Ecological Theatre:
Dealing with Complexity in Forestry

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Outline

- Complexity in forestry

- The multiple values in forestry

- Respect for nature

- History of forestry and the concepts of "Ecological Theatre" and "Ecological Rotations"

- Conclusions

Complexity in Forestry

Simple message:

Most things are complex

We always seek simplicity, but great thinkers warns us that we must face the complexity of real systems

Theories, policies and actions should be :

"As simple as possible, but as complex as necessary"   William of Occam, 13th Century

"As simple as possible, but   not simpler"

Albert Einstein, 20th Century

A problem is an issue that does not get solved

An issue that gets solved quickly is not a problem

Problem issues often persist because they are complex, but only simple solutions are offered.

Why do we need to deal with complexity in forest management ?

Because we are managing forest ecosystems

Ecosystem attributes:

- Structure

- Function

- Interconnectedness

- *Complexity*

- Change over time – temporal complexity

What is the role of science in resolving issues in forestry?
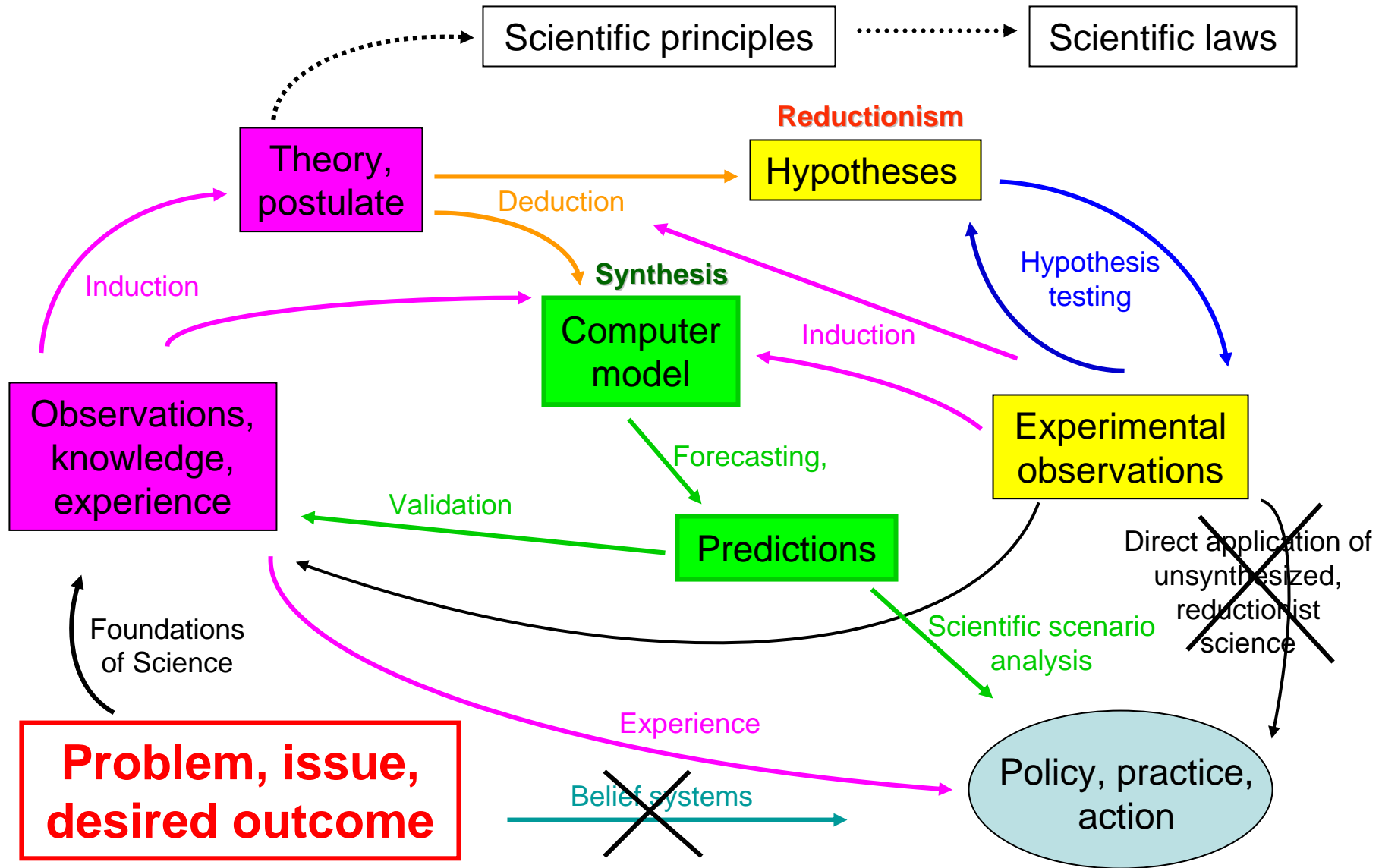
Science has three components:

