

Volume 7, Issue 1

January / February 2009



UNIVERSITY OF WASHINGTON  
COLLEGE OF FOREST RESOURCES • COLLEGE OF OCEAN & FISHERY SCIENCES

ONRC UPDATE

## Director's Message

John Calhoun, *Director*



This issue of *ONRC Update* features information from two events, a symposium and a workshop, convened recently at ONRC. Often ONRC's program of research is not visible to the general public and regretfully not recognized as paradigm-shifting events to most folks. We all know that progress in scientific understandings and changes in public policy are often achieved in baby steps.

The first event, a workshop led by ONRC research scientists Jason Cross and Jeff Cornick, described how northern spotted owl habitat should be measured and, more importantly, how habitat could be restored and developed. Cross and Cornick described effective and efficient pathways to achieve landscape scale habitat restora-

tion goals. These research findings emanated from several studies undertaken over the last few years. A room full of interested scientists and managers attended the workshop and engaged in discussions about the implications of the work presented.

The second event, Riparian Adaptive Management Symposium, convened 30 leading scientists and policymakers from around the United States. It explored how our understanding of riparian management and restoration has advanced over the last 15 years. Symposium proceedings will help guide managers as they strive to improve practices to achieve these important conservation goals.

The conference facilities at ONRC's Forks campus are ideal for

small to moderate scale retreats and symposia. As part of our community outreach program, we plan these events in the off season, bringing participants to Forks that would not otherwise visit the community. In this way, we can fulfill two important purposes of ONRC: conduct research that supports integration of ecological values (sustainability) into commercial management of forest resources - which will help resource dependent communities in the long run - and directly supporting the economy of these communities by attracting visitors in the off season. The science is outstanding; the community welcomes the additional support.

**ONRC UPDATE** is published bimonthly by the

University of Washington Olympic Natural Resources Center, PO Box 1628, Forks WA 98331  
(360) 374-3220 or from Seattle (206) 685-9477 Website: [www.onrc.washington.edu](http://www.onrc.washington.edu)  
Newsletter Editor: Ellen Matheny – [ematheny@u.washington.edu](mailto:ematheny@u.washington.edu) (360) 374-4556

# Managing Discord Between Policy and Method

Jeff Cornick, *Research Scientist*

## Introduction

Restoration of complex forest structure from simplified stands is a contemporary management problem. It is fundamentally a silvicultural problem, applying knowledge of tree physiology, stand dynamics, and forest ecology. Advances in information and technology have aided forest managers. Extensive tree inventories have been collected to support more precise analyses. Computer hardware has advanced to easily process very large datasets, and forest growth models have been refined. The trend towards computer analysis demands fully quantified definitions for management objectives. For a multifaceted and highly variable concept such as complex forest (such as “old growth”), this has proven problematic.

## Definitions and Unintended Consequences

A comparison of several definitions for complex structure illustrates the problem of definitions for forest managers. Many definitions of complex structure exist for Olympic Peninsula forests. These include the US Forest Service Northwest Forest Plan (FSNWFP) Northern Spotted Owl (NSO) definition, the DNR Forest Practices Act (DNRFPA) NSO definition, and the DNR Weighted Old Growth Habitat Index (WOGHI). DNRFPA is divided into two components: old forest (OF) and young-forest/marginal (YFM habi-

tats. Structural elements common to all definitions include trees with large diameters, multiple canopy layers, snags, and downed logs.

It is reasonable to assume each definition is attempting to identify a similar type of forest. A comparison of approximately 3500 stands in the Olympic Ex-

sult. First, the FSNWFP and DNRFPA definitions were written into laws as representative of “average” NSO forest habitat, but are applied as “minimum” requirements. Second, each definition includes multiple (slightly different) thresholds. A stand that fails to meet just one threshold (even by a very small margin) fails to meet the definition.

