INTERNATIONAL PERSPECTIVES

Ecosystem Management in US National Forests: Evolution of a paradigm

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Abstract

Ecosystem Management, which has rapidly gained currency in management of US National Forests since the early 1990s, now constitutes a paradigm which enhances concepts such as 'sustained yield', 'multiple use', 'indicator species' and others. This paper examines the background and continuing evolution of Ecosystem Management in the US Forest Service and related legislative and institutional aspects.

ECOSYSTEM MANAGEMENT PARADIGM — BACKGROUND IN US FOREST SERVICE

What is Ecosystem Management?

Ecosystem Management definitions range from informal ones, which convey just a readily comprehensible essence of the concept, to more rigorous, scientific-based portrayals. The former category might be exemplified by Jack Ward Thomas's "Ecosystem Management means not killing the goose that lays the golden eggs" (Unger, 1994). The other end of this spectrum would be found in the definition of the Ecological Society of America (1995):

> *"Ecosystem Management is management driven by explicit goals, executed by policies, protocols, and practices, and made adaptable by monitoring and research based on our best understanding of the ecological interactions and processes necessary to sustain ecosystem structure and function."*

The Ecological Society itself cites no fewer than nine additional selected definitions in scientific literature dating back a decade, but summarises that Ecosystem Management must include: (1) long-term sustainability as a fundamental value; (2) clear, operational goals; (3) sound ecological models and understanding; (4) understanding complexity and interconnectedness; (5) recognition of the dynamic character of ecosystems; (6) attention to context and scale; (7) acknowledgement of humans as ecosystem components; and (8) commitment to adaptability and accountability.

For its purposes, the Forest Service of the US Department of Agriculture (USDA-FS) defines Ecosystem Management as the:

> *"... concept of natural resources management wherein National Forest activities are considered within the context of economic, ecological, and social interactions within a defined area or region, over both short and long term" (Thomas and Huke, 1996). Thomas adds, that simply stated, it is the "Integration of ecological, economic, and social factors in order to maintain and enhance the quality of the environment to meet current and future needs. It is a holistic approach to natural resource management" (Thomas, 1996).*

Ecosystem Management involves broader perspectives than traditionally associated with forest management. This includes questions of scale, since ecosystems may range from small localised phenomena (a single rotting-log with mushrooms, sitting in the sunlight) to large, widespread ones (Great Plains in the USA). Ecosystem Management includes consideration of time frames which may involve wide-ranging historic reference points of ecosystem conditions (late Quaternary, pre-settlement, etc.); variation within ecosystems (successional mosaics, altitudinal and aspect variations, etc.); and factors associated with composition, structure and function. Forest Service managers have historically tended to focus on timber stands, elk herds, trout populations, or other generally compartmentalised perspectives. This enabled specialised technical expertise to be applied to break down complex issues into their component parts. Consequences of specific management actions tended to be examined primarily at the local level. Ecosystem Management provides more rigorous examination of consequences at broader spatial and temporal levels.

The USDA-FS actively pursues four principles when applying Ecosystem Management: (1) Public Involvement; (2) Ecological Approach; (3) Partnerships; and (4) Management Based on Sound Science (USDA-FS, 1994). Each has been described and illustrated in recent literature (Thomas and Huke, 1996).

As with any new concept struggling for legitimacy, much effort is evident, in both the literature and in professional fora, to articulate the concept of Ecosystem Management. One author (More, 1996) has concluded that a precise definition of Ecosystem Management, like one for the word "chair", may elude us. He suggests "it is time to move beyond arguments over definition to a discussion of ecosystem management in practice. An undue emphasis on precision, although laudable in some respects, is also limiting".