Knowing, understanding, predicting

All three components are needed in forestry:

- Experience – "knowing"

- Understanding – disciplinary, reductionist research

- Predicting – synthesis to the appropriate level of complexity

Components of the Scientific Method
## *The need to balance description, analysis and synthesis*

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People – the ultimate problem, but also the ultimate solution

World Population: 1950-2050

As Pogo said:

WE HAVE MET THE ENEMY AND HE IS US.
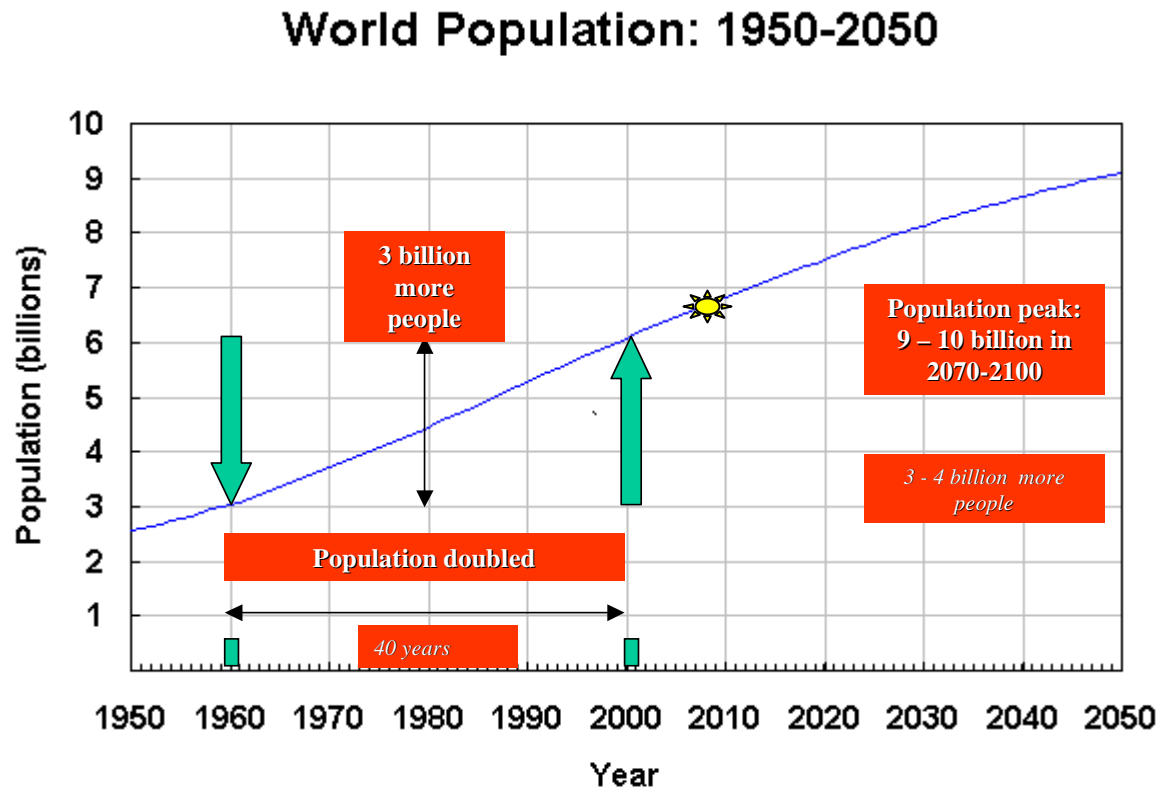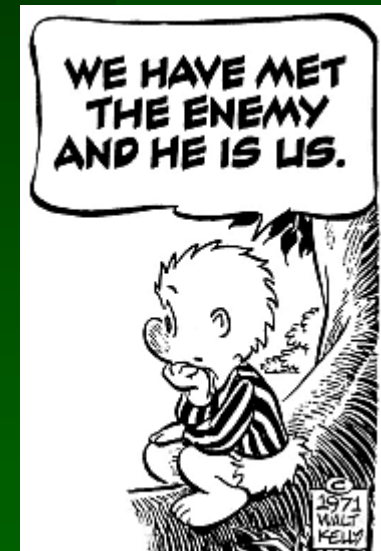
Forestry is about people - values, needs, desires

It is more complex than just the complexity of ecosystems

Wood

Recreation

Non-wood botanical products

Aesthetics

Water

Wildlife/fish

Biodiversity

Complex

Employment

Ecosystem processes

Economics - wealth creation

Spiritual values

Environmental protection

Bioenergy - fuel

Malaysia

NW Thailand

People's

Needs

Amazon

Malaysia

Java

Conflicting values

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 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.

