Ecosystem Management
Tenures
Institutional Arrangements to Promote Stewardship and Sustainability

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Take-home messages

1. In the face of 6.5 billion humans, and with the prospect of another 3-4 billion within the life of a northern temperate timber crop, we must manage forests as integrated functional systems (ecosystems), rather than the separate management of their individual component values.
Pogo: “I have met the enemy. He is us”

Population doubled: 3 billion more people

Population: 6.6 billion in 2007

Population peak: 9 – 10 billion in 2070-2100

3 - 4 billion more people

Source: U.S. Census Bureau, International Data Base 5-10-00.
Consequences of single-objective management – SW China
2. One of the several key pre-requisites for EM on public land is ecosystem management tenures — and this requires tenure reform.

3. Successful EM tenures require a new generation of multi-value, ecosystem-level decision-support systems.
Outline

• Definitions, responsibilities, historical perspective
• Ecosystem management – key components and pre-requisites
• EM in BC – currently a mirage; impediments
• Stand-level concepts for EM
• Decision-support tools for EM
Forestry: what is it?

The art (skill), practice, science and business of managing forest stands and landscapes to sustain an ecologically possible and socially desirable balance of values over appropriate spatial and time scales.

Forestry is – or should be - managing forest ecosystems to provide desired values by sustaining the necessary ecological processes and components – ecosystem management.
Forestry is about people - values, needs, desires - and sustaining the ecosystems on which these are dependent.
The Two Responsibilities of Forestry

1. To change the way in which a forest is managed as the desired balance of values and environmental services changes.

2. To reject current practices and resist proposed new practices that are inconsistent with the ecology and sociology of the desired values and services over ecologically appropriate temporal and spatial scales.

It is unlikely that these responsibilities can be met without tenure reform.
“Quo Vadis?” in Forestry

Local people with experience-based wisdom → Sustainable Exploitation — Passive Management — Active Management → Replaced by Non-sustainable exploitation → Resource depletion

Leads to

Non-locals without local knowledge → Administrative forestry → Variable results; often single value

Evolves into

Pressure from ecologically inappropriate belief systems and incomplete knowledge about nature → Ecologically-based forestry (EBM), initially timber biased → Sustained timber production +++?

Application of social and biophysical sciences that respect the ecology and sociology of desired values

Integrated management of stands and landscapes for multiple values.

FOREST ECOSYSTEM MANAGEMENT
Ecosystem management: What is it?

- Multiple values sustained in a shifting landscape mosaic of changing stand conditions
Key components of Ecosystem Management

- Manage multiple values for economic return
- Focus on ecosystem structures, processes, change
- Management units - watersheds and “ecological landscapes”
- Long term tenures to manage multiple values
- AAC based on ecosystem management models
- Management matched to ecosystem type
- Accept disturbance and change as part of sustainability
- Zonation to reduce resource use conflicts.
- Manage both landscape and stand-level.
Landscape-level concepts of sustainability

About 100,000 ha

- WATER
- NON-FORESTED
- 0-40 YEARS
- 41-100 YEARS
- 101-140 YEARS
- 141+ YEARS

Actual landscape pattern from natural disturbance

FOREST EDGE = 969 km
CORE AREA = 17,750 ha
LARGEST PATCH = 19%
The infamous Bowron River clearcut – 66,000 ha – beetle kill salvage
Landscape pattern that would result from the old BC Forest Practices Code
Natural fire disturbance pattern: SE B.C.

“Small is beautiful” harvesting; same area
Many factors must be in place before we can achieve EM

- Long-term objectives for all values: tradeoffs
- Appropriate tenure systems
- Public trust
- Adequate inventory of diversity and resource values
- All values managed under a single plan
- Economic and social sustainability
- Management of all marketable values for economic reward
- Establishment of markets for non-timber forest values
- Use of multi-value, multi-scale, ecosystem-level planning and decision support tools
- Communication with and involvement of all interested stakeholders
So, Is Ecosystem Management in BC a “Miracle” or a Mirage?

