

A Research Agenda For Silviculture In The Great Lakes Region

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Introduction

The Great Lakes Silviculture Summit took place in April 2003 at Michigan Technological University. The primary audience of the summit included institutional representatives who define needs and set policy regarding silvicultural approaches and practice, as well as researchers working in silviculture or related disciplines.

An overarching goal of the summit was to develop and strengthen a collaborative research network that focuses on priority silvicultural information needs of various “user groups,” i.e., those that implement silviculture on the ground. A first step in developing this network was to obtain a clear message from decisionmakers about their needs.

A desired outcome for the summit was the development of a research agenda from topics identified and supported by summit participants. Our intention is that this agenda be used to articulate and prioritize informational needs for silviculture and related disciplines to funding agencies and to organizations that allocate internal resources to silviculture research.

We present the research agenda by organizing information needs within the context of our landscape spectrum model of forest management (see below and Palik *et al.*, this volume). Using this approach, we identified where along the nodes of the management spectrum (intensive management, integrated management, reserve management) the informational needs lie.

For this synthesis, we relied on information needs expressed during presentations by the various “user group” representatives, along with their contributed papers, if they provided one (see this volume). The presenters were

selected to represent six different perspectives on institutional management goals or objectives, including: 1) *pulp and paper production*, 2) *saw log and veneer log production*, 3) *nonindustrial private forest management*, 4) *conservation management*, 5) *Federal forest management*, and 6) *State forest management*. Before the summit, invited presenters were asked to determine and summarize the needs for the “type of organization” they represent, rather than the needs of their specific organization. In this way, we hoped that the research agenda would be broadly inclusive of information needs in the region.

The research agenda also is developed from comments by summit participants, as recorded during breakout sessions. Moreover, we drew upon views expressed by a panel of invited responders representing major research and management organizations in the region (see appendix).

We attempted to identify dominant themes, i.e., information needs that clearly stood out as being important to the overall summit group. Dominant themes were repeated, although not necessarily verbatim, by multiple participants in a breakout session, in multiple breakout sessions, and by one or more invited speakers or panel members. Note that some stated needs may be included under multiple management nodes (e.g., production and integrated management). This occurred when the research need, as expressed by participants, clearly pertained to more than one node.

Research Needs Across the Landscape Spectrum

Our summary of silvicultural information needs can be articulated as a comprehensive research agenda by organizing around nodes of the “landscape spectrum” model in figure 1. Definitions of the nodes in our model are specific to our use. Others may define these nodes differently.

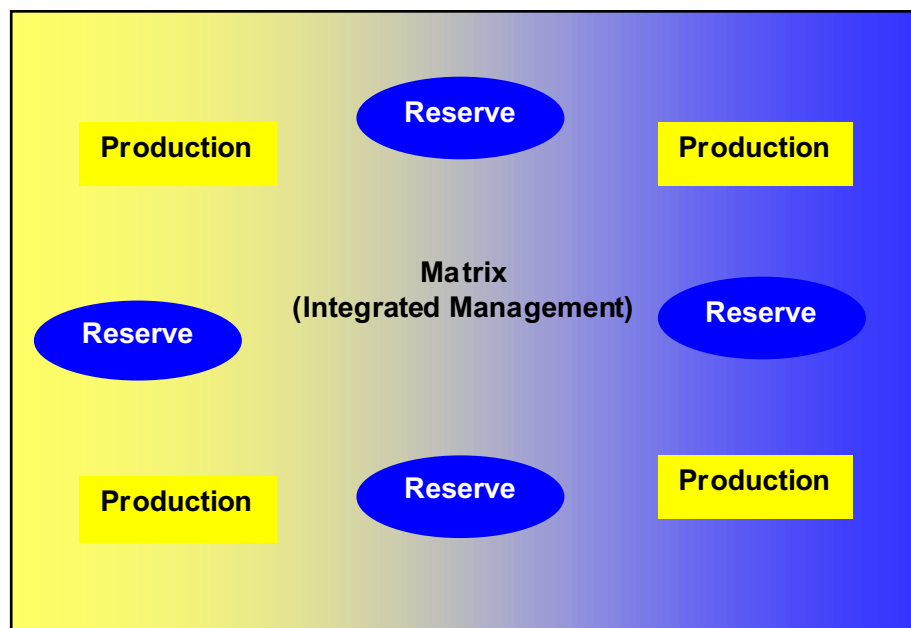


Figure 1. —A spectrum model of forest use allocation (adapted from Seymour and Hunter 1999). Production and reserve forests are embedded within a matrix managed for integration of ecological and production goals.