- "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

How do we manage forests to sustain all the values we want?
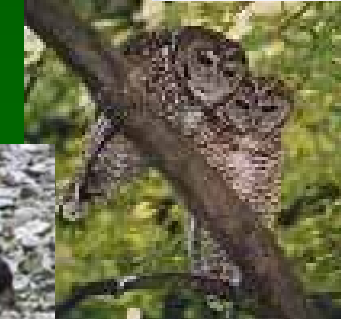
By balancing Nature's diversity – ecological and biological – and social values

This requires a respect for Nature as it is, and not as we might want it to be

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The public seems to think that only big, old trees – "Old Growth" – is the right condition for a forest

The response of most people to forests is visual and emotional

Which image evokes the strongest emotion?

However, most of Canada's forests are not made up of old large trees

The character of most of Canada's forest landscape is dependent on disturbance

The health of many of our forests depends on periodic disturbance

Most of our forest ecosystems are disturbance driven, and disturbance dependent
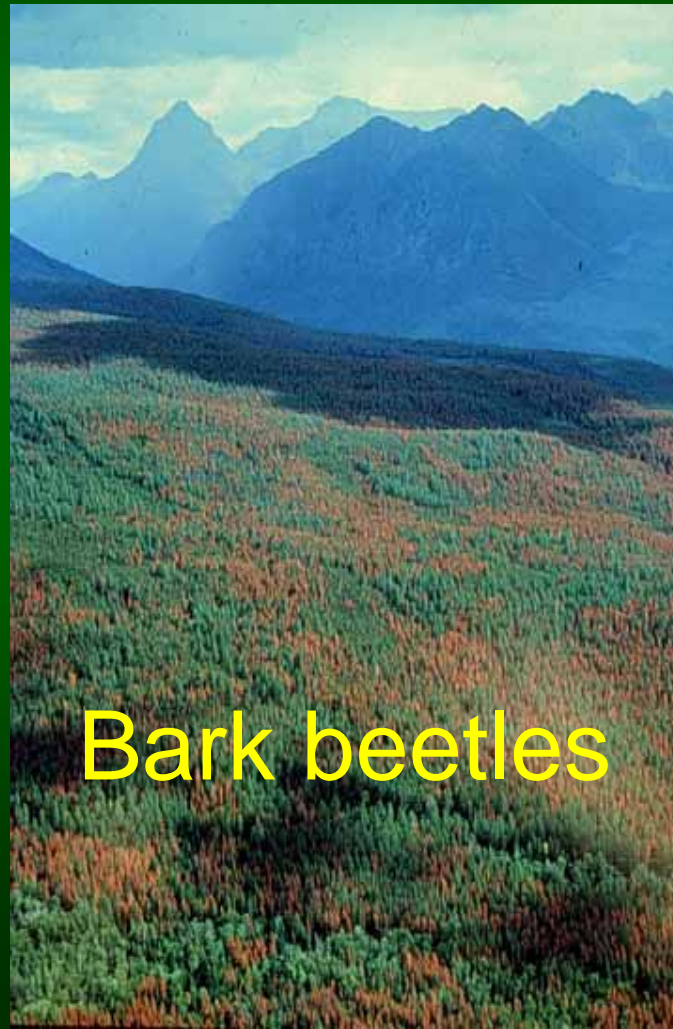
Landslide

