2203

WATERSHEDS '94

RESPECT
RETHINK
RESTORE

PROCEEDINGS OF
THE FIFTH BIENNIAL
WATERSHED MANAGEMENT CONFERENCE

Ashland Hills Inn Ashland, Oregon
November 16-18, 1994

Edited by

Richard R. Harris

Rick Kattelmann

Hannah Kerner

Jeff Woled

Sponsored by

The Watershed Management Council

The Department of Environmental Science, Policy, & Management: Cooperative Extension Forestry
University of California, Berkeley

CENTERS FOR

WATER AND

WILDLAND

RESOURCES

University of California
Water Resources Center Report No. 86
ISBN 1-887192-02-6
July 1995

WATERSHED ANALYSIS ON THE PUBLIC LANDS: WHERE ARE WE NOW AND WHERE SHOULD WE BE GOING?[1]

Gordon E. Grant, Frederick J. Swanson[2]

Abstract. *Watershed analysis (WA) for public lands was originally designed as a formal process to address a specific problem - fitting regional conservation strategies to a given landscape. It represents a mechanism for conducting ecosystem-scale analyses before planning and calculation of commodity outputs. Legally mandated on public forest lands throughout the Pacific Northwest, it is struggling to define its role against a backdrop of continued uncertainty and contention about the direction of Federal forest management. Current objectives for WA range from using analyses to (1) identify best management practices to mitigate or reduce cumulative effects, (2) develop conservation strategies for critical species, or (3) design landscapes based on ecosystem dynamics interpreted from the historical or natural variation in past ecosystem conditions. Efficiently and effectively conducting WA requires that priorities among these objectives be established, but no well defined forum is providing clear policy direction. In spite of these uncertainties, future WAs will be successful if they are better integrated with planning, used to formulate and evaluate a range of alternatives, address both terrestrial and aquatic systems and their interactions simultaneously, and move toward using ecologic principles, such as recognizing the importance of disturbance regimes as underlying principles for landscape design.*

Key words: watershed analysis, ecosystem management

INTRODUCTION

Assessing the intrinsic capability of a landscape to produce goods and services without impeding ecosystem function is a primary requirement of ecosystem management. Though still in its infancy, watershed analysis is the only formal process now being conducted on public lands that fulfills this role. Given the massive commitment of agency time and resources to this effort, it seems appropriate to take stock of where watershed analysis is headed and what problems it is encountering along the way. In this paper, I assess the issues and uncertainties underlying watershed analysis, and consider the direction that future analyses might take.

Watershed analysis is also being conducted on state and private lands in Washington and elsewhere (Washington Forest Practices Board 1992; 1993). Although many aspects of the federal watershed analysis process were patterned after those currently in practice in Washington, the differing legal requirements, agency directions, land base, and public expectations between the public and private sectors have resulted in rather different social and institutional settings for watershed analyses. This paper focuses on how watershed analysis is being conducted on public lands.

BACKGROUND

Watershed analysis (WA) on public lands was originally designed as a formal process to address a specific problem - fitting regional conservation strategies to a given landscape (Thomas et al. 1993a). It grew out of the recognition that measures to protect biodiversity developed at a regional scale might well be too broad or too restrictive when applied to individual landscapes. Therefore, some mechanism was needed to develop more specific prescriptions consistent with an overall regional strategy. For public lands, the concept of watershed analysis emerged more or less simultaneously in several regional conservation efforts, including the Scientific Advisory Team (SAT) report on viability for species associated with late successional forests (Thomas et al. 1993b), a western U.S. conservation strategy for anadromous fish (PACFISH), and the Forest Ecosystem Management Assessment Team (FEMAT) report (Thomas et al. 1993a). A premise of watershed analysis, as described

[1]*Published in Proceeding of the Fifth Biennial Watershed Management Conference, R. Harris, R. Kattelmann, H. Kerner, J. Woled, editors. Water Resources Center Report No. 86, University of California, Davis*

[2]*USDA Forest Service, Pacific Northwest Research Station, 3200 Jefferson Way, Corvallis, OR 97331*

in these efforts, was that watersheds of tens to several hundreds of square miles were an ecologically relevant and manageable scale for fine tuning regional ecosystem management. Although initially conceived as a means of addressing aquatic biodiversity and water issues, the scope of watershed analysis was broadened early in the FEMAT process to include both terrestrial/upland and riparian concerns. As such, it represented a mechanism for conducting ecosystem-scale analyses before planning and calculating commodity outputs. A Record of Decision (ROD) formally amended the Forest and BLM plans for the region of the northern spotted owl, and it mandated watershed analysis before conducting any harvest activities on key watersheds or in riparian zones in this region.

