

Biodiversity, Beauty and the Beast

- *Are beautiful landscapes always sustainable?*
- *Are sustainable landscape always beautiful?*
- *Is biodiversity linked to beauty?*

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Human impacts on forests call for a change in our relationship to them

China



Brazil



The need for a land ethic

- “A thing is right when it tends to preserve the *integrity*, *stability*, and *beauty* of the biotic community. It is wrong when it tends otherwise”

but

- “The evolution of a land ethic is an intellectual as well as emotional process. Conservation is paved with good intentions which prove to be futile, or even dangerous, because they are devoid of critical understanding either of the land, or of economic land-use”

Aldo Leopold, *The Land Ethic*

Outline

- The issue of aesthetic judgment
- Sustainability in the face of change
- The complexity of the biodiversity issue:
the concept of “ecological theatre”

Definition of Forestry

- *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*

The balance of desired values will vary from place to place and over time



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 from that forest 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.

How do we judge good forestry???

- Is “ugly” non-sustainable? Is beautiful sustainable?
- Is today’s condition permanent and a good indicator of the future?
- Is forestry that pleases our eyes and hearts today always the best for future generations?

Responses to visual information: our eyes and our heart



Which images evoke the strongest emotional response?

Both
unsustainable

Sustainable



Timber MAI -1 to 3



Two unmanaged
conditions of the same
stand type

Timber MAI 20 to 23



Does disturbance damage
ecosystem productivity?



Preference?



Outline

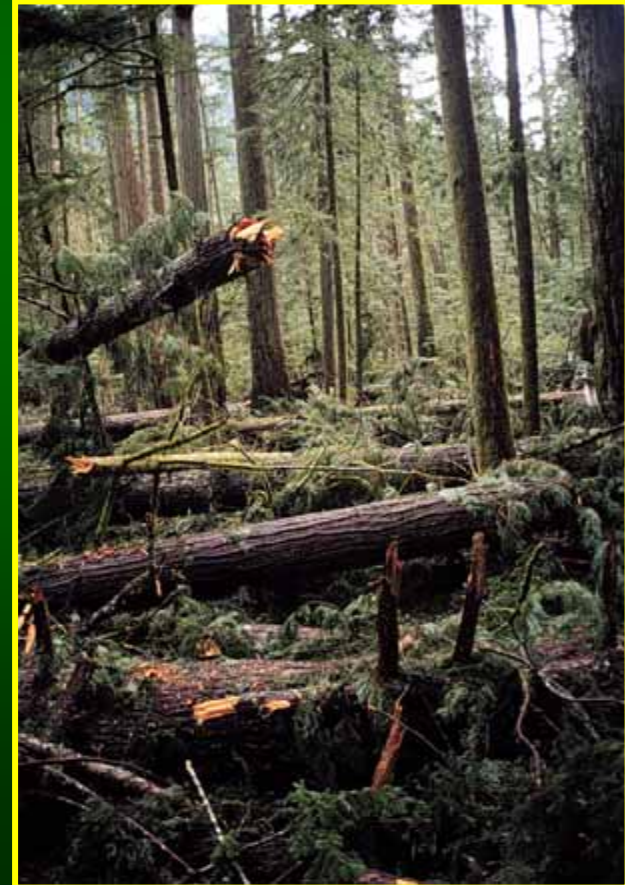
- The issue of aesthetic judgment
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Many if not most forest ecosystems are driven by and depend on disturbance

