach to account for changing goals and values, as well as new information concerning ecological conditions. NEPA can be used to promote such an adaptive management approach (Cooper 1993). First, programmatic EISs can be written to anticipate more precise or changed scientific data, analytical techniques, or alternate management strategies. In short, the programmatic EIS can include a feedback loop that is based upon an ongoing monitoring program (Cooper 1993, 135). Subsequent, tiered EISs can then be prepared to account for new information, scientific and engineering advances, shifting values and priorities, and other factors. Second, original EISs can be supplemented to reflect newly acquired

information (40 C.F.R. § 1502.9(c)). Relatedly, the Sikes Act requires that INRMP plans be reviewed on an ongoing basis, and at least every five years (16 U.S.C. § 670a(b)(2)). NEPA can be employed during this review process to address new information or changed circumstances.

Agencies should not view the NEPA process as an obstacle to adaptive ecological management. Preparation of an EIS is often a lengthy and difficult process, especially when controversial decisions and multiple parties are involved. Once the EIS is completed and a final decision is made, the natural tendency is to consider the matter closed and to proceed with project implementation. Although the regulations require supplemental EISs under some circumstances, the courts have generally deferred to agencies in deciding when a supplemental EIS is needed (Marsh v. Oregon Natural Resources Council, 490 U.S. 360 (1989)). Thus, agencies may avoid preparing a supplemental EIS unless one is legally required. Similarly, agencies may be inclined to avoid a controversial change in direction, however desirable, to avoid the risk of triggering a supplemental EIS and additional project delay.

The NEPA process, however, can be adjusted to address these problems. If a wide range of alternatives and project strategies are considered when the EIS is initially written (as suggested under the targeting principle), then new NEPA compliance may not be required. The changes in evolving knowledge or conditions will already have been anticipated and alternative strategies will already have been addressed. The tiering process—particularly the use of a programmatic EIS—can be employed to ensure an initial broad and comprehensive analysis, including the use of monitoring programs. Such analyses can be incorporated directly into an ecological management program.

Conversely, by adopting a sound ecological management program, the agency can anticipate these NEPA problems and address them in the early planning stages. As noted above, such an approach is also consistent with the Sikes Act's general requirements. Alternatively, the NEPA process can be augmented with a representative advisory or management committee that is vested with authority to implement variations and other project changes. Although such a committee may not always obviate the need for supplemental NEPA compliance, it should minimize project delays and reduce controversy. It also could promote support for changes based upon an EA rather than a full-blown EIS.

6.5 Conclusions and Recommendations

The above analysis demonstrates that NEPA and the Sikes Act can be jointly employed to establish and implement ecological management programs on DoD lands. Although there are some differences between the two statutes and their regulations, each can be used to promote ecological management principles in DoD natural resource programs. The commonalities between the two laws should allow integrated implementation in a manner that produces efficiencies in the use of funds and personnel while promoting and achieving the goals of ecological management. Similarly, because each statute has strengths and weaknesses as a tool for ecological management, integrated compliance with both laws may result in more efficient planning for DoD installations and better management of ecological resources. Finally, by employing sound principles of ecological

management, DoD agencies can achieve better and more efficient compliance with environmental planning and decision-making statutes, including NEPA and the Sikes Act.

The following specific recommendations are suggested by this analysis:

1. Sound implementation of NEPA, with early and frequent opportunities for all affected interests to participate at each stage of NEPA compliance, can help to develop the shared goals and interagency relationships that are essential to good ecological management. Similarly, cooperative programs implemented under the Sikes Act can be used to generate interagency agreement on ecological management goals. However, the NEPA and Sikes Act decisionmaking processes have some limitations in the ecological management context: NEPA establishes a punctuated rather than ongoing decision process, and the legal reality is that ultimate NEPA and Sikes Act decisions are made unilaterally and not by consensus. To avoid these problems, consensus-building might be achieved by integrating NEPA and Sikes Act compliance with other tools, such as the establishment of ongoing advisory committees under the Federal Advisory Committee Act, and the use of alternative dispute resolution methods where necessary.

2. In general, NEPA and the Sikes Act establish a process for environmental decisionmaking and natural resource management. Although consensus goals and strategies are desirable and should be developed whenever possible as part of ecological management programs, some goals and minimum requirements are established by independent federal, state, or local laws and regulations. As a legal matter, these requirements will override any conflicting consensus ecological management goals or agreements. Thus, while NEPA and the Sikes Act may be useful tools for developing ecological management goals, DoD agencies should make clear at the outset that underlying legal requirements may constrain the goals and strategies advocated by some parties. This will avoid ecological management participants from later claiming surprise or bad faith.