By our definition, the sole goal of production management is to maximize wood or fiber growth and yield without compromising the long-term sustainability of the production system. Managing for biological diversity or ecological complexity is not a stated objective for production systems, although there could be realized, but unplanned, ecological amenities associated with this management.

The sole goal for reserve management is to sustain (or restore) native biological diversity and ecological complexity in amounts and patterns deemed appropriate, given a selected benchmark for comparison. Commodity timber management is not an objective for reserves, although it could be a byproduct of this management, for instance, by thinning overstocked stands during restoration.

Goals and desired conditions for the matrix are diverse, as are the silvicultural approaches used to achieve them. Consequently, research needs for the matrix are equally diverse. They will integrate and balance production and ecological objectives to varying degrees depending on many factors, including landowner or stakeholder goals, landscape position, and current conditions.

The Research Agenda

A research agenda for production silviculture

The research agenda for production silviculture is driven largely by information needs for production of bulk fiber; however, needs related to sawtimber production, largely of softwoods for dimensional lumber, also figured prominently (see related paper in this volume). One dominant theme emerged: the need for information on *management systems that better realize the productive potential of species and sites*. This theme surfaced at least 12 times during breakout discussion, an order of magnitude more than any other topic. Specific information needs relative to this theme include systems to maximize and sustain production, realizing the potential to maximize production at various scales, understanding the limiting factors to production, realizing production potential of mixed-species systems, predicting the cumulative effects of repeated management actions, and determining what actions are affordable and practical.

Additional information needs for production management include:

1. *Aspen and hybrid poplar management for fiber:*
—Harvest prescriptions that increase the aspen component on desired sites

- Genetic selection, breeding, biotechnology, and plantation establishment
- Improved aspen growth and yield models including interactions of site, stocking, and fertilization
- Systems for improving wood quality
- Development of integrated management systems for hybrid poplar inclusive of weed control, stand establishment, tree nutrition, and pest management

2. *Softwoods:*

- Strategic assessment of softwood supply options, e.g., increased production vs. increased imports
- Cost/benefit analysis of silvicultural options for maturing and overstocked softwood stands
- Softwood silviculture options including thinning and fertilization of pine, deployment of hybrid larch plantation systems, and options for increasing spruce and fir production in planted or natural stands
- Ecological implications, at multiple scales, of plantation management systems

3. *Hardwoods:*

- Growth and yield research that enables value growth projection as a function of site quality, stand density, and species composition
- Prescriptions that promote regeneration of high quality mixed-hardwood and softwood stands
- Reliable and cost-effective herbicide treatments to control sedge, grass, and invasive plant and animal species
- Reliable predictions of time windows for successful regeneration, based on effective deer population control measures and knowledge of natural population cycles

4. *Carbon sequestration:*

- Realizing the potential of sequestration in forest ecosystems

5. *Management systems:*

- Integrated, cost-effective management systems (e.g., nutrition, density management) that can better realize productive potential of Great Lakes species
- More or maintained demonstrations (e.g., experimental forests) of research on systems for production management
- Understanding the impacts of production systems on tree population genetics

A research agenda for integrative silviculture in the landscape matrix

As with production management, one dominant research theme for integrative (matrix) management emerged from summit speakers and participants: *the need for information on trade-offs or balances between ecological objectives and production objectives*. This theme surfaced at least 12 times during breakout discussions, an order of magnitude more than any other topic. Specific information needs related to this theme include understanding the tradeoffs for wood productivity when managing for ecological complexity; being able to quantify ecological and productivity outputs on a common scale to better measure tradeoffs; research on the effects of complex structure (e.g., multicohort) and extended rotations on regeneration and growth and yield; cost analysis of damages from selective logging in multi-cohort stands and how to minimize damage; systems for quality hardwood management to increase economic potential of the matrix; systems to emulate natural disturbance.