Landslide



Wind



Fire

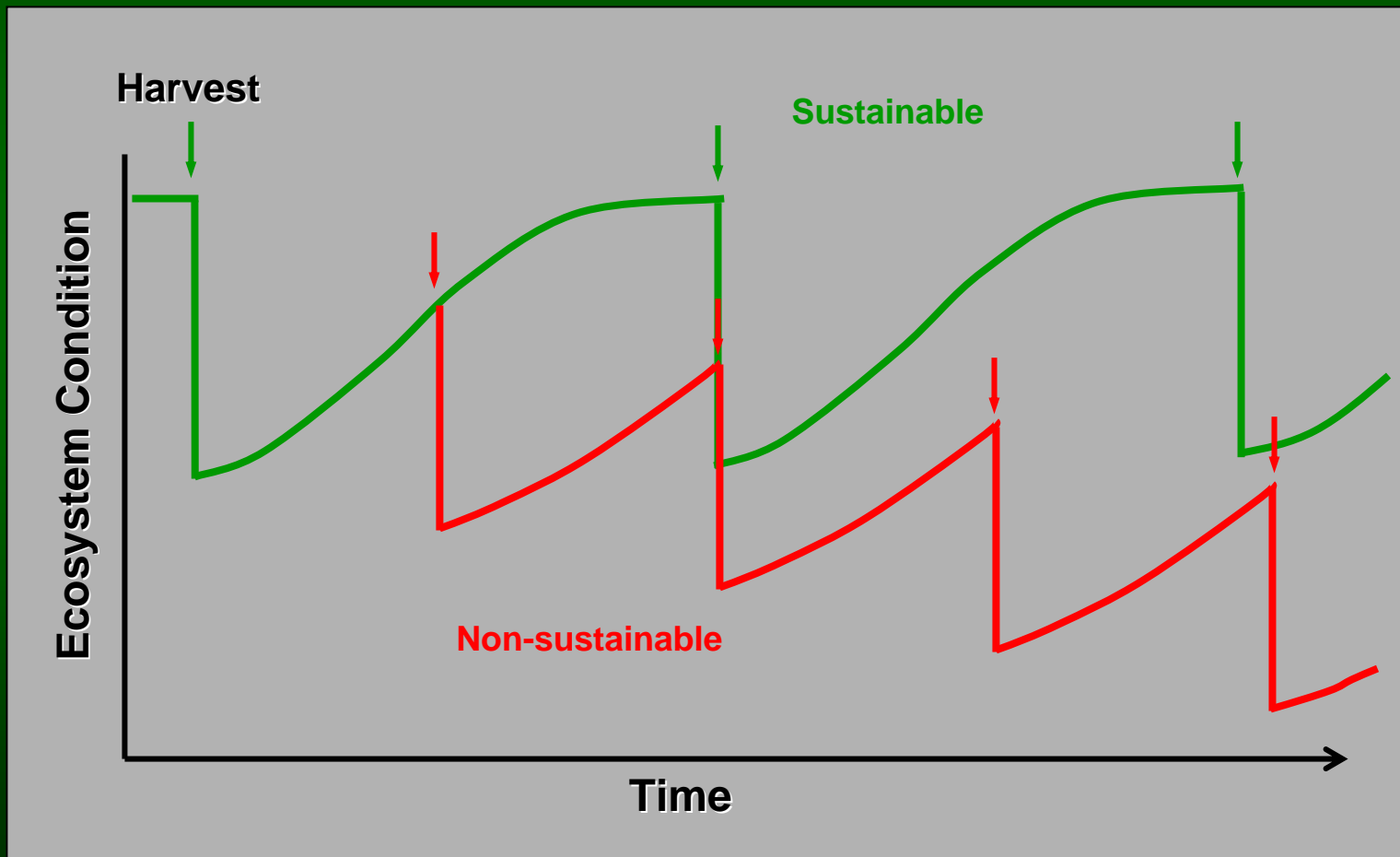
Insects

Six million+ ha Mountain Pine Beetle outbreak in BC

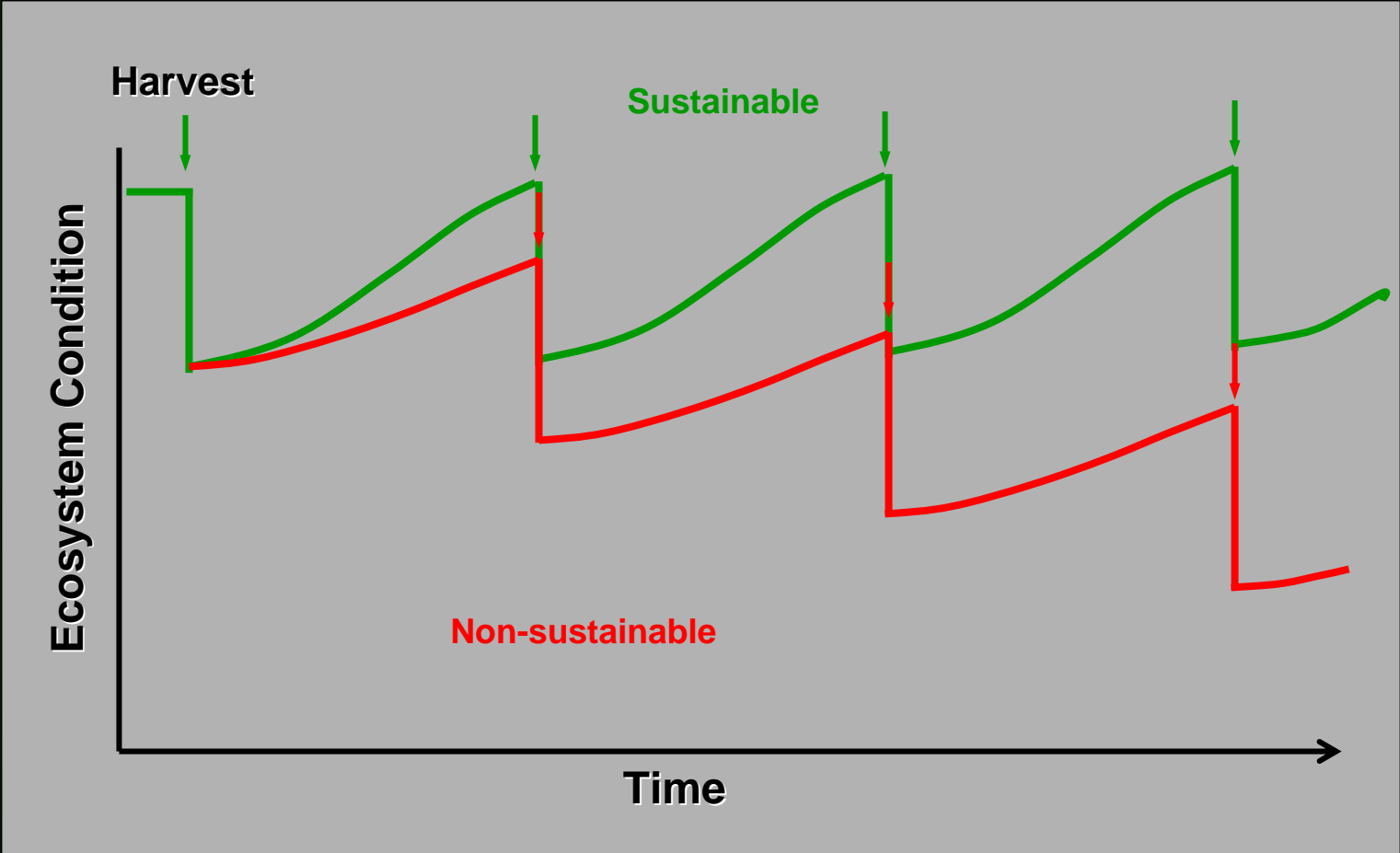


Stand level sustainability as non-declining patterns of change

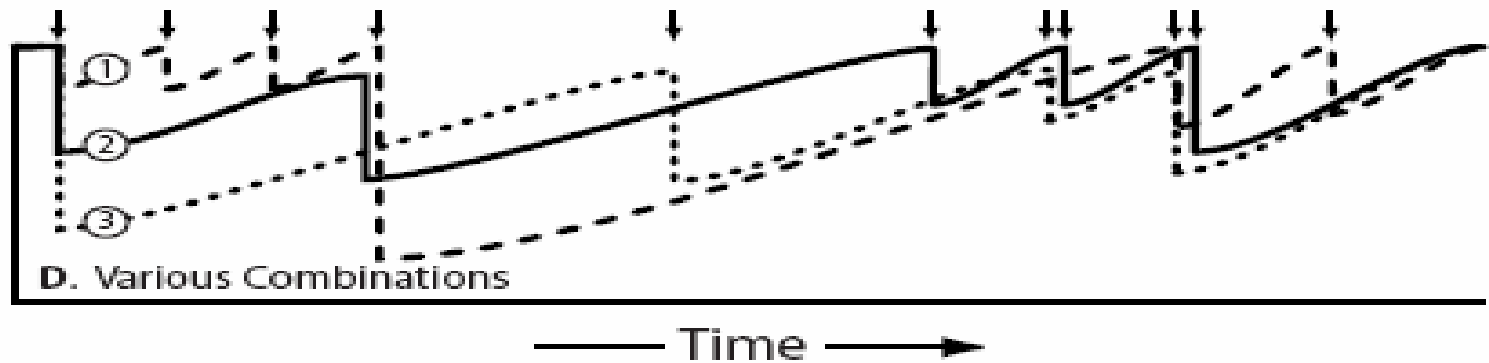
1. Rotation too short



2. Ecosystem recovery too slow



Inappropriate to repeatedly apply the same disturbance



Use varying combinations of severity and frequency

C

learcutting and Other Silvicultural Systems

A continuum of ecological disturbance

Single tree selection



Group selection



Patch cutting



Shelterwood



Seed tree method



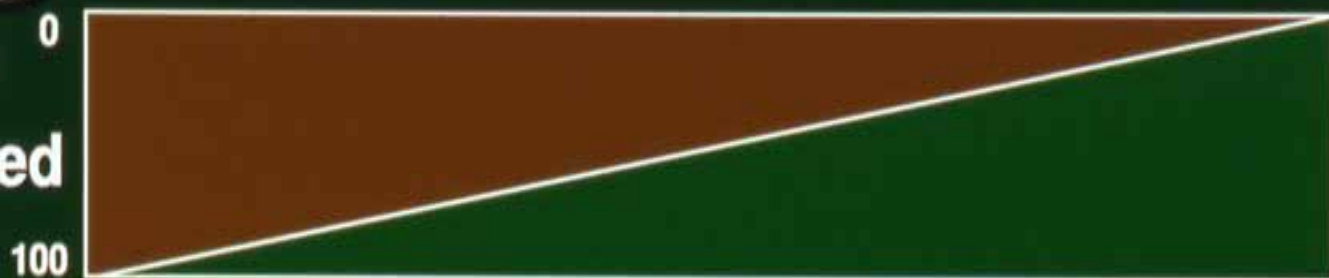
Clearcutting



S

ilviculture. A Continuum of Disturbance

% trees
harvested



% trees
retained

Clearcutting

Shelterwood

Patch Cut

Selection

Reservation

Landslide

Wildfire

Insects, Wind

Diseases

Outline

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Biodiversity

Nature's insurance policy
A Valuable legacy for humans

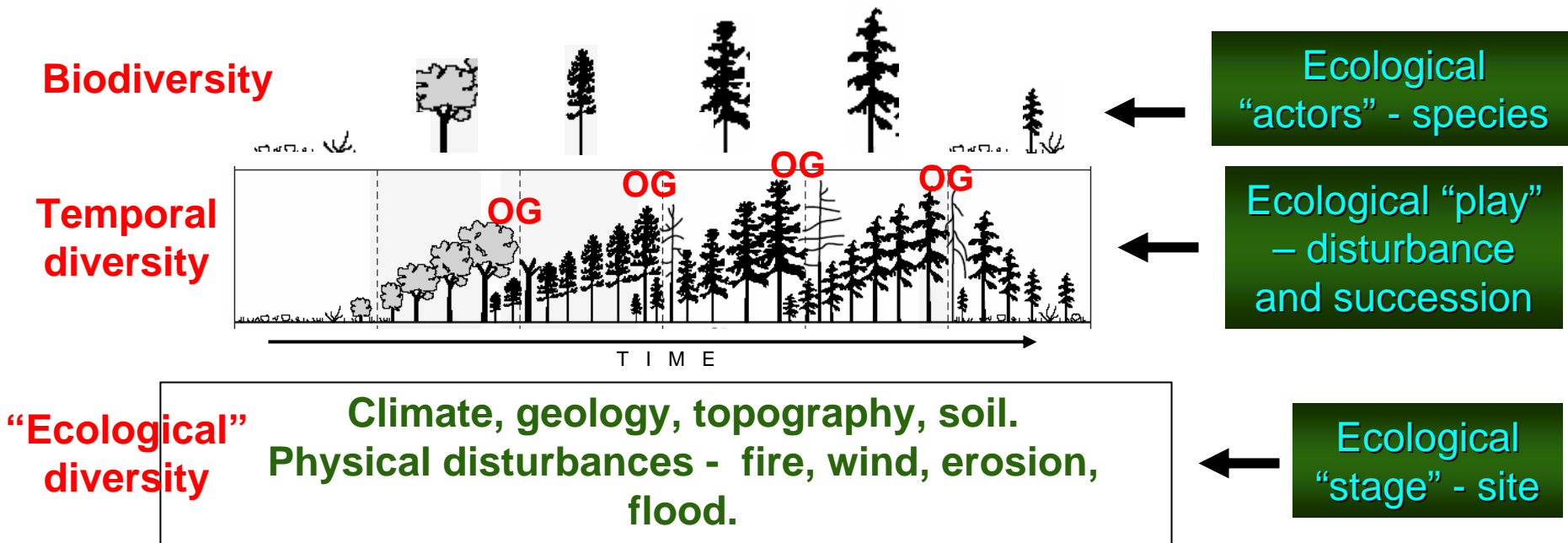
- **Multiple measures – there is no single “biodiversity”**
- **Multiple spatial scales: local, local landscape, and regional landscape**