Since then, several dozen watersheds throughout the Pacific Northwest have been analyzed. These initial analyses represent a range of landscapes, technical and philosophical approaches, and agency and social contexts. Evaluating them has been difficult because there is no agreement as to what the results should look like (Grant et al. 1994). This lack of a common understanding of what WA is supposed to "do" and how it fits within the agencies' missions reflects deeper unresolved issues concerning the current social and political context of forest management decisions.

THE CURRENT CONTEXT FOR WATERSHED ANALYSIS

Evaluating any watershed analysis requires recognizing the management and policy framework in which it is being conducted and its objectives (Montgomery et al. In press). Current objectives for WA range from using analyses to (1) identify best management practices to mitigate or reduce cumulative effects, (2) develop conservation strategies for critical species, or (3) design landscapes based on ecosystem dynamics interpreted from the historical or natural variation in ecosystem conditions. Watershed analysis to meet the first of these objectives is most clearly demonstrated by the Timber, Fish, and Wildlife (TFW)/Department of Natural Resources (DNR) process in the state of Washington (Washington Forest Practices Board 1992; 1993). Some harvest activities are assumed and watershed analysis is used to minimize the resulting degree of environmental disturbance. Analyses are conducted to identify dominant processes affecting hillslopes, channels, and riparian zones; prescriptions are developed to reduce hazards from mass movements, hydrologic effects of forest activities, and channel changes. This approach seems well suited to the private lands, where a relatively high rate of timber harvest activities can be assumed for the future. It is less well suited to the public lands, where the balance between commodity production and managing for biodiversity is clearly different but still unclear.

The objective of using WA to protect individual or groups of species underlies much of the FEMAT approach, where a primary goal of watershed analysis is to provide the knowledge and information necessary to modify interim riparian reserves for fish and other riparian-dependent and terrestrial organisms (Thomas et al. 1993a). By this objective, watersheds are analyzed to identify opportunities to improve or restore degraded habitat, and to minimize land-use activities that place individual species at risk. An example of this approach is provided by the Elk River WA, conducted by the Siskiyou National Forest in Southwest Oregon (Siskiyou National Forest 1994), where protection of anadromous fish stocks was a primary consideration.

Uncertainties in determining habitat requirements for the many thousands of species found in forested watersheds, however, or even in identifying the species themselves, have undermined confidence in modifying reserve boundaries or locations. The unresolved legal status of many organisms contributes to this uncertainty, as does the lack of clear priorities or standards for judging risk to either species or ecosystems. Land managers therefore, find themselves in the unenviable position of having conducted expensive and time consuming analyses without being able to act on the results, thereby raising questions about the value of the analysis in the first place.

The third objective of using WA as a formal process for implementing ecosystem management is clearly explicit in the direction provided by FEMAT. The premise underlying this approach is that by interpreting natural variability and arrangement of watershed processes and structures (e.g., seral age class, channel conditions) through time and space, and using this understanding as a reference point for designing land-use activities, risks to ecosystems and species can be minimized (Swanson et al. 1993). Moving forward with this objective has proved difficult, however, in part because of confusion between this and the first two

revolve around anticipated resumption of harvesting and associated commodity outputs estimated in the FEMAT/ROD; uncertainties stem from a future made murky with legal challenges, pending Threatened and Endangered species listings, questions about the extent to which regionally mandated reserves can be modified without exhaustive species-by-species considerations, and other unresolved issues, including the role of province-scale planning. With debate over these issues likely to continue, the future of WA depends on clear policy direction in the interim.

SOME DIRECTIONS FOR THE FUTURE

In spite of these uncertainties, some clear directions have emerged that the next round of watershed analyses should follow. It is most important that WA is well integrated with planning and decision making. Without a seamless transition between analysis and planning, the new information generated during analyses is unlikely to be utilized, and much of the enormous expenditure of time and resources will be wasted. At the same time, WA needs a specific mandate to guide planning to focus the analysis effort and provide planners with the necessary products. Analyses need to be more than encyclopedias of information or watershed-based novels. They should produce maps, data, and projections of future conditions within the watershed through time to give planners the necessary framework for developing and analyzing alternatives (Montgomery et al. In press). Additionally, WA needs to produce accurate, well documented, and well archived data bases for future use. Otherwise, the economies of scale from conducting multiple WAs within a forest or province will never emerge.