Wind

Fire

Most of our forest ecosystems are disturbance driven, and disturbance dependent

Bark beetles

Silviculture. A Continuum of Disturbance

% trees harvested — 0 ... 100

% trees retained — 100 ... 0

Clearcutting   Shelterwood   Patch Cut   Selection   Reservation

← Landslide →

← Wildfire →

← Insects, Wind →

← Diseases →

Politically correct view of stand-level disturbance on B.C's Gulf Islands

Continuous forest cover system

Drought-induced mortality
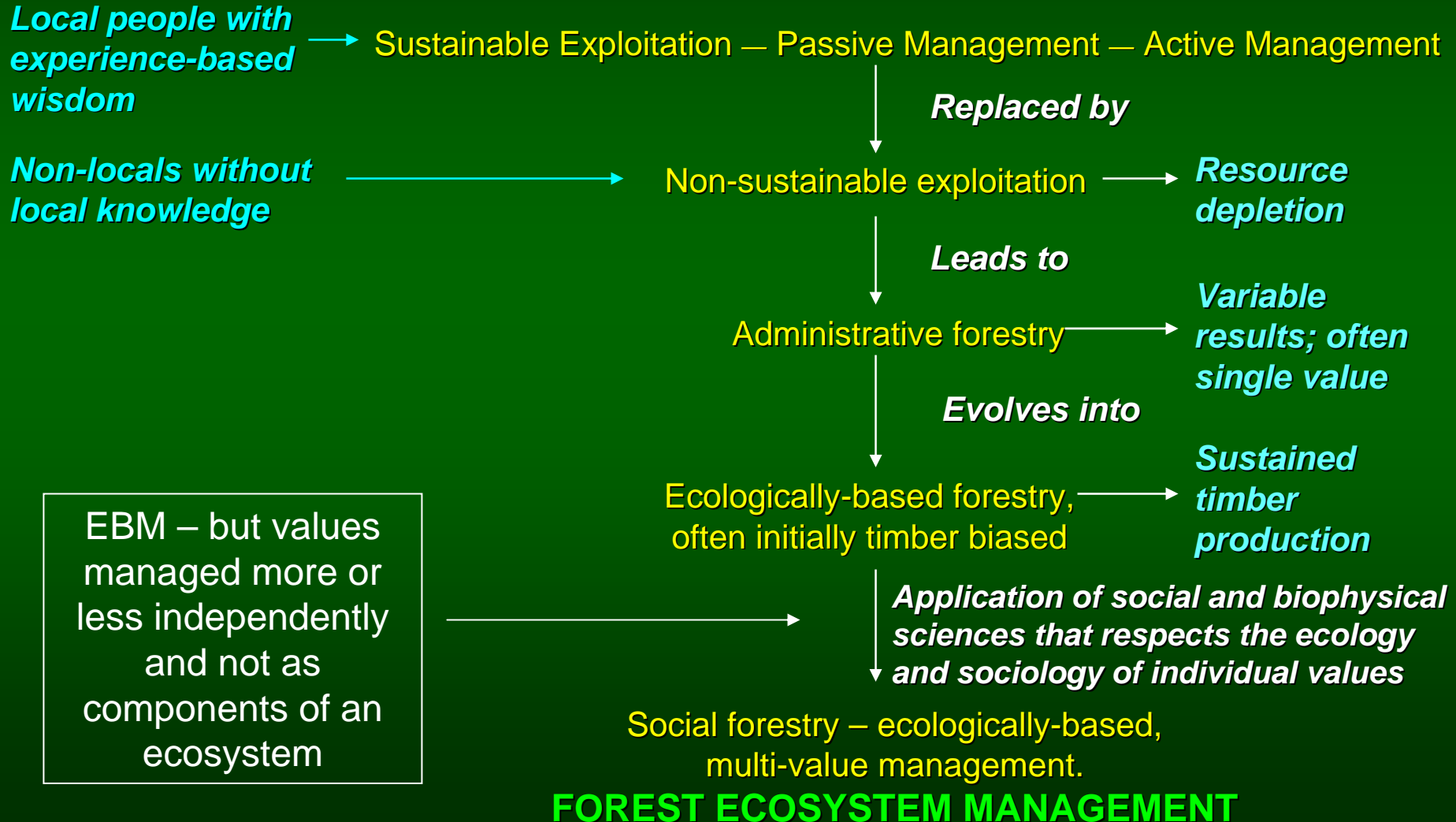
Variable retention harvesting, Vancouver Island, BC
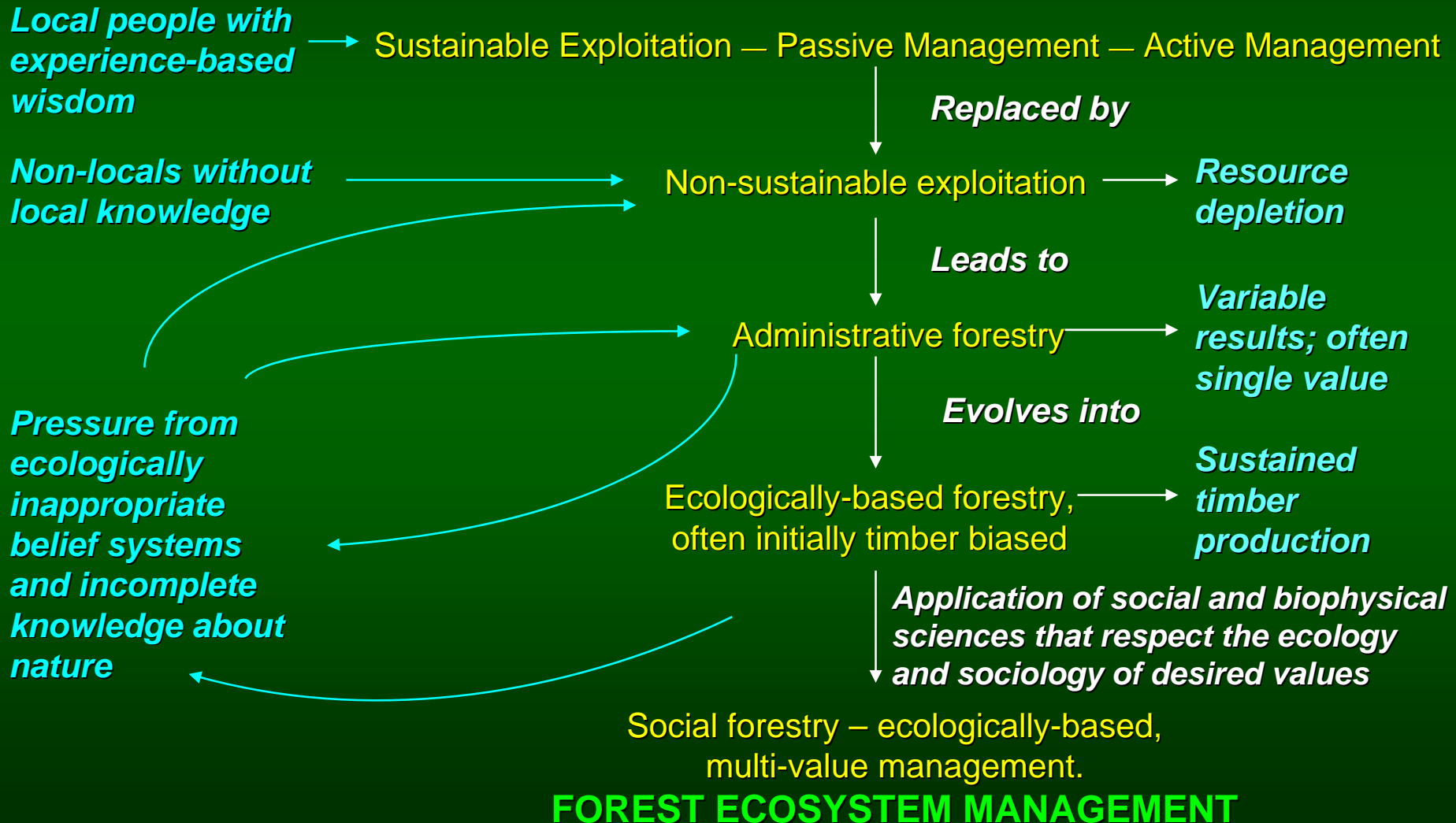
Aggregation of patches into landscape "events"