- **Temporal diversity – everything changes**

The multiple measures of biodiversity

		Temporal Diversity 								
<u>Measure</u>	<u>Spatial scale -</u>	<u>Time 1</u>			<u>Time 2</u>			<u>Time 3</u>		
		α	β	γ	α	β	γ	α	β	γ
Genetic		*	*	*	*	*	*	*	*	*
Taxonomic		*	*	*	*	*	*	*	*	*
	Species									
	Genera									
	Families									
Species		*	*	*	*	*	*	*	*	*
	Richness									
	Evenness									
Structural		*	*	*	*	*	*	*	*	*
	Canopy layers									
	Snags									
	Dead wood									
	Life forms									
Functional		*	*	*	*	*	*	*	*	*
	Ecophysiology									
	Nutrition									
	Water									
	Light, etc									



The Concept of “Ecological Theatre”



The ecological play is driven by disturbance

B

eauty and the “Beast” in Forestry

- Are beautiful landscapes always sustainable?
- Are sustainable landscapes always beautiful?”
- Are “small” and “gentle” always ecologically appropriate?



Ugly



Beautiful



Continuous forest cover system



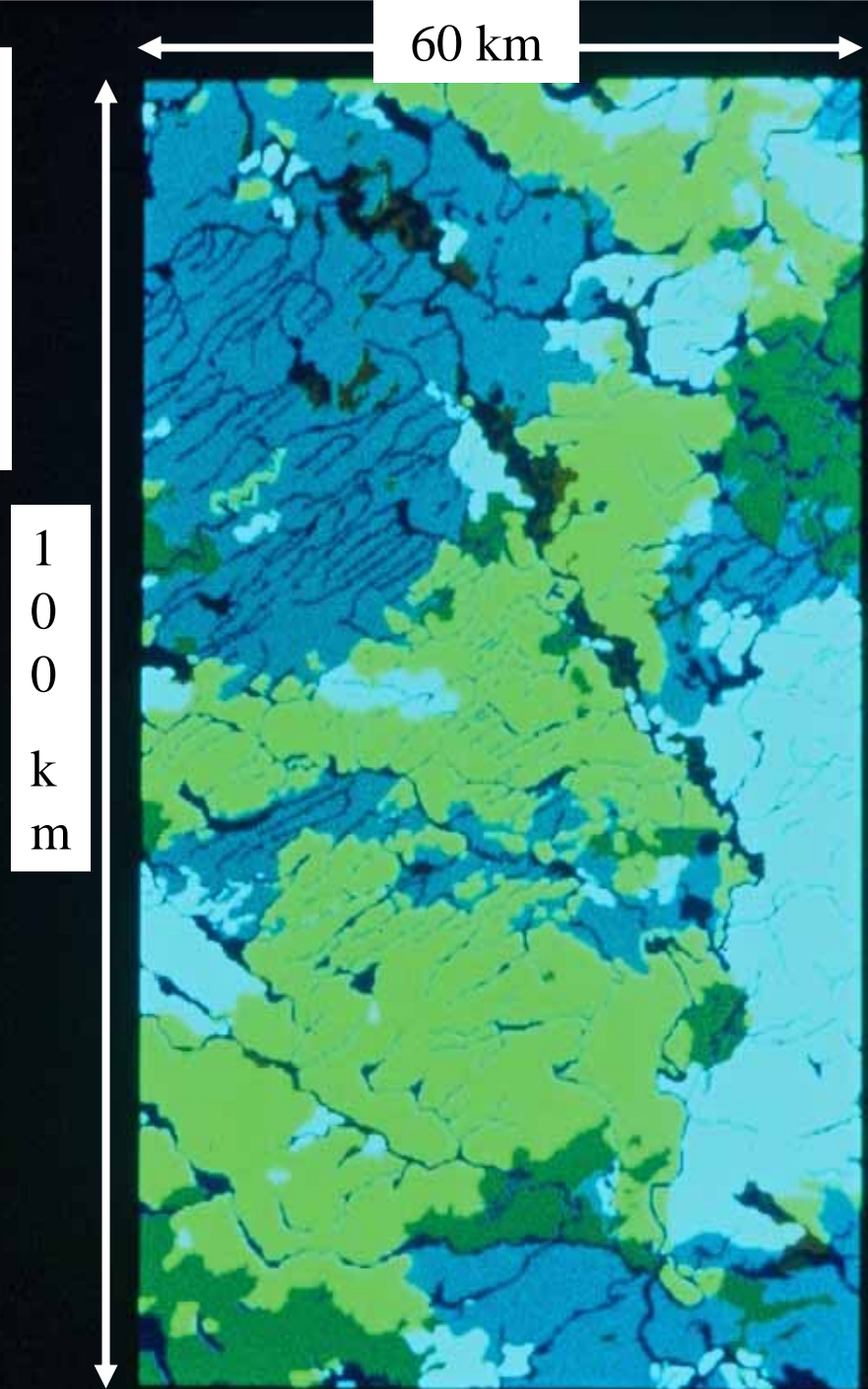
Drought-induced mortality



Natural landscape
forest age class pattern
in 1954 caused by
wildfire, central BC