Where applicable, analyses should at least consider the biological and physical implications of implementing the default FEMAT or other regional reserve system in the watershed in question, and provide planners with other options for reserve design and layout. Watershed analysis was explicitly designed to help tune regional conservation strategies. Analyses need to be directed at providing planners and decision makers with alternative strategies for meeting conservation or other objectives. Again, this process will require defining alternatives, projecting them through time, and evaluating the outcomes in terms of key environmental variables. Although some interpret NFMA/NEPA as limiting the opportunities for explicit watershed-scale planning, considering options and exploring alternative landscape designs at the watershed scale does not necessarily involve a NEPA or NFMA decision. Properly conducted, watershed analyses provide a common planning framework that can be aggregated to support decisions at the forest level, or provide the larger context for project decisions.

Ultimately, WA needs to provide the information necessary for implementing ecosystem management. An increasingly accepted paradigm for ecosystem management is using an interpretation of natural variability as the basis for land use decisions. The most useful WAs in the future are likely to be those that can provide decision makers with some understanding of the potential risks to ecosystem processes and organisms posed by alternative scenarios. To do this requires looking beyond analysis of individual processes or "modules" to a more integrated conception of *landscape design*, where the understanding of biotic and abiotic processes, terrestrial/riparian/aquatic organisms, and hillslopes/channels is used to project a range of watershed futures and to evaluate outcomes (Montgomery et al. In press). Watershed analysis should be viewed as the analytical engine for landscape design, which can be defined as the science and art of using the best available information, knowledge, and understanding to formulate a blueprint for future landscape conditions. Landscape design will require all the skill, tools, and ingenuity that planners can bring to bear to develop landscape units and prescriptions based on interpretations of the range of natural variability in ecosystem processes, and to model how such units change through time.

CONCLUSIONS

The fundamental questions facing land managers and policy makers at this juncture are how do we use WA to make better decisions on the ground, and is the improvement in our decisions worth the cost. Given that the decision space is highly constrained by regional conservation strategies and legal uncertainties about the Northwest Forest Plan itself, even the best WA may not provide many new options for management. Nonetheless, agreement is widespread that a science-based analysis of watershed and landscape history, behavior, and future prospects offers the best chance for balancing the range of objectives for forested landscapes and sustaining both ecosystems and human needs. Looking ahead, one can imagine that future

objectives: the conflict between species- and ecosystem-oriented scientists and specialists, and the lack of good examples to emulate. Some of the best examples of this approach are the Watershed Analyses of Augusta Creek (Grant et al. 1994; Cissel et al. 1994) and South Fork McKenzie River (Willamette National Forest 1994) WAs on the Willamette National Forest. For Augusta Creek, interpreted fire disturbance patterns were used to develop a landscape design defined by large (0-300 acres) landscape blocks, with harvest prescriptions within blocks intended to correspond with natural fire frequencies, intensities, and sizes. Both spatial distribution and block prescriptions were modified to accommodate other ecosystem issues, including providing habitat needs for birds and amphibians, minimizing hydrologic and geomorphic effects, and maintaining protection for riparian zones. Part of the watershed analysis involved projecting land-use patterns 400 years into the future and interpreting the consequences for both ecologic and physical processes and timber production.

Evaluating WAs requires clear direction as to which of these objectives is a priority. Although more than one objective may be accommodated in a particular analysis, the goal of the analysis must be set external to the analysis itself. This external goal-setting requires policy decisions as to whether the dominant paradigm for forest management in the Northwest (and elsewhere) will be to (1) set a cut level and minimize or mitigate environmental effects, (2) employ a species conservation strategy emphasizing recovery of old growth and old-growth associated species, or (3) move towards an ecosystem management approach where interpretation of natural system dynamics and range of variability is used to set the magnitude and pattern of harvest activities. These three paradigms can be viewed as an evolutionary trajectory, moving from the 1970s and 1980s for the first objective, through the present for the second, and into the future for the third. Without a clear statement of the direction of forest policy, however, watershed analysts and decision makers will continue to struggle to define the roles and goals of the analyses. Is it merely a "scoping" exercise to gather information about watersheds before initiating projects, as some have suggested, or is it an integrated part of the next generation of forest planning and action?