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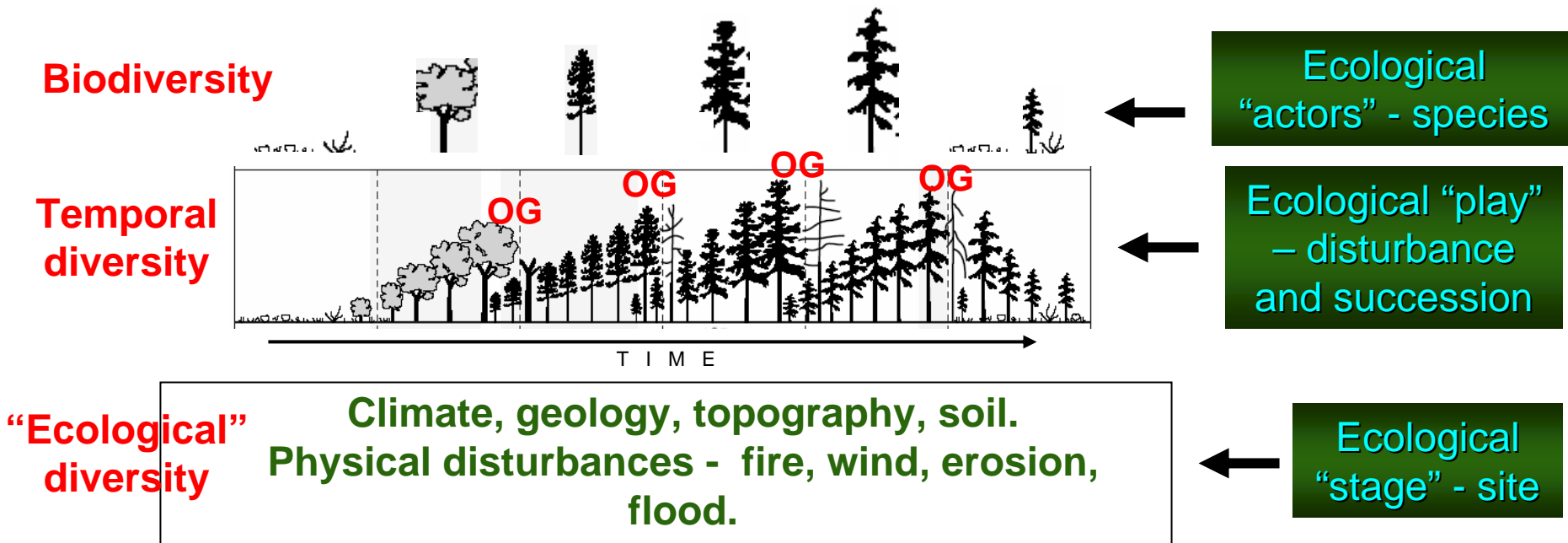
- Conclusions