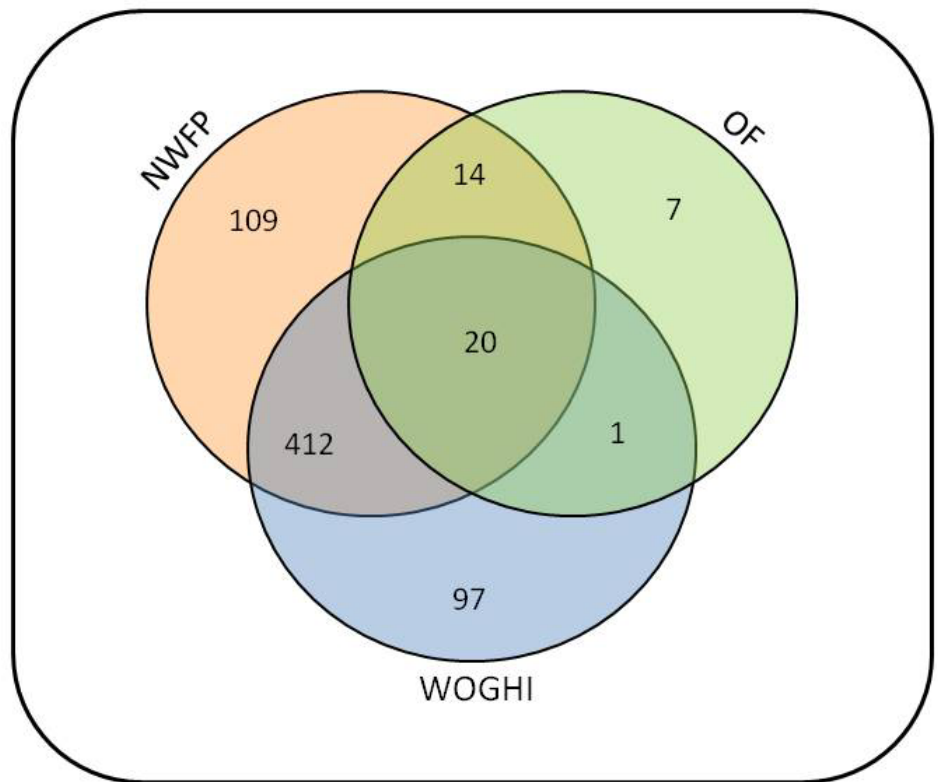


Figure 1. Count of stands that satisfy USNWFP (NWFP), DNRFPA (OF), and WOGHI definitions.

perimental State Forest provided a surprising result: of 700 stands that satisfied at least one definition, only 20 satisfied all three. Further breakdown of this analysis is provided in the Venn diagram in Figure 1. Two causes are suggested for this undesired re-

An overly restrictive definition can cause unintended consequences that are severe for conservation objectives on a working forest. While a stand that meets a definition may be prioritized (or required) for protection, a stand that misses a definition

(Continued on page 3)

(Continued from page 2)

is available for harvest. Further, because complex structure is an advanced stage of stand development, a stand that just misses the definition will likely have high volume and value, and could be prioritized for harvest.

A better approach to defining complex habitat was explored at ONRC. In fuzzy set theory, stands can have degrees of membership in the complex habitat set depending on the number of definition elements they satisfy. A fuzzy logic version of the DNRFPFA definition (allowing a stand to meet any 5 or 6 elements) proved more robust than the original definition, better matching biologists' original estimates of NSO habitat while resulting in similar population characteristics. Unfortunately, while fuzzy set theory proved superior, rarely can managers change definitions at will. DNRFPFA and FSNWFP definitions represent legal requirements that

must be managed for to achieve agency obligations.

One critical conclusion of the fuzzy logic investigations was that the number of parameters in a definition is related to the Type I and Type II error rates: More parameters are associated with higher rates of Type II Errors (i.e., failure to identify actual habitat); while fewer parameters encourage higher rates of Type I Errors (i.e., improperly identifying stands as habitat). The best definitions are those that include the fewest number of parameters, but identify those parameters most critical to success – which we called the 'limiting factors'.

### An Integrated Management System with a Density Management Diagram

Recognizing the influence of definitions on silviculture and selection of stands for treatment or conservation, ONRC has investigated a system that integrates these elements with growth mod-

els, and which emphasizes simplicity and communication. The system uses the “-3/2 law of self-thinning” (a.k.a., 3/2 Power Law) as the organizing principle. A paraphrasing of the law is that for any given number of trees there exists a maximum possible average size for those trees; the slope of this maximum is approximately -3/2. When approached, an increase in average size is only possible at a lower density through competition-induced mortality. Stands are well-organized within these bounds, and growth is predictable. Stand density management diagrams have been developed from the -3/2 law of self-thinning and historically used to plan the timing and intensity of thinning treatments for a single stand.