Remember, EM is the balancing act of sustaining multiple values in forest ecosystems.

Under current tenures and other constraints – EM is still only an attractive mirage!
Impediments to Ecosystem Management

- Constraints imposed by anachronistic tenure systems
- Lack of trust of forest companies and of government forestry departments by the public
- Failure to develop a single integrated ecosystem management plan for a defined forest area
- Lack of markets and marketing infrastructure for non-timber forest values – tragedy of the commons
- Lack of adequate inventories of all the values that are to be managed
- Lack of experience and understanding of management of non-timber ecosystem values
- Failure to use dynamic, process-based, multi-value, ecosystem-level planning tools at appropriate scales
An EM tenure must satisfy all these requirements to be a “miracle”, not a mirage.
Important Stand-level Concepts for Ecosystem Management

1. Ecological theater
2. Succession vs stand dynamics
3. Ecological rotations
Stand-level concepts of sustainability

Biodiversity

Temporal diversity

“Ecological” diversity

Climate, geology, topography, soil.
Physical disturbances - fire, wind, erosion, flood.

The Concept of “Ecological Theatre”
Succession vs Stand Dynamics

Seral “old-growth” vs successional “old growth”

Regeneration of same species = Stand dynamics
Regeneration (invasion) of different species = Succession
EM must manage succession not just stand dynamics
How to Evaluate Stand-level Sustainability: The Concept of Ecological Rotation

- Short ecological rotation
- Intermediate ecological rotation
- Long ecological rotation

Disturbance

Ecosystem Condition

Time
Bear den in old redcedar tree

Vancouver Island
Balancing Disturbance severity/frequency with Rates of Ecosystem Recovery

1. Rotation too short

![Graph showing ecosystem condition over time with harvest points and sustainability status.]

- **Sustainable**
- **Non-sustainable**
Balancing Disturbance severity/frequency with Rates of Ecosystem Recovery

2. Recovery too slow

Diagram showing the relationship between ecosystem condition, harvest, time, and sustainability.
Balancing Disturbance severity/frequency with Rates of Ecosystem Recovery

3. Degree of disturbance too great

Diagram showing the relationship between ecosystem condition, time, and harvest, highlighting sustainable and non-sustainable conditions.
Decision-support tools required by Ecosystem Management

• Ecosystem-level models, not population or community models
Levels of biological organization

- Ecosystem
- Community
- Population

Levels of biological integration

- Prediction
- Prediction
- Prediction

The need for the ecosystem level: PREDICTION
Decision-support tools required by Ecosystem Management

- Ecosystem-level models, not population or community models
- Multi-value models, not single value models
- Hybrid experience-process simulation, not historical models
- Multi-scale models
- Models of appropriate complexity, not simple models
- Models linked to advanced visualization, not models with conventional analytical output
POSSIBLE FOREST FUTURES: watershed landscape management model

LLEMS: local landscape/complex cutblock simulator

LLEMS Visualization software – stand and landscape

Stand visualization

FORCEE: Individual tree, complex stand model

FORECAST
Non-spatial ecosystem management stand model
DECISION SUPPORT SYSTEM: Modelling Framework

**Forest-level Model (ATLAS)**
- Polygon-Based

**Stand-level Model (FORECAST)**
- Merchantable Volume
- Ecosystem C Storage
- Snags (>25cm dbh)
- Early Seral Shrub Cover (%)

**Projection**

**Interpretation**

**Habitat Model (SimFor)**
- Raster-Based

**Visualization Software**
CALP FORESTER visualization output using a mouse to select cutblock boundary for dispersed retention
CALP FORESTER visualization output showing 20% dispersed retention
Defining grouped retention with a mouse
A closer view of the LLEMS landscape visualization
Conclusion

• Sooner or later we will have to apply EM. Why not sooner than later?

• Tenure reform and ecosystem-level decision support systems are amongst the key needs before we can achieve this

Sorry, but EBM is not EM. Shall we continue the mirage, or strive for the “miracle”? 