A Brief History of Forestry

Local people with experience-based wisdom → Sustainable Exploitation — Passive Management — Active Management

Non-locals without local knowledge → Non-sustainable exploitation → *Resource depletion*

Replaced by

Leads to

Administrative forestry → *Variable results; often single value*

Evolves into

Ecologically-based forestry, often initially timber biased → *Sustained timber production*

EBM – but values managed more or less independently and not as components of an ecosystem →

Application of social and biophysical sciences that respects the ecology and sociology of individual values

Social forestry – ecologically-based, multi-value management.
FOREST ECOSYSTEM MANAGEMENT

A Brief History of Forestry

Local people with experience-based wisdom → Sustainable Exploitation ─ Passive Management ─ Active Management

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Evolves into

Pressure from ecologically inappropriate belief systems and incomplete knowledge about nature

Ecologically-based forestry, often initially timber biased → *Sustained timber production*

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

Social forestry – ecologically-based, multi-value management.
FOREST ECOSYSTEM MANAGEMENT

The Concept of "Ecological Theatre"

Biodiversity

Temporal diversity

"Ecological" diversity

OG   OG   OG   OG

T I M E

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

Ecological "actors" - species

Ecological "play" – disturbance and succession

Ecological "stage" - site

The ecological play is driven by disturbance

How do we design appropriate "ecological plays" to sustain multiple values?