Just as forest management in general has expanded beyond single stands to the landscape, ONRC is extending the use of the diagrams to map multiple stands and management objectives. For example, mapping the DNRFPFA stands on the density management diagram identified that they clustered tightly to a region of low overstory TPA and high volume. The concept of mapping management objectives on density management diagrams is also not new: British Columbia Ministry of Forests has identified regions that maximize stand growth (CAI); elk hiding and thermal covers have been mapped for inland lodgepole pine forests. Regions that minimize knot size (for wood quality) have been identified for longleaf pine forests in the South.

The new and integrating characteristic of ONRC's use of a den-

(Continued on page 4)

OF / YFM Score	5/5	4/5	3/5	2/5	1/5	0/5
6/6	27	4	0	0	0	0
5/6	156	38	1	0	0	0
4/6	311	185	52	25	4	0
3/6	261	628	630	300	50	7
2/6	32	69	84	292	195	24
1/6	0	8	42	17	39	7
0/6	0	0	2	0	0	5

Figure 2. Count of stands by number of NSO habitat elements satisfied. Definitions are DNRFPFA NSO Old Forest and Young Forest Marginal.

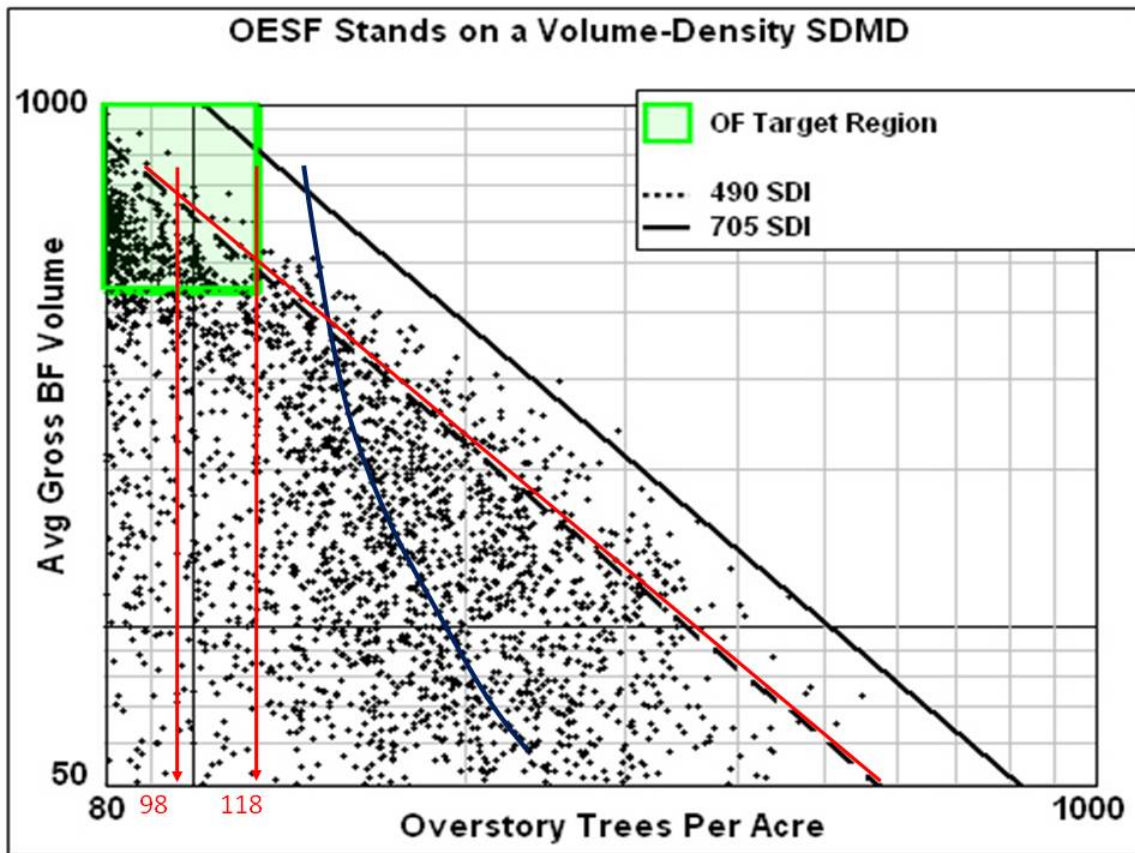


Figure 3. Volume-TPA density management diagram with complex structure target region (green box) and economic criteria (blue line). Each dot represents a stand.