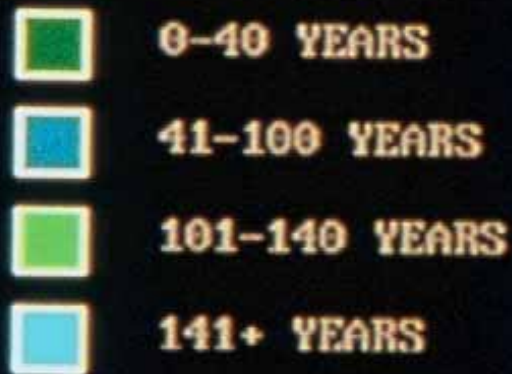
FOREST EDGE = 969 km
CORE AREA = 17,750 ha
LARGEST PATCH = 19%



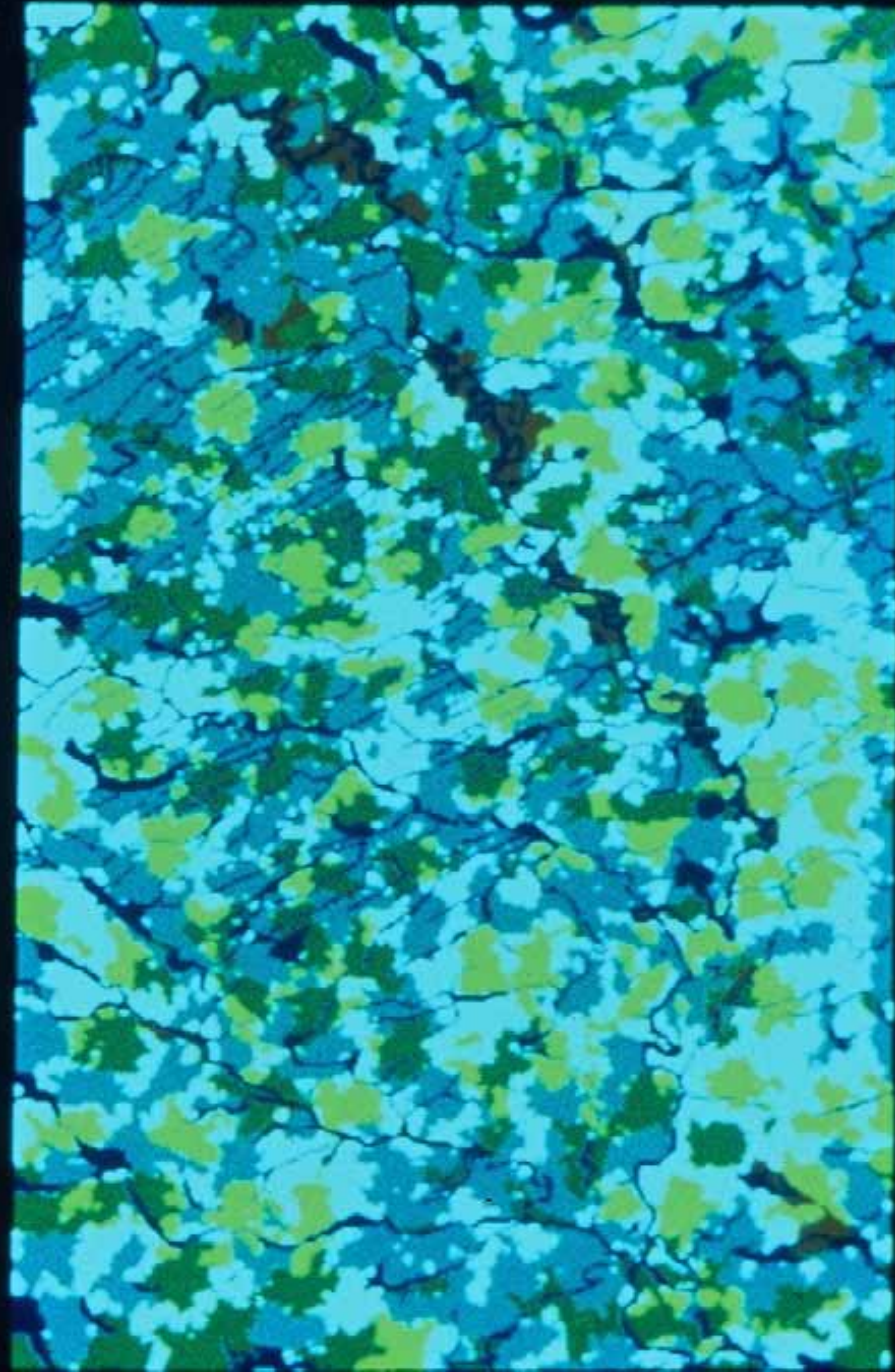


**62,000 ha salvage clearcut, central BC –
bark beetle mortality. Early 1970's**


Landscape age class pattern in the same area of central BC that would have resulted from anti-large clearcutting pressure from environmentalists



FOREST EDGE = 1,978 km
CORE AREA = 9,727 ha
LARGEST PATCH = 6%







Variable retention
system, BC. An
ecosystem-based
approach to harvesting
design

F^orest Ecology and Management in Two Words

It Depends!

What planning tools are needed?

- Ecosystem management simulation models
 - hybrid models that combine traditional experience-based tools and process simulation

Why Ecosystem Management Decision Support Systems?