3. Ecological management, NEPA, and the Sikes Act all promote the use of good science, and the coordination of scientific research and data collection by multiple entities within a defined geographic region. All three processes should be used and coordinated to maximize the economic efficiencies and to improve the scientific data that is employed in ecological management planning and decisionmaking. Data collection efforts should include comprehensive inventories of all ecological and other natural resources within the defined ecological boundaries, an assessment of existing and potential ecosystem health (including biodiversity), a list of all existing and potential sources of ecological impairment, and an analysis of the full range of potential protection and restoration strategies.

4. To maximize its usefulness for ecological management and to avoid implementation delays in natural resource management programs, NEPA compliance should be accomplished as broadly as possible from a geographic and temporal perspective. This will involve:

    a. Maximizing the use of programmatic and tiered impact statements according to ecosystem or watershed boundaries

b. Avoiding the use of program-specific (as opposed to geographically-focused) programmatic EISs

c. Including all relevant federal, state, and local agencies in the region, and as diverse a range of nongovernmental participants as possible throughout all phases of NEPA compliance, with special attention to early involvement through EIS scoping and other means

d. Identifying the widest possible range of project alternatives, along with accompanying restoration and mitigation strategies, with a view towards potential future changes in scientific understanding, priorities and program goals

5. The goal of adaptive ecological management can be promoted through NEPA by providing for supplemental EISs where necessary to address major changes in conditions, impacts or project proposals. Tiering and the use of Environmental Assessments, when appropriate, can also be used to address adaptive management concerns. Alternatively, ongoing advisory or cooperative management committees, including Sikes Act cooperative programs, can be used to anticipate and to address necessary changes. To ensure full participation in adaptive management processes, Sikes Act compliance should include federal agencies in addition to the Department of the Interior, as well as relevant nongovernmental entities and private parties.

6. DoD should consider further institutionalizing coordinated compliance with NEPA and the Sikes Act, along with an ongoing policy of ecological management. Preparation of a joint programmatic environmental impact statement and INRMP under NEPA would save agency resources while maximizing the breadth and effectiveness of both statutes. Similarly, establishment of ongoing, broadly-defined ecological management programs will facilitate DoD compliance with both NEPA and the Sikes Act, and promote professional natural resources management consistent with DoD's underlying mission of national defense.

BIBLIOGRAPHY

Adler, Robert W. *Addressing Barriers to Watershed Protection*. Environmental Law 25:973-1106, 1995.

Army Environmental Center. Conservation Branch. Integrated Natural Resources Management Plan: Preparation Guidelines (Interim Final Draft). May 9, 1996.

Caldwell, Lynton. Science and the National Environmental Policy Act: Redirecting Policy Through Procedural Reform. University of Alabama Press, University, AL. 178pp., 1982.

Congressional Research Service. Ecosystem Management: Federal Agency Activities. 94-339 ENR. Washington, D.C. 124 pp., 1994.

Cooper, J.C. *Broad Programmatic, Policy and Planning Assessments Under the National Environmental Policy Act and Similar Devices: A Quiet Revolution in an Approach to Environmental Considerations*. Pace Environmental L. Rev. 11:89-155., 1993.

Cortner, H.J., M.A. Shannon, M.G. Wallace, S. Burke and M. Moote. Institutional Barriers and Incentives for Ecosystem Management: A Problem Analysis. Water Resources Center. University of Arizona, Tucson, AZ. 51pp., 1994.

Davis, Wayne S. and Thomas P. Simon. Biological Assessment and Criteria. Tools for Water Resource Planning and Decision Making. Lewis Publishers. Boca Raton, FL. 415pp., 1995.

Department of Defense Instruction. Environmental Conservation Program: Ecosystem Management Principles and Guidelines, 1996.

Ecological Society of America. The Scientific Basis for Ecosystem Management: An Assessment by the Ecological Society of America (Prepublication Copy). Washington, D.C., 1995.

Goodman, Sherri W. *Ecosystem Management at the Department of Defense*. Ecological Applications 6(3):706-707, 1996.

Grumbine R. Edward. *What is Ecosystem Management?* Conservation Biology 8:27-38, 1994.

Hunsaker, C.T. *Ecosystem Assessment Methods for Cumulative Effects at the Regional Scale*, in Stephen G. Hildebrand and Johnnie B. Cannon, eds., Environmental Analysis: The NEPA Experience. Lewis Publishers. Boca Raton, FL, 1993.