Multi-value, ecosystem management simulation models

Concept of Ecological Rotation: Balancing disturbance and recovery

1. Rotation too short
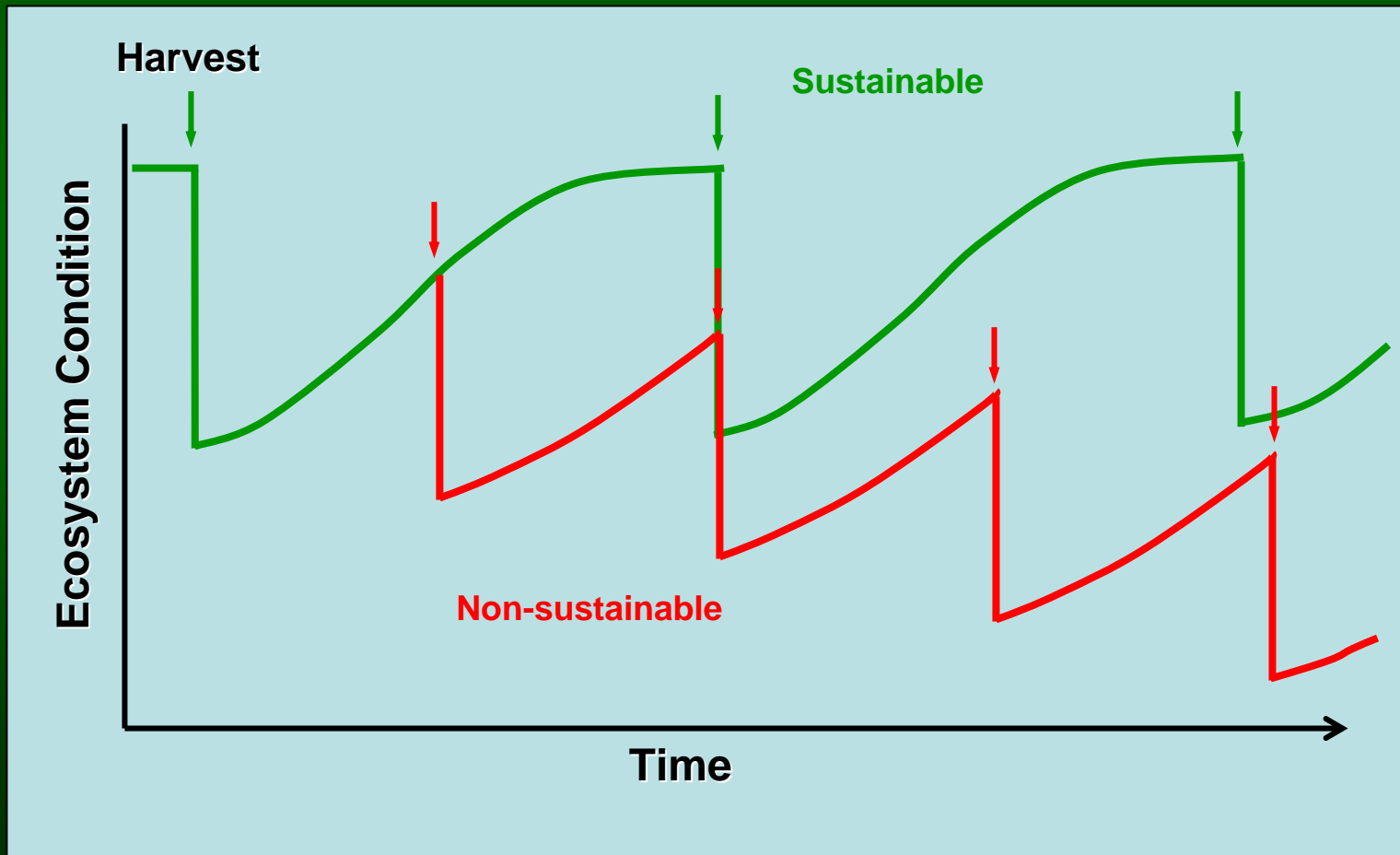
Balancing Disturbance and Ecosystem Recovery