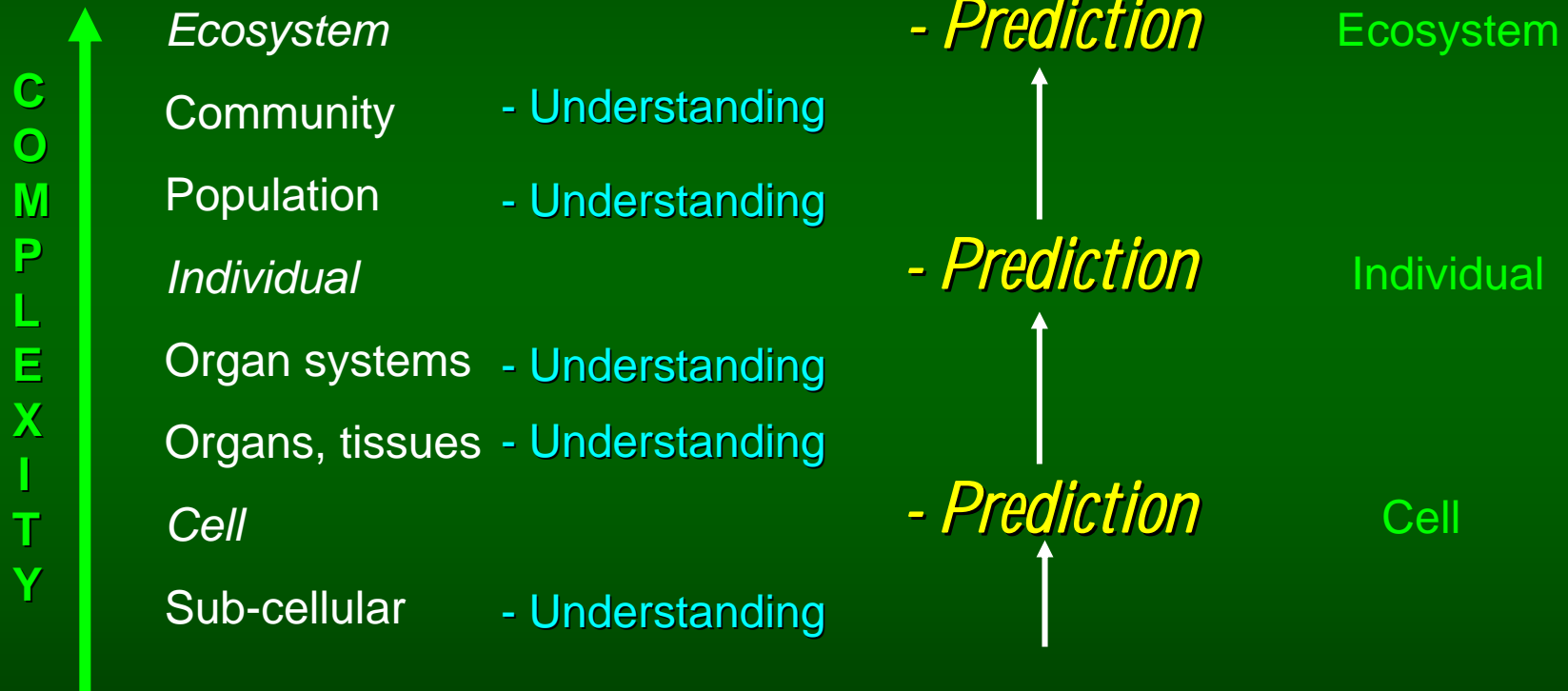
Management paradigms

- Zonation and adaptive management
- Emulation of natural disturbance and NRV - variable retention systems
- Concepts of “*ecological theater*” and “*ecological rotation*”
- Results-based forest regulation

All need
ecosystem
level
forecasting
tools

Levels of biological organization

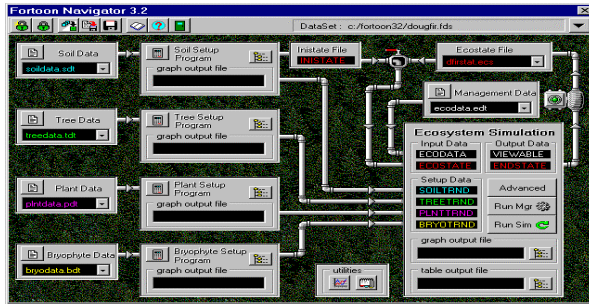
Levels of biological integration



Why Ecosystem management models: **PREDICTION**

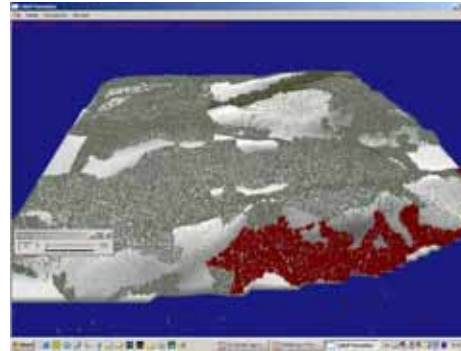
FORECAST

Non-spatial ecosystem management stand model

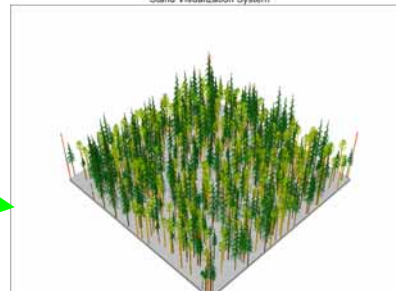


FORCEE:
Individual tree,
complex stand model

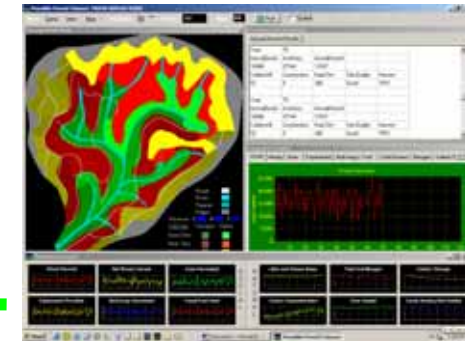
LLEMS Visualization
software – stand and
landscape



Stand
visualization



POSSIBLE FOREST
FUTURES:
watershed landscape
management model



LLEMS: local
landscape/complex
cutblock simulator

LLEMS
Local Landscape Ecosystem Management Simulator

* Is this a clearcut?
* What will the future forest species composition be?
* How will Douglas-fir compete with western hemlock?
* Will shade tolerant hardwoods be able to grow?

Legend: Trees (green), Ecotone (yellow), Open (white)

Large landscape model driven by stand-level ecosystem management model

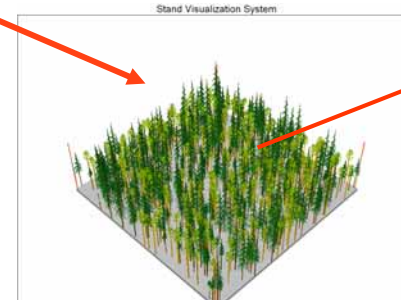
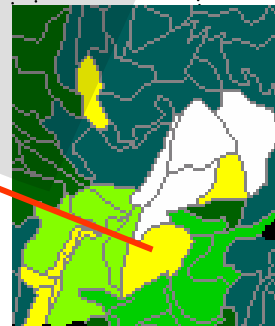
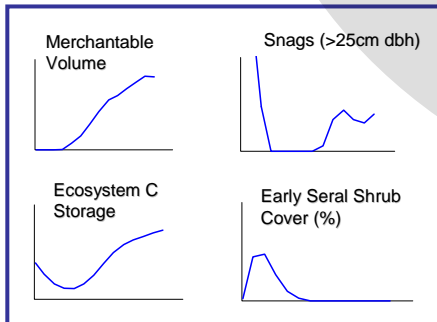
**Forest-level Timber Supply Model
(ATLAS)**