Interagency Ecosystem Management Task Force. The Ecosystem Approach: Healthy Ecosystems and Sustainable Economies. Volume I- Overview. Washington, D.C., 1995a.

Interagency Ecosystem Management Task Force. The Ecosystem Approach: Healthy Ecosystems and Sustainable Economies. Volume II-Implementation. Washington, D.C., 1995b.

Karr, James R. *Biological Integrity: A Long-Neglected Aspect of Water Resource Management*. Ecological Applications 1:66-81, 1991.

Keiter, R. *NEPA and the Emerging Concept of Ecosystem Management*. Land and Water Law Review 25:43-60, 1990.

Keiter, Robert B. *Beyond the Boundary Line: Constructing a Law of Ecosystem Management*. University of Colorado Law Review 65:293-333, 1994.

Lee, Kai N. Compass and Gyroscope: Integrating Science and Politics for the Environment. Island Press. Washington, D.C. 243 pp., 1993.

Lubchenko, Jane, et al. *The Sustainable Biosphere Initiative: An Ecological Research Agenda (A Report from the Ecological Society of America)*. Ecology 72(2):371-412, 1991.

Moote, M.A., S. Burke, H.J. Cortner and M.G. Wallace. Principles of Ecosystem Management. Water Resources Research Center, University of Arizona, Tucson, AZ. 14pp., 1994.

Myslicki, A. *Use of Programmatic EISs in Support of Cumulative Impact Assessment*, in Stephen G. Hildebrand and Johnnie B. Cannon, eds., Environmental Analysis: The NEPA Experience. Lewis Publishers. Boca Raton, FL, 1993.

National Research Council. *Restoration of Aquatic Ecosystems*. Science, Technology and Public Policy. National Academy Press. Washington, D.C. 552pp., 1992.

National Training Center Mojave Desert Ecosystem Initiative Office. Mojave Desert Ecosystem Initiative. Fort Irwin, CA, 1996.

Noss, Reed F. and Allan Y. Cooperrider. Saving Nature's Legacy: Protecting and Restoring Biodiversity. Island Press. Washington, D.C. 416pp., 1994.

Office of Technology Assessment. Technologies to Maintain Biological Diversity: Summary. U.S. Congress, Washington, D.C., 1987.

Office of the Undersecretary of Defense. Memorandum re Implementation of Ecosystem Management in DoD, 8 August 1994.

Porterfield, M.C. Agency Action, Finality and Geographical Nexus: Judicial Review of Agency Compliance with NEPA's Programmatic Environmental Impact Statement Requirement after Lujan v. National Wildlife Federation. Univ. of Richmond L. Rev. 28:619-667, 1994.

Proceedings, Watershed '96. Moving Ahead Together. Technical Conference and Exposition. Baltimore, MD. 1165pp., June 8-12, 1996.

Rodgers, William H., Jr. Environmental Law. West Publishing Co., St. Paul, MN, 1994.

Shannon, M.A. *Community Governance: An Enduring Institution of Democracy*, pp. 219-246, in U.S. Congress House of Representatives, Committee on Interior and Insular Affairs. Multiple Use and Sustained Yield: Changing Philosophies for Federal Land Management. Print No. 11. U.S. Government Printing Office. Washington, D.C., 1993.

U.S. Environmental Protection Agency. Evaluation of Ecological Impacts from Highway Development. EPA 300-B-94-006, 1994a.

U.S. Environmental Protection Agency. Background for NEPA Reviewers, Grazing on Federal Lands. EPA 300-B-94-004, 19994b.

U.S. Environmental Protection Agency. Office of Water. Watershed Approach Framework. EPA840-5-96-001. 16pp., 1996.

U.S. General Accounting Office. Ecosystem Management: Additional Actions Needed to Adequately Test a Promising Approach. Washington, D.C. GAO/RCED-94-111. 87pp., 1994.