Additional silvicultural informational needs for the matrix include:

1. *Forest composition and structure:*

- Methods for maintaining aspen as a component in mixed-species and multi-cohort stands
- Management systems for red pine/white pine or white pine/hemlock that incorporate multi-cohort structure and reintroduction of fire

2. *Growth and yield:*

- Growth and yield data for long-rotation management, especially red pine

- Hardwood growth and yield equations that respond to stand density
- Tools for projecting value growth of mixed-species stands

3. *Regeneration:*

- Minimization of regeneration failures due to deer browsing and improvement of regeneration in winter deeryards
- Methods for white pine restoration, including regeneration in the understory of established stands
- Improved approaches for regeneration of “difficult species,” like paper birch, white cedar, eastern hemlock

4. *Management systems:*

- Options for maturing and overstocked softwood stands
- Approaches for the NIPF; prescriptions that are efficient, effective, ecologically sustainable, and affordable on small ownerships
- Approaches for improving ecological condition, wildlife habitat, and regeneration on small NIPF ownerships
- Systems for maintaining biodiversity while ensuring a sustainable rate of economic return

5. *Invasive species:*

- Understanding of how overstory treatment predisposes stands to invasion by exotic species (floral and faunal)
- Herbicide treatments for eradication of invasive plant species

6. *Natural disturbance-based silviculture:*

- Prescriptions that emulate natural disturbance processes and pathways
- Factoring range of natural variation into site-level prescriptions

A research agenda for silviculture in ecological reserves

In part, the research agenda for reserve management is based on information needs *inferred* from several of the invited speakers. None of the invited speakers actually stated needs specific to reserve management. However, many

informational needs, particularly for matrix management, are applicable to reserves. In contrast to the invited speakers, the summit participants were quite vocal about information needs relative to reserve management. Two somewhat related themes emerged. There is a strong regional interest in determining *if natural disturbance is sufficient to sustain reserves in a desired condition*. Stated another way, there is concern that no action is insufficient for sustaining reserve ecosystems. Related to this is an interest in *emulating natural disturbance with silviculture* in reserves. These themes surfaced at least eight times during breakout discussions. The second theme, which surfaced at least five times during breakout discussions, was the need to understand *systems for developing old-growth forest and perpetuating it over time on the landscape*.

Additional information needs for ecological reserves include:

1. *Regeneration:*

- Approaches to minimize regeneration failures due to deer browsing and improving regeneration in winter deeryards
- Improved approaches for regeneration of “difficult species,” like paper birch, white cedar, eastern hemlock

2. *Invasive species:*

- Herbicide treatments for eradication of invasive plant species
- Understanding of how overstory condition and treatment predisposes stands to invasion by exotics/invasive species (floral and faunal)

3. *Conifer research needs:*

- Methods for successful white pine restoration
- Management systems for red pine/white pine or white pine/hemlock that incorporate multi-cohort structure and reintroduction of fire

4. *Management Systems:*

- Approaches specific to the NIPL for improving ecological condition, wildlife habitat, and regeneration

- Silviculture prescriptions that emulate natural disturbance processes

Landscape integration of stand-scale silviculture

Several of the stated information needs, while related to silviculture, are better articulated as needs related to landscape-scale integration of stand-scale management. Most of the “user group” presenters articulated such a need, and it was clearly and repeatedly expressed by summit participants and the invited panel. One dominant theme emerged related to landscape integration: *how and where to allocate stand-level management for production systems and ecological reserves within the landscape matrix*. Related to this is the need to shift the perspective of individual landowners toward a landscape focus.

Additional information needs for landscape integration include:

- Understanding of the potential of carbon sequestration in forested landscapes
- Ecological implications, at multiple scales, of plantation management systems
- Management approaches for landscapes of mixed ownership
- Understanding of landscape context/cumulative impacts of stand management
- Sustainability of multiple objectives (biodiversity, timber production, aesthetics) at multiple scales
- Methods to compare aesthetics with timber production, i.e., tradeoffs or multiple responses

General themes

Two additional themes surfaced repeatedly during small group and panel discussions; they are general themes and not clearly specific to nodes of the management spectrum (fig. 1). The themes include 1) an interest in *silviculture research cooperatives* as a method for increasing communication between researchers and managers; and 2)

maintaining and invigorating experimental and demonstration forests. Poor information and technology transfer is seen as a great hindrance to practicing new and better silviculture. Cooperatives are seen as an effective way of improving this communication. Experimental and demonstration forests are seen as places to support the testing of new ideas, but also to aid in information transfer. Summit participants viewed the Federal Government as the obvious regional entity that is best suited to maintain experimental forests and associated research over the long term.

Literature Cited

Seymour, R.S.; Hunter, M.L., Jr. 1999. *Principles of ecological forestry*. In: Hunter, M.L., Jr., ed. *Managing biodiversity in forest ecosystems*. Cambridge, UK: Cambridge University Press: 22-61.