Framework for US National Forests since 1992 expands

The USDA-FS was the first agency in the US Federal Government to adopt an ecological approach to managing public lands. Jack Ward Thomas (1996) has noted that his predecessor, Chief F. Dale Robertson, stated in 1992 that "an ecological approach will be used to achieve the multiple-use management of the national forests and grasslands". Robertson went on to say that "...we must blend the needs of people and environmental values in such a way that the national forests and grasslands represent diverse healthy, productive, and sustainable ecosystems". No fewer than 18 federal agencies had committed to the principles of Ecosystem Management within the next couple of years (Congressional

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Research Service, 1994), and similar support is found in an increasing number of natural resource managers at state and local levels, as well as in the private sector. The US President talked about Ecosystem Management in conjunction with the Forest Plan for the Pacific Northwest and the White House has established a Federal Interagency Ecosystem Management Task Force comprised of sub-Cabinet officials from 15 Departments including Agriculture, Interior, Defence, Energy, Transportation and others, which is producing materials linking healthy ecosystems and sustainable economies (Interagency Ecosystem Management Task Force, 1995a & b). Vice President A. Gore's "National Performance Review" recommended that federal agencies "...adopt a proactive approach to ensuring a sustainable economy and a sustainable environment through ecosystem management". Boise Cascade Corporation has even developed "coffee table" style environmental educational materials on Ecosystem Management.

Forest management regimes and biodiversity conservation approaches

Sedjo (1996) and Risbrudt (1995) have examined the evolution of strategies to manage forests and conserve biodiversity, both ultimately culminating with Ecosystem Management. Sedjo's forest management system descriptions progress as: Custodial-> Sustained Yield-> Multiple Use-> Ecosystem Management. Risbrudt's biodiversity conservation strategy approaches progress as: Species> Management Indicator Species-> Ecosystem Function Indicator-> Natural Community Representation-> Ecosystem Management. The converging evolution of these approaches, moving beyond definitions, suggests that Ecosystem Management is gaining widespread acceptance in the natural resource management community.

A new paradigm in management of US National Forests

Webster's New World Dictionary defines a paradigm as a "pattern, example, or model" and as "an overall concept accepted by most people in an intellectual community, as a science, because of its effectiveness in explaining a complex process, idea, or set of data". Ecosystem Management appears to be quickly evolving as such a concept as increasing public and private sector interests adopt it to meet their needs in describing natural resources management.

LEGISLATIVE AND INSTITUTIONAL ASPECTS OF THE PARADIGM

Legislation

The Forest Service manages US National Forests and Grasslands within the parameters established in legislation promulgated by Congress. Key laws which have a direct effect on the Forest Service implementation of Ecosystem Management are:

Multiple-use Sustained-Yield Act of 1960.

National Environmental Policy Act (NEPA) of 1969.

Forest and Rangeland Renewable Resources Planning Act (RPA) of 1974.

This requires the Forest Service to generate a long-term (1995-2045) strategy with particular emphasis on goals over five-year periods.

National Forest Management Act (NFMA) of 1976.

Cooperative Forestry Assistance Act of 1978.

Forest and Rangeland Renewable Resources Research Act of 1978.

International Forestry Cooperation Act of 1990.

Government Performance and Results Act (GPRA) of 1993.

This requires all agencies of the US Federal Government to increase their emphasis on strategic planning and to link performance measures to that planning.

Forest Service Mission, Vision and Course to the Future

The Forest Service Mission Statement, "Caring for the Land and Serving People", captures the essence of the agency's activities. The Vision of the Forest Service is to be an "efficient, productive, multicultural, and multidisciplinary organisation that is recognised for its national and international leadership in natural resource conservation".

The Forest Service "Course to the Future" describes its philosophical underpinnings and strategic focus, that is, the management context to provide sustainable benefits. The four pillars of the "Course to the Future" are: (1) Protect Ecosystems, (2) Restore Deteriorated Ecosystems, (3) Provide Multiple Benefits for People Within the Capabilities of Ecosystems, and (4) Ensure Organisational Effectiveness. These have been adopted as the agency's strategic goals (USDA-FS 1995). The Mission is achieved by developing and practising Ecosystem Management.

US Forest Service long-term strategic plan

Building upon the Government Performance and Results Act and the Forest and Rangeland Renewable Resources Planning Act, the USDA-FS has articulated strategic and tactical goals to implement Ecosystem Management on National Forest lands (USDA-FS, 1995). Since only 34% of forested lands in the US are in federal ownership, the Agency clearly must develop effective partnerships with private landowners and non-federal interests to help achieve the President's commitment to sustainable forest management by the year 2000, made through a Presidential Decision Directive in 1993. The Santiago (Chile) Declaration, signed by the US in 1995 further committed the US to develop and evaluate national indicators of sustainable forest management. USDA-FS Strategic Goals, with their corresponding tiered Tactical Goals, are:

- Sustainable Ecosystems (Protect and Restore)
  - Healthy and Diverse Forest Lands, Rangelands, Aquatic Ecosystems
- Multiple Benefits (Products and Services, Human Needs, Uses and Values)
  - Timber Production, Grazing Use, Minerals Production, Recreational Use, Heritage Resources, Community Assistance
- Ensure an Efficient and Effective Organisation
  - Generation of knowledge, Programme support, Productive Workforce Infrastructure and Land Ownership, External Relationships.