Index

A

Aberdeen Proving Ground 4-5
Academy 6-24
acquisition 2-2, 4-5, 5-6, 5-7, 5-18
acreage 3-12
adaptive management 2-2, 2-3, 2-6, 2-7, 2-8, 3-2, 3-8, 4-11, 4-16, 4-19, 4-20, 5-2, 5-5, 5-6, 5-15, 5-16, 5-19
Adler 2-9, 6-2, 6-4, 6-23
ADPA 4-25
AEMB 5-7
Ahmann 4-25
air 4-3, 4-4, 4-5, 4-7, 4-17
aircraft 4-6
airports 4-8
Alabama 6-23
Ambos 3-23
AMC 4-5
Andrus 6-5
arctic 4-5
Arizona 5-24, 5-26, 5-42, 6-23, 6-24
armor 4-6, 5-43
artillery 4-4, 4-6
asbestos 4-7
Audubon 6-6
Austin 5-19
avoidance 4-23
awareness 3-14, 3-26, 5-1, 5-6, 5-14, 5-19, 5-20, 5-29

B

Bailey 5-24, 5-41
Baltimore 6-25
Bartuska 5-41
Baton Rouge 5-42
battlefield 4-5
benchmarks 2-2, 2-7, 5-2, 5-5, 5-15, 5-19, 5-22, 5-36
biodiversity 2-2, 4-8, 4-10, 4-11, 5-7, 5-14, 5-15, 5-16, 5-21, 5-23, 5-32, 5-33, 6-3, 6-4, 6-15, 6-16, 6-20
biogeography 4-10
bioregionalism 5-23, 5-24
biosphere 6-5, 6-16
biota 5-24
bird(s) 5-12, 6-12
BLM 4-10, 4-14, 4-17, 4-18, 5-25, 5-27, 5-28
Boca Raton 6-23, 6-24
bottomland 5-20
Bourne 2-9, 5-38, 5-41
Brandt 5-20, 5-41
brigade 4-4
Brown 2-9, 5-1, 5-7, 5-41
budget 4-3, 4-11, 4-16
Burke 5-42, 6-23, 6-24
burning 4-9

C

Caldwell 2-1, 2-9, 6-13, 6-23
California 4-13, 4-14, 5-24, 5-25, 5-26, 5-27, 5-29, 5-30, 5-31, 5-41, 6-15
Camp Clark 2-3, 5-11
Camp Pendleton 2-3, 5-31, 5-32, 5-34, 5-36, 5-38
Cannon 6-23, 6-24
cantonment 4-4
cardinal 3-18
Carpenter 5-41
carrying capacity 4-5, 4-7
case study 2-3, 4-20, 5-2, 5-25
CDPA 5-25
CEQ 6-5, 6-6, 6-7, 6-8, 6-9, 6-11, 6-12, 6-13, 6-17
characterization 5-20
Chavez 3-23
Chawla 2-9
Chesapeake Bay 4-12, 4-13, 4-25
Clark 5-2, 5-11, 5-20, 5-21, 5-22, 5-23, 5-35, 5-36, 5-41
climate 5-23
collaboration 2-3, 2-5, 5-2, 5-21, 5-23, 5-27, 5-28, 6-3
Colorado 5-24, 6-24
Colorado State University 5-13
combat 4-3, 4-4, 4-7, 5-31
commander 6-12
conflict resolution 2-1, 2-5, 2-8, 3-3, 3-5, 3-16, 3-17, 4-5, 4-12, 4-13, 4-14, 4-22, 5-13, 5-17, 6-10
confrontations 5-1

Congress 2-6, 4-2, 4-3, 4-25, 5-25, 5-26, 5-27, 5-42, 6-5, 6-16, 6-24, 6-25
Conrad 2-9
consensus 2-4, 2-5, 2-6, 3-28, 5-42, 6-2, 6-3, 6-10, 6-20
construction 2-9, 4-4, 4-7, 4-13, 5-11, 5-28, 6-8
consultation 2-4, 3-17, 4-1, 4-9, 5-2, 6-6, 6-10, 6-12, 6-13
contingency 4-7, 4-19
contractors 5-13
CONUS 4-7
Cooper 6-7, 6-18, 6-23
Cooperrider 6-3, 6-24
Corps of Engineers 4-15, 5-28
correlation 5-4
corridors 4-10
Cortner 3-23, 5-42, 6-2, 6-4, 6-23, 6-24
cost-effectiveness 6-18
costs 2-2, 3-13, 4-5, 4-16, 4-17, 4-21, 4-22, 5-8, 5-12, 6-6
court 6-1
culture 3-11, 4-18