**Wildlife Habitat Supply Model
(SimFor)**

**Polygon-
Based**

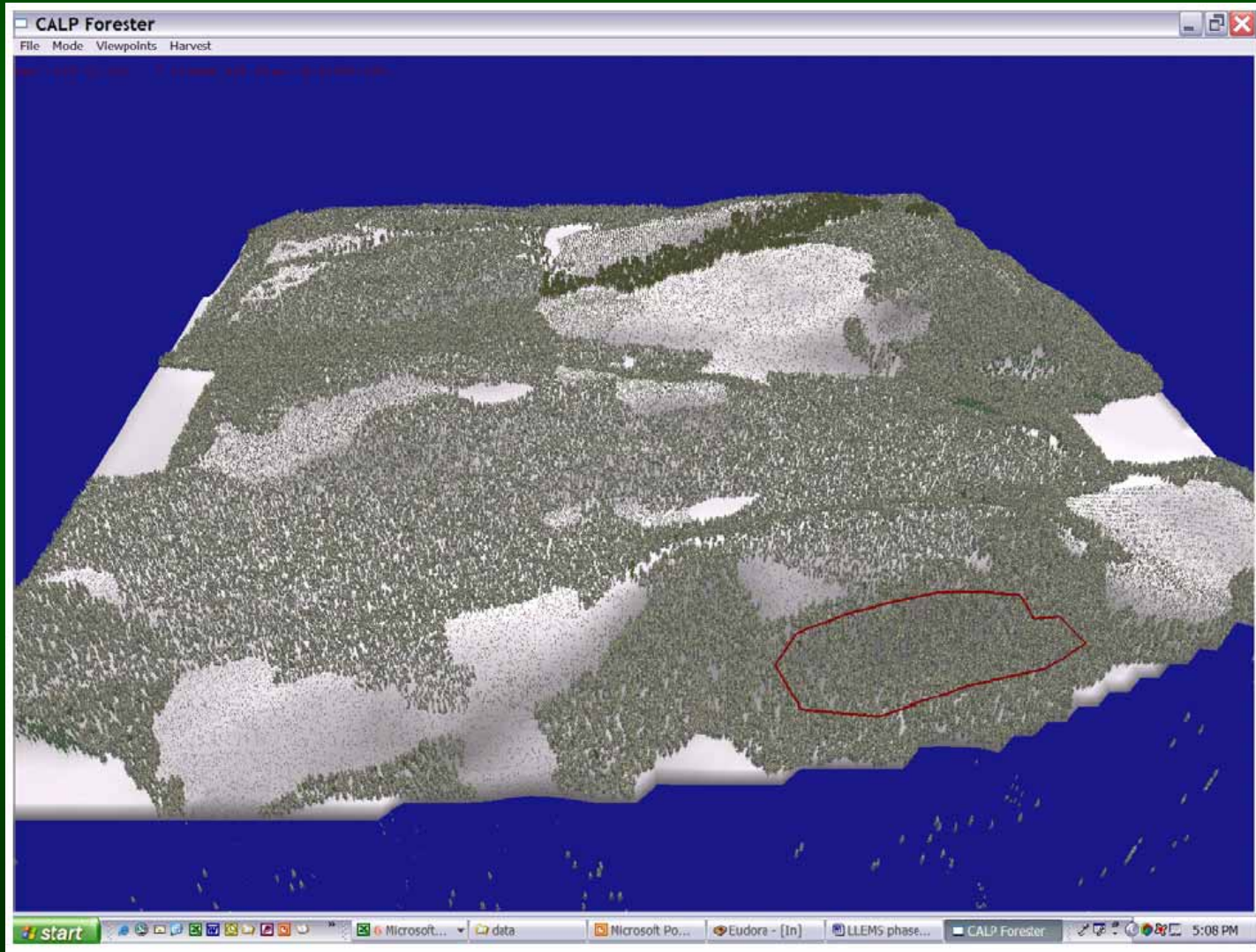
**Raster-
Based**

**Stand-level Model
(FORECAST)**

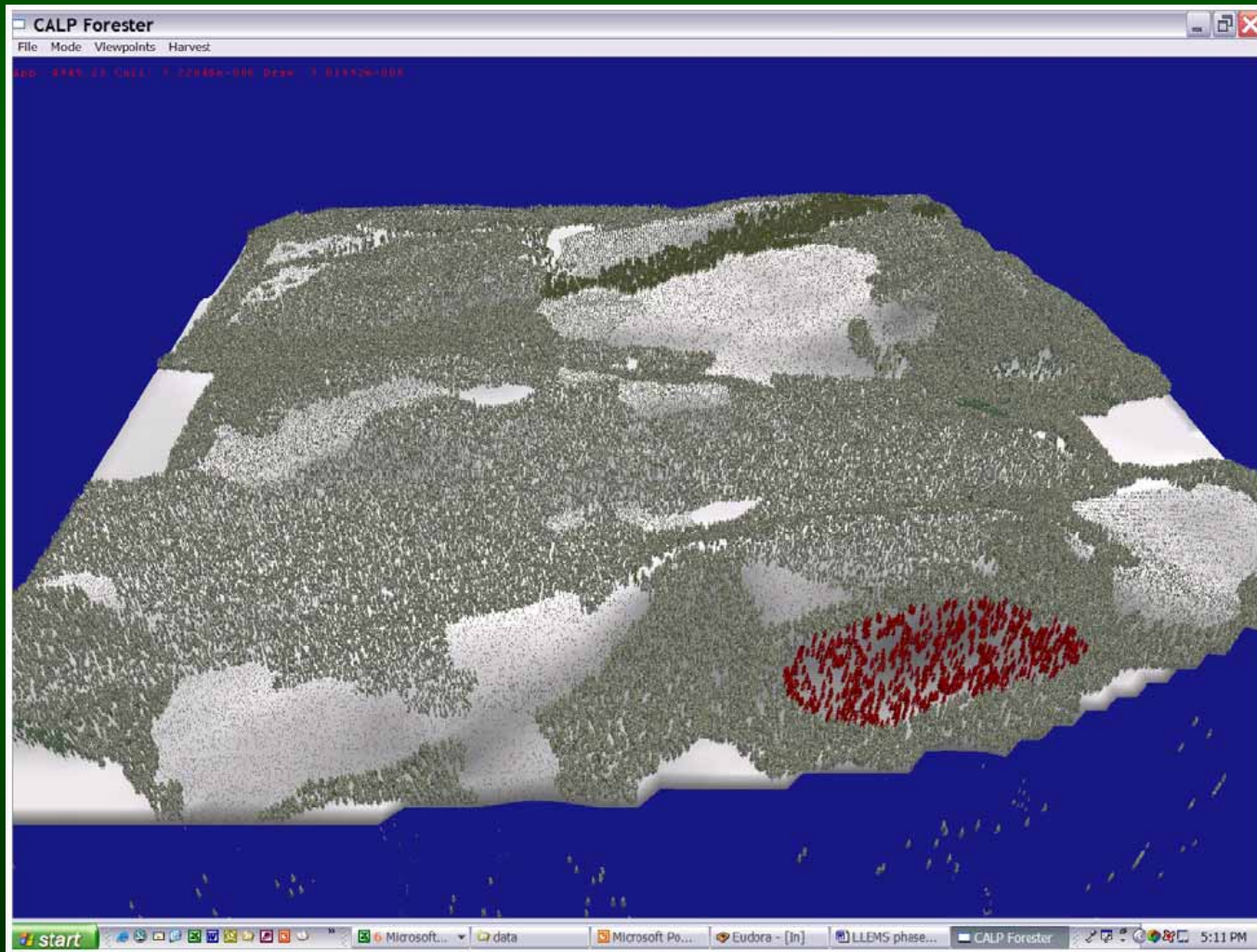


**Visualization
Software**