RECENT DEVELOPMENTS IN IMPLEMENTING ECOSYSTEM MANAGEMENT

Tucson Workshop — researchers and managers nudge the paradigm

In late 1995, an Ecological Stewardship Workshop was organised in Tucson, Arizona, cosponsored by some 30 government agencies, non-governmental organisations, universities, corporations, and private foundations. The workshop was designed to bring scientists and resource managers together to synthesise state-of-the-art recommendations for an ecological approach to natural resource management. This included analysis of available scientific theory and data for essential elements of an ecological approach, as well as current resource management experience in implementing those elements in various field situations (Sexton, *et al.* 1996). The workshop was designed to take current scientific knowledge and leap ahead to application of that knowledge in resource management with-

out the normal lag time of several years. The various topic papers associated with the workshop are available on the internet through the USDA-FS homepage at http://www.fs.fed.us/eco/workshop.htm.

Regional ecosystem assessments

Large-scale ecoregion assessments develop and summarise current, science-based information on the status of the biological, physical, and human characteristics of regional resource systems for use by planners. Assessments facilitate forest planning by providing information in a cost-effective way that can be gathered once instead of several times independently. They review present and potential conditions, as well as trends, so as to establish a range of possibilities. They are not decision documents, nor are they required as a precursor to resource decision making. Several National Forests may be within the geographical area covered by a regional ecosystem assessment and utilise the information generated by it. In 1996 the USDA-FS was involved in the Interior Colombia Basin Ecosystem Management Assessment (ICBEM), the Southern Appalachian Assessment (SAA), and the Sierra Nevada Ecosystem Project (SNEP). New ones coming on line include the Ozark and Ouachita Highlands, Lake States, and Northern Great Plains Assessments.

Land and Resource Management Plans and Process

National Forest Land and Resource Management Plans establish a framework to harmonise laws and regulations governing National Forest Management. At the forest-wide, programmatic decision level they articulate goal statements of where we would like to be in the future; time-specific and measurable objectives needed to achieve the goals; mandatory standards and guidelines; and monitoring and evaluation requirements. The NFMA requires that each forest has a Forest Plan, and that it be revised at least every 15 years. Other laws affecting management of National Forest lands include the National Environmental Policy Act (NEPA), Clean Water Act, Clean Air Act, and Endangered Species Act. Forest Plans do not resolve all disagreements, but allow long-term strategies to be developed while recognising the need to make short-term decisions. Day-to-day resource outputs at the site-specific decision level require environmental analysis tiered to the Forest Plan. Depending on the magnitude of the action, they may require a full Environmental Impact Statement (EIS). The USDA-FS prepares annually about 100 Draft or Final EISs, 5200 Environmental Assessments, and 9800 Categorical Exclusions. The USDA-FS is revising the planning process to more closely align it with an Ecosystem Management approach. The proposed revision anticipates issues of multiple scales, ecosystem dynamics, and strengthened cooperation with state and tribal governments, and with the public.

National Inventory and Monitoring Institute

In 1996 an Inventory and Monitoring Institute (IMI) was chartered, located in Ft. Collins, Colorado. Its mission is to facilitate collection and management of compatible, scientifically reliable, resource information at the National, Regional, and National Forest Planning levels to support natural resource management. IMI functions include work to standardise protocols for strategic level inventory, monitoring, and evaluation activities; serving as a clearing house for such activities; and, providing technical assistance.