D

Davis 6-3, 6-23
decision-making 2-3, 2-4, 2-5, 2-6, 2-8, 3-1, 3-4, 3-5, 3-6, 3-7, 3-8, 3-10, 3-11, 3-12, 3-19, 3-21, 3-24, 3-25, 3-28, 4-14, 4-15, 4-16, 4-18, 4-19, 4-21, 4-22, 5-6, 5-7, 5-8, 5-29, 5-30, 5-34, 6-3, 6-6, 6-9, 6-10, 6-13, 6-20
defense 2-1, 2-2, 4-2, 4-4, 5-27, 6-21
definition 2-5, 3-2, 3-4, 4-2, 4-11, 5-24, 6-17
deployment 4-7, 4-8, 4-22, 6-17
desert 4-4, 4-5, 4-13, 5-24, 5-25, 5-27, 5-29, 5-30, 5-42
Desert, Mojave 2-3, 2-5
DeWitt 5-42
dialogue 2-4, 5-42
digitization 5-30
disagreement 3-14, 3-26, 4-12, 5-27
dispute 6-10, 6-20
DMG 5-28, 5-30, 5-31
doctrine 6-2
DOI 4-14, 5-25, 5-26, 5-27, 5-29, 6-15
drainage 2-7, 4-4, 5-15
drinking water 4-7
Dugway Proving Ground 4-5
dust 4-17

E

ecology 4-11, 5-6, 5-23, 5-42
economy 5-25
ecoregion 4-14, 5-30
ecosystem 2-1, 2-2, 2-3, 2-4, 2-5, 5-1, 5-2, 5-3, 5-4, 5-5, 5-6, 5-7, 5-8, 5-10, 5-11, 5-12, 5-13, 5-14, 5-15, 5-16, 5-17, 5-18, 5-19, 5-20, 5-21, 5-22, 5-23, 5-24, 5-25, 5-26, 5-27, 5-28, 5-29, 5-30, 5-31, 5-32, 5-33, 5-34, 5-35, 5-36, 5-37, 5-38, 5-39, 5-41, 5-42, 5-43, 6-1, 6-2, 6-3, 6-4, 6-11
Edgewood Arsenal 5-41
education 3-9, 3-16, 3-22, 4-15, 4-16, 5-6, 5-7, 5-29
Edwards 5-25
effluent 4-16
EIS 6-5, 6-6, 6-7, 6-8, 6-9, 6-11, 6-12, 6-13, 6-14, 6-15, 6-17, 6-18, 6-19, 6-21
end-state 4-5
endangered species 2-2, 3-3, 3-5, 3-6, 3-24, 4-1, 4-8, 4-9, 4-16, 4-17, 5-5, 5-6, 5-7, 5-11, 5-12, 5-31, 6-11, 6-16
England 6-7
environmentalists 3-5, 4-16
EPA 4-12, 6-2, 6-25
erosion 2-7, 4-4, 4-5, 4-16, 5-22, 5-38
ESA 4-1, 4-9, 4-12
evaluation 2-7, 2-8, 3-19, 3-28, 4-5, 5-7, 5-15, 5-16, 5-23, 5-33, 5-38, 5-39, 6-6, 6-14, 6-16

F

FACA vii, 3-8
facilitator 3-9, 3-10, 3-16, 3-17, 3-18, 3-21, 3-22
facilities 4-1, 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 5-7, 5-8, 5-9, 6-1, 6-10
fauna 5-11, 5-12
FEMAT 4-16
FERC 6-6
fire 3-2, 3-6, 4-5, 4-7, 5-16, 5-17, 5-19, 5-32
Fischer 3-23
fish 4-1, 4-8, 5-1, 5-9, 5-10, 5-11, 5-12, 6-8, 6-12, 6-16

fisheries 3-23, 5-9, 5-42
flora 5-11
forecast 5-31
forest 2-7, 3-6, 3-7, 4-8, 4-9, 4-10, 5-10, 5-11, 5-12, 5-14, 5-15, 5-16, 5-19, 5-20, 6-9, 6-16
forestry 5-11, 5-12, 5-16
Fort Benning 5-5
Fort Bragg 5-5
Fort Irwin 4-14, 6-24
Fort Knox 2-3, 4-6, 5-2, 5-11, 5-12, 5-13, 5-17, 5-18, 5-19, 5-20, 5-21, 5-22, 5-23, 5-36, 5-43
Fort Lee 5-11
Fort Polk 2-3, 5-2, 5-11, 5-16, 5-18, 5-19, 5-21, 5-22, 5-23, 5-42
Fort Sill 4-6
Fraley 3-23
fuel 2-6, 3-6
fugitive dust 4-17
FWS 4-9, 4-10, 4-11, 4-14, 5-28