Resource managers assigned the task of conducting watershed analysis need to have these uncertainties resolved. Recognition of the need for some type of landscape analysis before initiating land use activities appears to be spreading, and most practitioners will likely learn by doing. In this sense, watershed analysis may be one of the most visible examples of "adaptive management"; an iterative process of using experience to guide and modify management decisions in the face of uncertainty. Watershed analysts will inevitably be confronted with questions for which science can offer little guidance. These questions include:

- How should reducing risks to landscape hazards (e.g., landslides, channel changes) and biological processes (e.g., habitat needs for specific species) be weighted against using an interpretation of the historical range of variability in setting landscape goals?

- What questions are appropriately asked and answered at the watershed scale versus larger (e.g., river basin, province, region) or smaller (e.g., site) scales? How does the designation of a watershed of a particular size as the subject of WA define the context, scope, and level of detail of the analysis?

- How are terrestrial, riparian, aquatic, and social objectives and opportunities melded and integrated? What sequence of analysis tasks permits maximum flexibility and refinement of joint objectives? How is the mosaic of patches integrated with the network of roads and channels? Over what time scale are ecosystem processes assessed?

- What assumptions and standards of risk are used to modify reserve boundaries? How are ecological and social risks balanced?

These questions point out the need for a forum where policy goals are established. A plethora of interagency working groups are currently exploring new ways of decision making and consensus building, but no clear direction has emerged; the plethora is, in fact, part of the problem. Both high expectations and the uncertainty attached to any decisions made on the forested public lands will continue. High expectations

activities on the public lands may involve some combination of restoration practices, more modest but judicious future management, and forest regrowth. As new information provides changing understanding of species needs and ecosystem variability, new options and flexibility for managers may emerge. The results of watershed analyses will help this process along and likely find new uses in the future.

REFERENCES

Cissel, J., Swanson, F. J., McKee, W. A., and Burditt, A. L. 1994. Using the past to plan for the future in the Pacific Northwest. *Journal of Forestry* 92(8): 30-31,46.

Grant, G., C. McCain, and J. Cissel. 1994. Summary of the watershed-landscape analysis workshop. In: M. Herring (editor). *Proceedings of the Watershed-Landscape Analysis Workshop.* February 2-4, Blue River, OR. General Technical Report PNW-GTR-338. Portland, OR. USDA Forest Service, Pacific Northwest Research Station. 68 pp.

Montgomery, D. R., Grant, G. E., and Sullivan, K. 1995. Watershed analysis as a framework for implementing ecosystem management. *Water Resources Bulletin.* In press.

Siskiyou National Forest. 1994. *Watershed Analysis: Elk River Watershed.* USDA Forest Service, Pacific Northwest Region, Portland, OR. 69 pp.

Swanson, F. J., J. A., Jones, D. A. Wallin, and J. H. Cissel. 1993. Natural variability - implications for ecosystem management. In: M. E. Jensen and P. S. Bourgeron (editors). *Eastside Forest Ecosystem Health Assessment–Volume II: Ecosystem Management: Principles and Applications.* USDA Forest Service, Pacific Northwest Research Station, Portland, OR. pp. 89-103.

Thomas, J. W. et al. 1993a. *Forest ecosystem Management: an ecological, economic, and social assessment.* Report of the Forest Ecosystem Management Assessment Team (FEMAT). U.S. Government Printing Office 1993-793-071, Washington, DC. 1,000+ pp.

Thomas, J. W., M. G. Raphael, R. G. Anthony, et al. 1993b. *Viability assessments and management considerations for species associated with late-successional and old-growth forests of the Pacific Northwest.* USDA Forest Service, Portland, OR. 530 pp.

Washington Forest Practices Board. 1992. *Standard methodology for conducting watershed analysis.* Washington Forest Practice Act Board Manual, Version 1.0. 105 pp.

Washington Forest Practices Board. 1993. *Standard methodology for conducting watershed analysis.* Washington Forest Practice Act Board Manual, Version 2.0. 85 pp.

Willamette National Forest. 1994. *South Fork McKenzie Watershed Analysis.* Willamette National Forest, Eugene, OR. 284 pp.