National Hierarchical Framework of Ecological Terrestrial and Aquatic Units

A National Hierarchical Framework of Ecological Units was adopted by the USDA-FS in 1993 (USDA-FS 1993). It provides a standardised hierarchy of scales for terrestrial ecological units based on existing conditions and potentials. As such, it has a direct bearing on Land and Resource Management Plans. Products associated with the development of the terrestrial hierarchy include a map and accompanying description of Ecological Subregions of the US and a map of continental ecoregions (Bailey 1989a and b). In the continental US, most forests lie in Bailey's Humid Temperate and Dry Domains. A National Hierarchical Framework of Aquatic Ecological Units in North America was released in 1995, which provides a similar hierarchy for watersheds and aquatic environments.

Adaptive learning model

The National Environmental Policy Act (NEPA) and its regulations requiring US federal agencies to disclose environmental effects of proposed actions have existed for about 30 years. The USDA-FS is working with the President's Council on Environmental Quality (CEQ) to make the NEPA process more efficient as a way to "operationalise" Ecosystem Management. A new model is being field tested in several National Forests, which emphasises monitoring, learning, and adapting, within predefined limits for environmentally acceptable conditions. The model is based on decision science-based questions which guide users through a structured analysis process, which should consistently lead to better documentation of decision rationale, as well as better decisions. This contrasts with the current model which approaches NEPA analysis seeking certainty of effects from the onset, and on comparatively smaller geographical areas.

Key references

Bailey, R. 1989a. Explanatory supplement to the ecoregions map of the continents. Environmental Conservation 1 5(4):307-309.

_____ 1989b. Ecoregions of the continents (map). Washington, D.C. USDA-Forest Service.

Congressional Research Service. 1994. Ecosystem management: Federal agency activities. Library of Congress. Washington, D.C. 124pp.

Ecological Society of America. 1995. The scientific basis for ecosystem management. Washington, D.C. (Prepublication Copy np)

Interagency Ecosystem Management Task Force. 1995a. The ecosystem approach: healthy ecosystems and sustainable economies. Vol. 1. Overview. National Technical Information Service. US Dept. of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. 55pp. Internet order address: orders@ntis.fedworld.gov

_____ 1995b. The ecosystem approach: healthy ecosystems and sustainable economies. Vol. 2. Implementation issues. National Technical Information Service. US Dept. of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. 137pp.

More, T.A. 1996. Forestry's fuzzy concepts: an examination of ecosystem management. Journal of Forestry 94(8) pp. 19-23.

Risbrudt, Christopher D. 1995. Ecosystem management in the National Forest System USDA Forest Service, USA. Forest Policy Analysis-Methodological and Empirical Aspects. Proceedings of IUFRO-COST-EFI Workshop on Evaluation of Forestry Policy Means for Securing Biodiversity and Other Non-timber Products. Gmunden, Austria. Editors: Birger Solberg and Paivi Pelli. September 26-28, 1994. pp 225-238.

Sedjo, R.A. 1996. Toward an operational approach to public forest management. Journal of Forestry 94(8) pp. 24-27.

Sexton, W.T., R. Szaro, and P. Stangel. 1996. Toward a scientific and social framework for ecologically based stewardship of federal lands and waters. Interim Report of Dec. 4-14, 1995 Ecological Stewardship Workshop. Tucson, Arizona. Washington, D.C. 20090-6090. 37pp.

Thomas, J.W. 1996. Forest Service perspective on ecosystem management. Ecological Applications 6(3). Ecological Society of America. pp. 703-705.

Thomas, J.W. and S. Huke. 1996. The Forest Service approach to healthy ecosystems. Journal of Forestry 94(8): 14-18.

Unger, D. 1994. Current perspectives on ecosystem management from the US Forest Service. In Ecosystem manage-

ment: Proceedings of a symposium, ed. T. McEvoy, 13-16. Burlington: University of Vermont, School of Natural Resources.
USDA-Forest Service. 1994. A national framework for ecosystem management. Washington, D.C. 52pp.
USDA-Forest Service. 1995. The Forest Service program for forest and rangeland resources: a long-term strategic plan. Draft 1995 RPA Program. Washington, D.C. (np).

NEW INFORMATION

Restructuring

Several New Zealand forestry-related organisations have been reorganised in the past few months.

NZ Forest Research Institute Ltd
Bryce Heard, Chief Executive Officer of FRI, has announced a high-level restructuring in order to take into account the changing needs of the forestry sector. The structure is based on overlapping "portfolios".