G

GAO 4-11, 4-25, 6-25
geology 3-2, 3-6, 3-11
GIS 4-14
gnatcatcher 5-31
goals 2-2, 2-4, 3-3, 3-6, 3-14, 4-9, 4-11, 4-12, 4-14, 4-15, 4-20, 4-21, 5-2, 5-8, 5-10, 5-12, 5-13, 5-16, 5-17, 5-19, 5-27, 5-36, 5-38, 6-2, 6-4, 6-5, 6-7, 6-11, 6-15, 6-16, 6-18, 6-19, 6-20
Goldstein 3-23
Goodman, Sherri W. 2-1, 2-3, 2-9, 5-1, 5-6, 5-10, 5-26, 5-27, 5-42, 6-1, 6-23
Gore 4-2, 4-25
governance 5-23
government 2-3, 3-4, 3-7, 3-8, 3-11, 4-1, 4-2, 4-12, 4-14, 4-18, 5-3, 5-8, 6-1, 6-3, 6-10, 6-15
grasslands 5-4
Gray 3-23
grazing 4-14, 4-18
Gregory 5-41
Grumbine, R. E. 2-1, 2-9, 6-2, 6-3, 6-23
guidelines 2-1, 3-2, 3-8, 4-11, 4-18, 5-11, 5-14, 5-41, 6-4

H

habitat 2-7, 4-1, 4-8, 4-9, 4-17, 4-18, 5-9, 5-11, 5-12, 5-15, 5-20, 5-21, 5-25, 5-27, 5-31, 5-32, 5-33, 6-3, 6-4, 6-8, 6-11, 6-16
Haeuber, Dr. Richard 2-9, 5-1, 5-5, 5-42
Haiti 4-5
Hanna 3-23
Harper 6-7
Hart 5-16, 5-17, 5-19, 5-42
Hawaii 6-7
Headquarters, Dept. of Army 2-4, 3-4, 4-13
helicopters 4-6
hierarchy theory 2-3, 2-10
high-explosive 4-4
Hodel 6-6
Hunsaker 6-14, 6-18, 6-23

I

impacts 3-6, 3-13, 4-5, 4-20, 5-5, 5-6, 5-12, 5-23, 5-25, 5-33, 6-1, 6-4, 6-5, 6-6, 6-7, 6-9, 6-13, 6-14, 6-16, 6-17, 6-18, 6-21
impairment 4-8, 6-3, 6-13, 6-14, 6-20
improvement 6-8
incentive 3-1, 3-9, 3-16
indicator 2-4, 4-2, 5-13
inertia 4-11
infantry 4-4
infrastructure 4-3, 5-17
Ingram 3-23
initiative 4-12, 4-13, 4-14, 5-8
INRMP 2-7, 4-8, 4-9, 4-22, 5-2, 5-7, 5-10, 5-11, 5-12, 5-13, 5-14, 5-15, 5-16, 5-17, 5-18, 5-19, 5-20, 5-21, 5-22, 5-23, 5-35, 5-37, 5-38, 5-41, 6-9, 6-19, 6-21
integration 2-6, 2-7, 4-10, 5-4, 5-9, 5-10, 5-30, 5-34, 5-36
interaction 5-24, 5-30
interested parties 2-5, 2-6
interpretation 3-3, 3-6, 3-8, 5-30
Iraq 4-5
ITAM 2-7, 5-15

J

jurisdiction 3-6, 3-7, 4-3, 4-14, 5-6, 5-37, 6-6, 6-11, 6-12

K

Keiter, Robert 2-9, 6-3, 6-4, 6-18, 6-24
Kentucky 4-6, 5-13
Kerns 5-9
Keystone 5-37
Kirkpatrick 5-42
Kleppe 6-6, 6-7
Kuntzman 6-14

L

LaFlamme 6-6
landowners 3-4, 3-7, 3-8, 3-24, 4-15, 4-18, 5-14, 5-28, 6-9
landscape 4-10, 5-4, 5-25, 5-31, 5-32, 5-33, 5-34
Las Cruces 4-3
Legacy 4-9, 4-14, 5-27, 5-28, 5-29, 6-24
Lester 5-16, 5-19, 5-42
Logistics 4-4, 6-12
Los Angeles 5-31
Louisiana 5-16
LRAM 2-7, 5-15, 5-17
Lubchenko 6-3, 6-24
Lujan 6-24