(Continued from page 3)

sity management diagram is the relative position of stands to each other and to management objectives. Figure 3 shows a density management diagram with the complex region identified in green and the stands in the OESF represented as black dots. The blue vertical identifies which stands could be economically feasible for a thinning down to the overstory density of the existing complex stand population. This system: 1) Provides a definition for complex habitat by overstory size and TPA; 2) Identifies “next best” stands that are closest to the target region and stands that are furthest from the target region; 3) Suggests thinning levels to promote

stands towards the complex target region; 4) Indicates the economic feasibility of the proposed thinning level for all stands; and 5) Communicates the situation visually.

Like all models, simplifications and assumptions are required. For example, many non-complex stands map to the complex region. Additional discriminating metrics can be added to the base size-density definition to achieve the desired level of confidence, while including the size-density elements link the definitions to other management objectives, stands, and common silvicultural metrics. Stands may also not be as uniform as desired for density management diagrams in terms of the diameter and spatial distri-

butions. Generally, the diagram should be adequate to suggest stands and silviculture for analysis in more sophisticated tools such as growth models.

### Conclusion

Definitions for management objectives influence management in terms of stand selection and silviculture, and can have unintended consequences. ONRC is investigating using density management diagrams as an integrating system to coordinate definitions, stands, silviculture, and growth models. The visual nature of the diagrams should be useful for developing understanding, checking results of other analyses, and communicating with a wide range of audiences.

# ONRC Convenes Riparian Adaptive Management Symposium

John Calhoun, *Director*

---

Protection and management of the streams and wetlands on our forested landscapes is of vital interest to responsible managers and the public. The scientific basis for protection measures and restoration strategies were documented more than 15 years ago in major federal and state plans and regulations that are in force today. Important public planning documents make a commitment to adapting to new information to improve protection and restoration programs and regulations. Research and experience has provided important lessons over the last 15 years.

ONRC along with its partners - Washington State Department of Natural Resources (State Lands) and USDA Forest Service Pacific Northwest Laboratory - convened a group of outstanding scientists and key policymakers on November 3 & 4, 2008, to explore what we have learned and where we should adopt new policies and practices. Scientists came from throughout the Pacific Northwest to ONRC to explore four key questions:

1. What are the principle working hypotheses and key assumptions that underlay current riparian conservation strategies on federal, state, and private lands in western

Washington?

2. In light of current scientific understanding, what is the degree of both confidence and uncertainty for each of these working hypotheses and assumptions?
3. If there is scientific consensus to revise underlying assumptions or working hypotheses, would this revision have important consequences for management strategies or policy goals?
4. Which are the critical assumptions in terms of both scientific uncertainty and management/policy implications?

A combination of panel presentations and extended interaction among the scientists resulting in lively debate yet surprising consensus around a certain set of assumptions suggested adaptation to new knowledge may be appropriate. Key among these areas of consensus is a recognition that riparian systems are dynamic not static.

This means that sediment and large woody debris budgets are event driven and watershed wide assessments and strategies are necessary. Standard protections prescriptions - such as buffer width adjacent to streams - are not appropriately applied in a dynamic system where conditions are recognized to vary among stream segments and among watersheds. Other important advances in our knowledge of how riparian systems work and therefore how they should be protected and restored were noted.

Environmental services that are cherished most by Pacific Northwest citizens - salmon and clean water - can only be provided if we maintain healthy riparian systems. The Symposium conveners believe that results from this work will help guide policymakers to devise programs of adaptive management to better protect and restore the ecological services derived from forested riparian systems.

## SYMPOSIUM PROCEEDINGS

Symposium organizers are currently working on the production of the proceedings that will be widely available on the Internet. The symposium is currently available for viewing via streaming video on the ONRC website. Each set of presentation slides can also be downloaded. ONRC website:

[www.onrc.washington.edu](http://www.onrc.washington.edu)