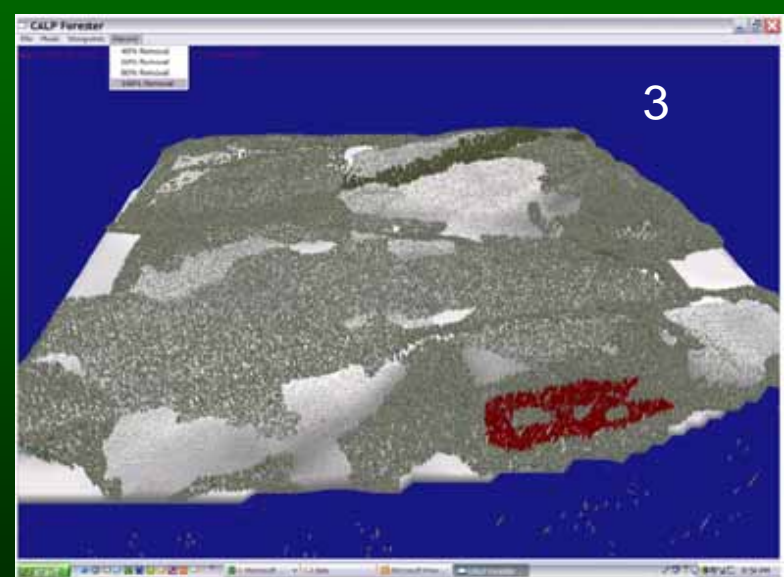
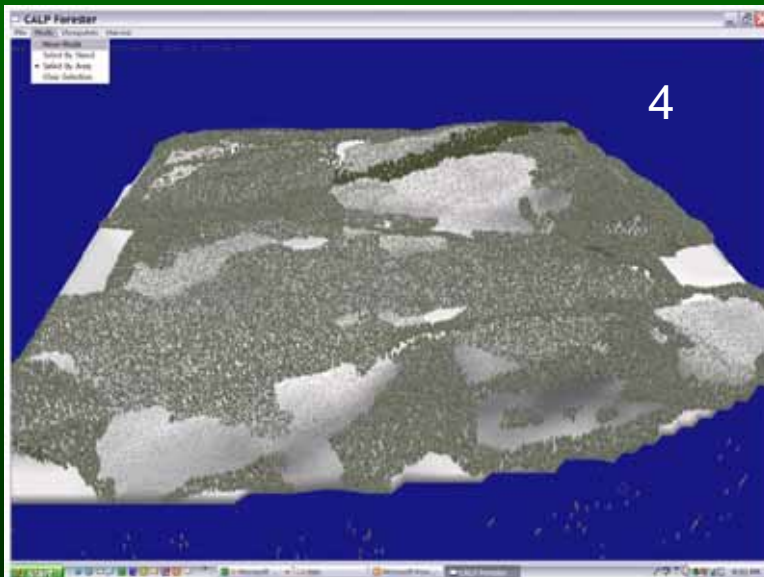
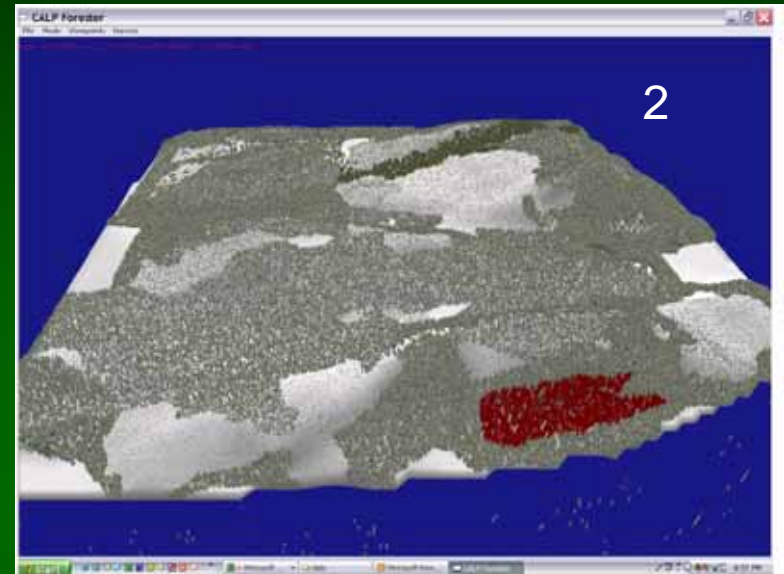
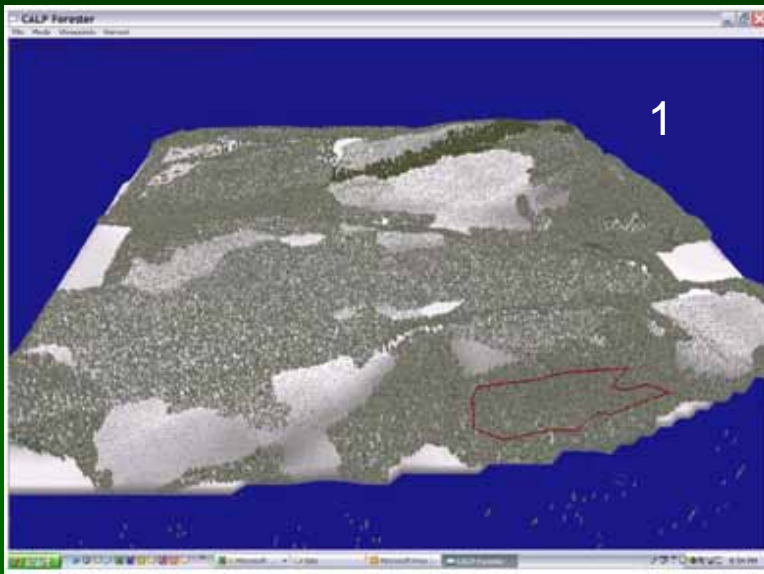
CALP FORESTER visualization output using a mouse to select cutblock boundary for dispersed retention