M

MacMahon 5-41
MACOM 2-2, 2-4, 4-8, 4-13, 4-18, 5-7
Marines 5-31
Marita 6-14
Marsh 6-6, 6-13, 6-19
Marshall 5-1, 5-41, 6-6
MDEI 2-5, 4-14, 5-26, 5-27, 5-28, 5-29, 5-30, 5-36
mediator 3-9, 3-10, 3-16, 3-17, 3-22
mission 2-2, 3-2, 3-6, 3-8, 3-13, 4-1, 4-2, 4-4, 4-7, 4-8, 4-10, 4-11, 4-12, 4-17, 4-19, 4-20, 4-21, 5-31, 5-32, 6-4, 6-8, 6-10, 6-21
Mississippi 2-3
Missouri 4-15, 5-21, 5-41
mobilization 4-7, 4-19, 4-22
Mojave Desert 2-3, 2-5, 6-15, 6-24
Moote 3-23, 5-3, 5-42
Morrissey 5-3, 5-42

N

Naiman 6-2, 6-3
NASA 2-9
National Guard 4-5, 4-7, 5-9, 5-11, 5-41
Nature Conservancy 4-8, 5-13
Navy 5-28
NBS 5-29
negotiation 2-4, 3-3, 3-4, 3-9, 3-10, 3-12, 3-14, 3-22, 3-24
NEPA 2-6, 2-9, 4-9, 4-11, 6-1, 6-5, 6-6, 6-7, 6-9, 6-10, 6-13, 6-14, 6-18, 6-19, 6-20, 6-21, 6-24, 6-25
nest 5-11
network 4-14, 5-7
Nevada 5-24, 5-26
Nogales 3-23
noise 4-5, 4-6, 4-17
NPR 5-25, 5-26
NPS 5-28
NRCS 5-17

O

Oak Ridge 2-10
Oklahoma 4-6
Orlando 4-25
owl 4-16

P

Panama 4-5
Parker 4-15, 4-25
parks/parklands 5-25, 5-27
Parsons, 5-41
penalties 5-9
perceptions 2-4, 3-5, 3-9, 3-16, 3-24
Perez, R. 2-9
place-based 3-7, 3-25, 5-1
policy 2-1, 2-2, 2-3, 2-6, 4-1, 4-5, 4-8, 4-21, 6-1, 6-2, 6-4, 6-5, 6-7, 6-10, 6-15, 6-16, 6-21
pollution 4-7, 4-8, 4-13, 5-6
Porterfield 6-7, 6-24
prairie 5-19, 5-20
predators 5-24

R

radon 4-7
railheads 4-8
rainfall 5-24
readiness 4-3, 4-11, 4-12, 4-14, 4-19, 5-7, 5-38, 5-42
recovery 4-5, 5-12, 5-30
recreation 4-1, 4-8, 4-9, 5-10, 5-11, 6-12
recycling 4-7
Red Cockaded Woodpecker 5-5
redwood 3-9
Reed 4-3, 5-41, 6-24
reform 3-7, 3-10, 6-23
regime 4-12, 5-17, 5-24, 5-32, 5-33
renewable resources 4-5, 5-10, 5-12, 6-20
reorganization 5-1, 5-3
reservation 4-18, 5-16, 6-8, 6-12, 6-13, 6-15
resiliency 4-15, 6-4
resistance 3-8
responses 3-16
responsibility 3-4, 3-6, 3-8, 3-10, 3-11, 3-25, 4-1, 4-5, 4-17, 6-11, 6-12
restoration 2-2, 2-7, 4-12, 5-7, 5-9, 5-11, 5-14, 5-15, 5-16, 5-17, 5-19, 5-29, 6-3, 6-4, 6-13, 6-14, 6-16, 6-18, 6-20, 6-21
Rice 6-6
Richmond 6-24
Riebsame 3-23
river 3-11, 5-19, 5-32
Robertson 6-6, 6-15
Rodgers 6-25
Roy 3-23

S

safety 2-2, 2-10, 4-5, 4-6, 5-7
San Diego 5-31, 5-32
San Francisco 3-23, 5-42
sandstone 5-20
savanna 5-20
scarcity 4-16
scenarios 5-33, 5-38
SCOPE 2-6
SDMIWG 5-28, 5-29, 5-30
Selin 3-23
SERDP 5-31
Shannon 6-3, 6-23, 6-25
Sierra Club 5-42, 6-5, 6-6, 6-7, 6-14
Sikes Act 4-1, 4-2, 4-9, 4-25, 5-9, 5-10, 5-11, 5-13, 5-21, 6-1, 6-5, 6-8, 6-9, 6-10, 6-12, 6-13, 6-15, 6-16, 6-19, 6-20
Slocombe 3-23, 5-23, 5-24, 5-42, 5-43
stakeholder(s) 2-2, 2-4, 3-8, 3-9, 3-17, 3-19, 3-21, 4-12, 5-2, 5-7, 5-12, 5-17, 5-21, 5-23, 5-27, 5-28, 5-32, 5-36, 5-37, 5-38
stewardship 5-6, 5-7, 5-8, 5-29
storage 2-5, 4-3, 4-6, 4-17, 5-29
stormwater 4-7, 4-13
strategy 2-2, 2-3, 2-7, 4-11, 5-2, 5-8, 5-15, 5-16, 5-22, 5-23, 5-26, 5-30, 5-39, 6-18
survey 4-18, 5-2, 5-29
sustainability 2-1, 2-2, 2-5, 3-2, 3-5, 4-2, 4-10, 5-2, 5-4, 5-5, 5-7, 5-11, 5-27, 6-4
Switzerland 5-43