Frances Maplesden is Manager, Market Knowledge. Market knowledge will assist FRI to develop appropriate technology for the forests and forest produce of the future.

Dr Paul McFarlane is Manager, Sustainability and Risk. This grouping includes studies on: sustainable forest practices; sustainable processing; product use, disposal and recycling; and risk management posed by fire, wind, weed, pests, diseases, climate change etc.

Dr Bruce Manley is Manager, Value Chain Optimisation. This portfolio seeks to develop tools for the industry to both manage the plantations and utilise them to meet market demands.

Dr Russell Burton is Manager of Manufacturing Technologies. The areas covered in this group range from log exports through sawmilling and wood engineering, to remanufacturing, pulp and paper and wood-based panels.

Dr Mike Carson, Manager, Future Forests. This includes silviculture, tree breeding and biotechnology through to provision of non-timber products and cultural values.

Supporting and interacting with these science managers are:

Andrew Newman, Manager, Strategic Development.

Dr Keith Mackie, Chief Science Adviser. He has a background in chemistry and was until recently the leader of the Composite Panels Research Group.

Tony Everitt, Sales and Marketing Manager. Tony has forestry and commerce degrees. He comes to FRI from the New Zealand Tourism Board.

Dr John Butcher, Manager, Technology Commercialisation. He will be responsible for transferring FRI technology to industry.

Nigel Hillind, Manager, Human Resources. He is new to FRI and recently was working in the Papua New Guinea Forest Authority.

Michael Franks, Manager, Finance and Information Systems.

South Island branch of NZFRI
This has now moved from Rangiora to University of Canterbury Campus at Ilam, Christchurch. Their address is PO Box 29237, Fendalton, Christchurch. Dr Glen Murphy is the local manager.

International Bioenergy Programme
NZFRI will be managing this international programme for the next three years. Mr John Tustin will be the key person involved.

Horticulture and Food Research Institute Ltd
Two new appointments have recently been made in Palmerston North. Dr Lindsay Fung has replaced Alan Wilkinson as poplar and willow breeder. Alan recently retired but will maintain his links as New Zealand's representative on the Poplar Commission. Lindsay did his PhD at the School of Forestry, University of Canterbury.

Dr Adrian Walcroft, a recent graduate from Waikato University, has taken over from Dr Ross Edwards as tree physiologist.

Department of Conservation
The following are now the key managers in DOC:

Wellington based:
Hugh Logan, Director General
Joris De Bres, General Manager, External Relations
Dr Alan Edmonds, General Manager, Science, Technology and Information Services
Mark Fell, General Manager, Human Resources and Organisation
Murray Hosking, General Manager, Conservation Policy
Mark Toon, General Manager, Business Management
Eru Manueura, Tumuaki Kaupapa Atawhai
John Holloway continues as Manager, Science and Research

Regional Managers:
Grant Barker, Northern (Hamilton)
John Ombler, Central (Wellington)
John Cumberpatch, Southern (Christchurch)

Conservators:
Bill Carlin, Wanganui
Neil Clifton, Nelson/Marlborough
Jeff Connell, Otago
Mike Cuddihy, Canterbury
Paul Green, Tongariro/Taupo Conservator
Chris Jenkins, Bay of Plenty
Greg Martin, Waikato
Allan Ross, Wellington
Gerry Rowan, Northland
Lou Sanson, Southland
Mike Slater, West Coast
Peter Williamson, East Coast/Hawkes Bay.

Dave A. Field retired as the Conservator, Bay of Plenty in 1997. Dave joined the NZ Forest Service as a technical trainee in 1957 and transferred to DOC on the demise of that Department. In 1997 Clive Anstey also left DOC and now works as a private consultant.

Ministry of Forestry
The Ministry of Forestry will merge with agriculture on March 1, 1998, forming the Ministry of Agriculture and Forestry, headed by Dr Bruce Ross. There is only one senior forestry appointment in the top management structure. Mr Murray McAlonan is the Group Manager, Forest Management.

Currently there are about 1700 people in MAF and 170 in the Ministry of Forestry and it is expected there will be 130 fewer positions in the new Ministry.

Dr John Valentine, Secretary of Forestry from 1989 to 1997, is now Chief Executive, New Zealand Seafood Industry Council.