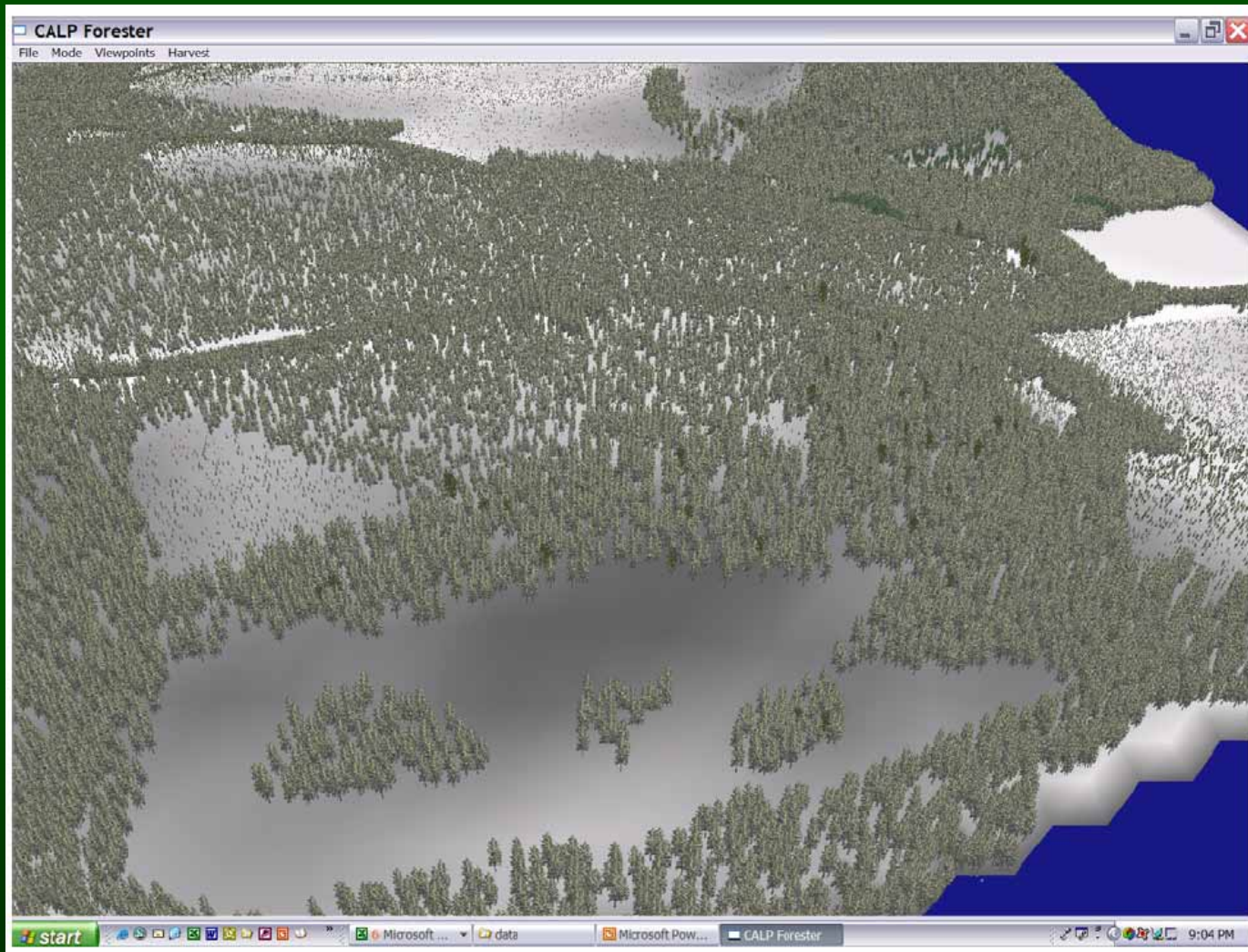
CALP FORESTER visualization output showing 20% dispersed retention



Defining grouped retention with a mouse



A closer view of the LLEMS landscape visualization



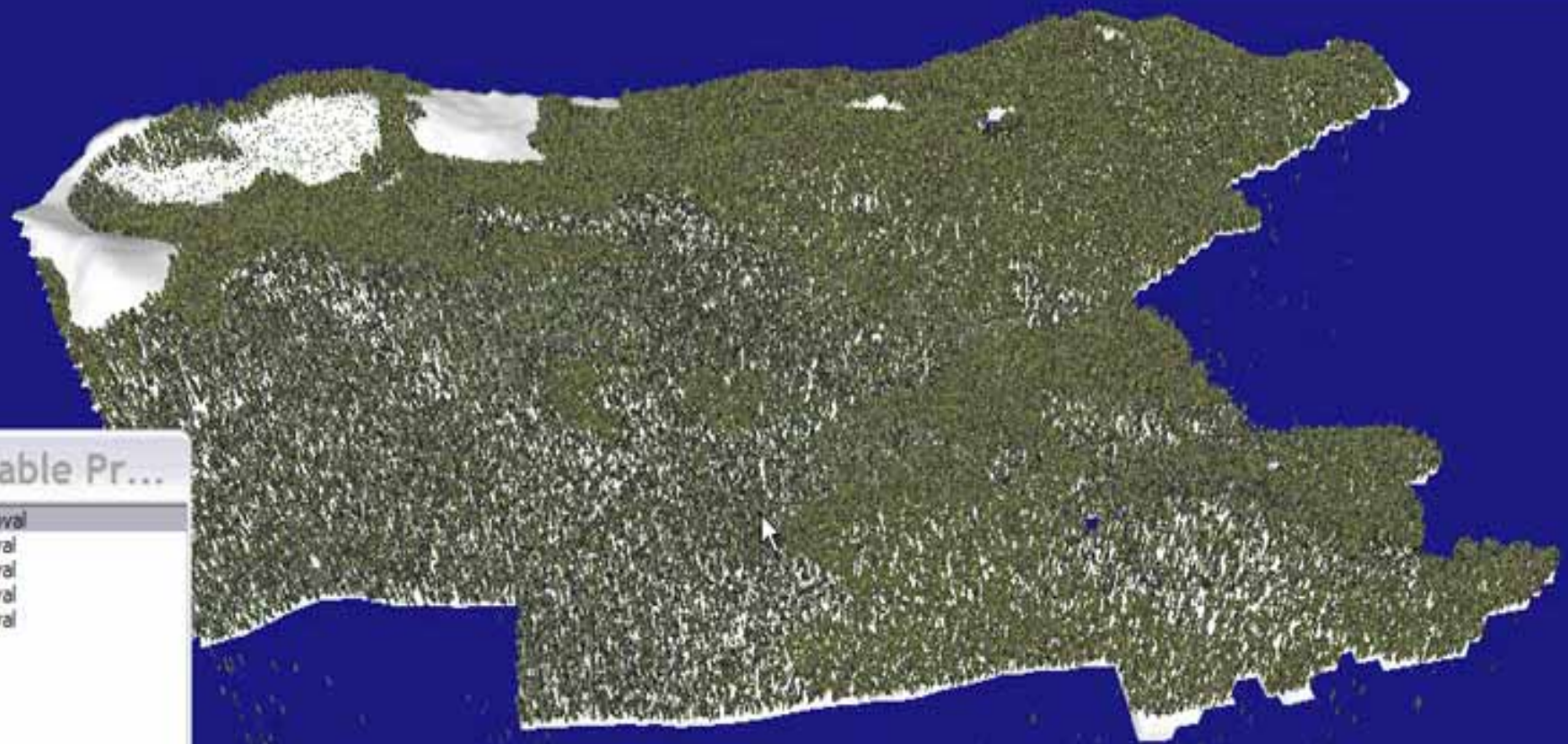
CALP Forester

File Edit Mode View

App: 172 Cull: 0 Draw: 0

Selected Stand

Species	%	Avg. Age	Merch. Vol



Available Pr...

- 100% Removal
- 80% Removal
- 60% Removal
- 40% Removal
- 25% Removal

Apply

Conclusions

- Sustainability is maintaining desired patterns of stand and landscape change through appropriate management of disturbance
- It will not be achieved unless complexity is addressed
- Incorporating complexity in management requires ecosystem management models
 - combined experience and ecosystem knowledge-based hybrid decision support tools