T

"take" 6-11
technology 4-4, 4-5, 5-6, 6-3
TECOM 4-5
TES 2-2, 4-17, 5-5, 5-6, 5-7, 5-15, 5-20, 5-21, 5-22, 5-30, 5-32, 5-33
Thomson 4-25
threat 3-11, 5-7, 5-8, 5-11, 5-17, 5-27
threshold 6-9
tiering 6-5, 6-7, 6-8, 6-9, 6-17, 6-19
"tiers" 6-8
topography 3-2, 5-23, 5-32
tortoise 5-25, 5-27
town 4-4, 5-14
toxic 4-5, 4-13
traffic 5-9, 6-8, 6-16
trainers 2-3, 2-6
training 4-1, 4-3, 4-4, 4-5, 4-6, 4-7, 4-9, 4-17, 4-18, 4-19, 4-22, 5-5, 5-6, 5-7, 5-8, 5-11, 5-13, 5-14, 5-15, 5-19, 5-20, 5-22, 5-27, 5-31, 5-32, 5-35, 6-11, 6-15, 6-17
transportation 4-3, 4-7
trees 3-6, 5-19
trend(s) 2-1, 4-2, 4-16, 4-22, 5-1, 5-8, 5-13, 5-14, 5-18, 5-21, 5-30
TRI 2-7, 5-15
triangulation 2-4
tribe 6-10, 6-12
Tucson 5-42, 6-23, 6-24
tundra 4-4

turkey 5-11, 5-12, 5-17
Turner 5-41

U

Udvardy, M.D.F. 5-24, 5-43
Umatilla Army Depot Activity 5-11
USDA 5-41
UST 4-6
Utah 5-24, 5-26, 5-28

V

variability 4-10, 6-3
variables 5-32
variances 4-7, 4-19
variations 6-19
vegetation 3-2, 3-6, 4-4, 4-5, 4-13, 5-21, 5-22, 5-24, 5-27, 5-29, 5-32
vehicle 4-6, 4-19, 5-7, 5-9, 5-23, 6-8, 6-10
Vermont 6-15
VOC 4-5
volunteer(s) 3-13, 5-6, 5-7

W

Walker, L.D. 2-10, 3-23, 5-8, 5-43
Wallace 5-42, 6-23, 6-24
Walsh 5-6, 5-43
Walton 6-13
war 4-20
war-game 4-20
warehouses 4-6
wartime 4-3
Washington 4-3, 4-18, 4-25, 5-41, 5-42
Washington, D.C. 2-9, 3-7, 5-42, 6-23, 6-24, 6-25
waste 4-7
wastewater 4-7, 4-13, 4-16
water(s) 2-1, 4-6, 4-7, 4-8, 4-9, 4-14, 4-17, 5-9, 5-14, 5-18, 6-2, 6-17
watershed 4-13, 5-17, 5-33, 6-1, 6-2, 6-3, 6-4, 6-20
Wayne 6-23
weapon/weaponry 4-4, 4-5, 5-25, 6-7, 6-17
Wedgebolt 4-21, 4-22
Weinberger 6-7
Westervelt, J. 2-9
wetland 2-7, 3-12, 5-11, 5-15, 5-19, 5-20, 5-30
White Sands 4-3, 4-5
wilderness 3-12, 5-25, 5-27
wildfire 2-7, 5-15
wildlife 2-9, 4-1, 4-4, 4-5, 4-8, 4-9, 4-14, 5-9, 5-10, 5-11, 5-12, 5-20, 5-23, 5-24, 5-25, 6-8, 6-12, 6-16
Woodmansee 5-41

Y

Yaffee 5-1, 5-43
Yankee 6-15
Yellowstone 3-23
yield 5-28, 6-4, 6-11, 6-25
Yuma Proving Ground 4-5

Z

Zinn 5-42