2. Recovery too slow
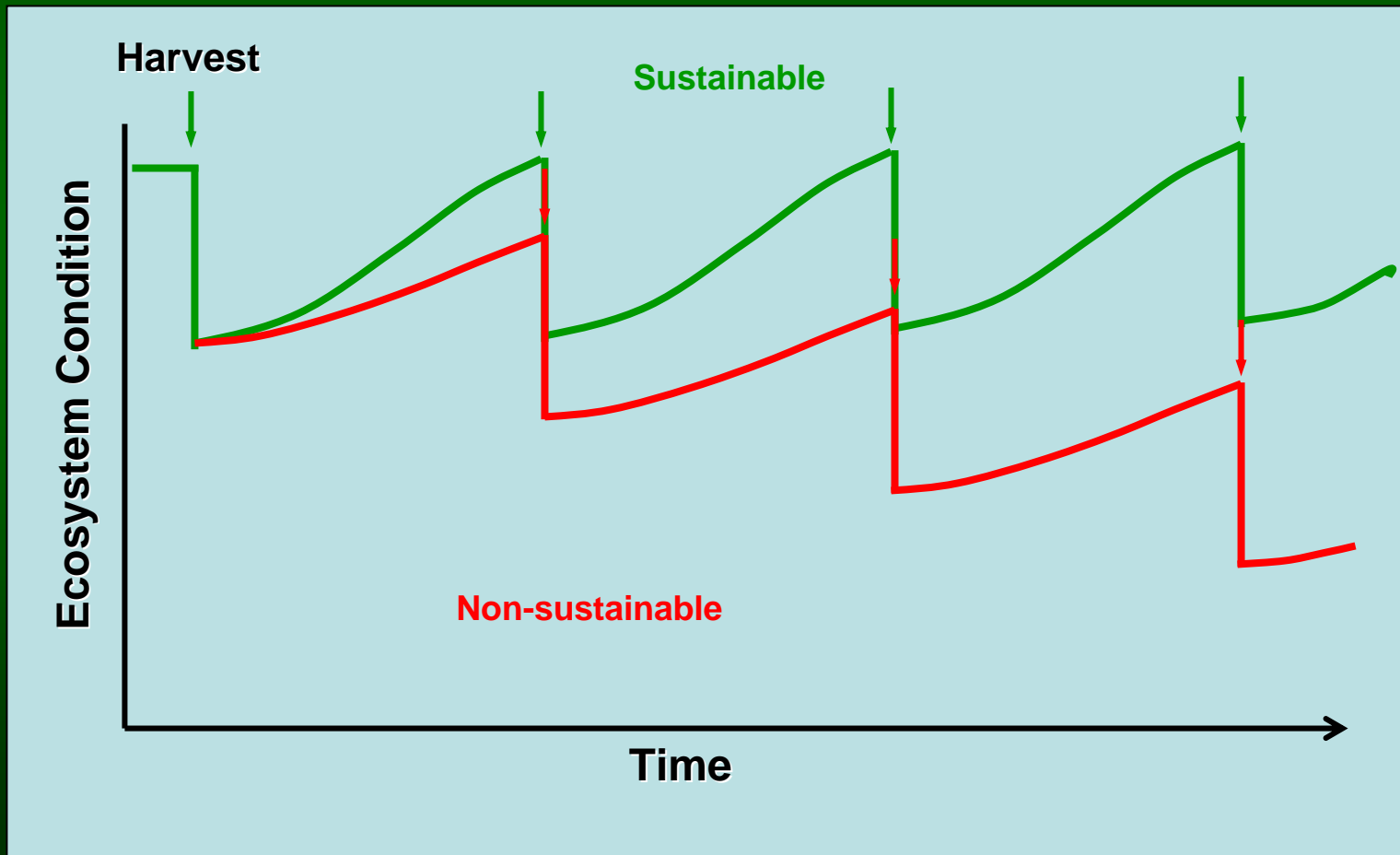
Balancing Disturbance and Ecosystem Recovery

3. Degree of disturbance too great
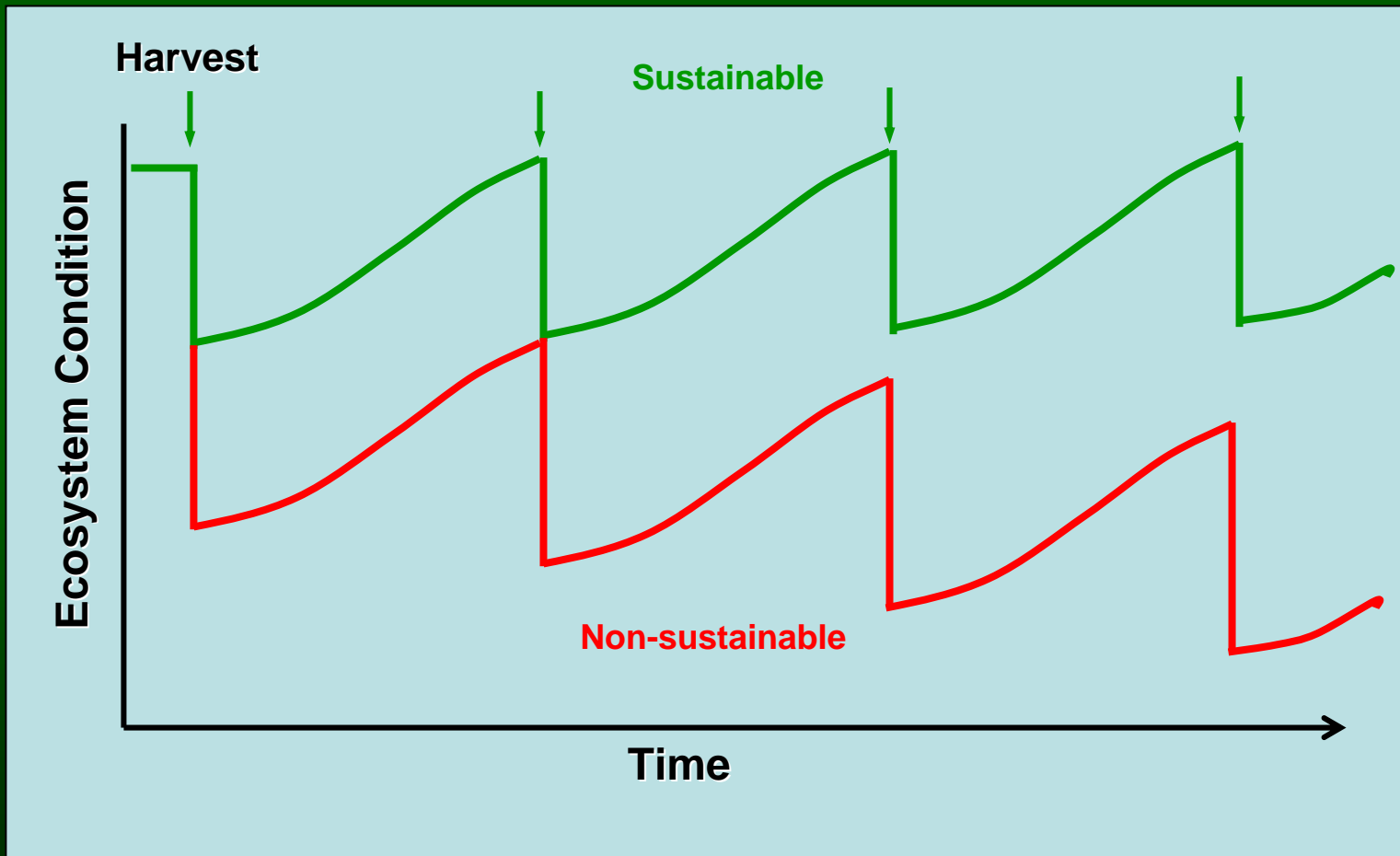
Adaptive application of the ER concept

D. Various Combinations
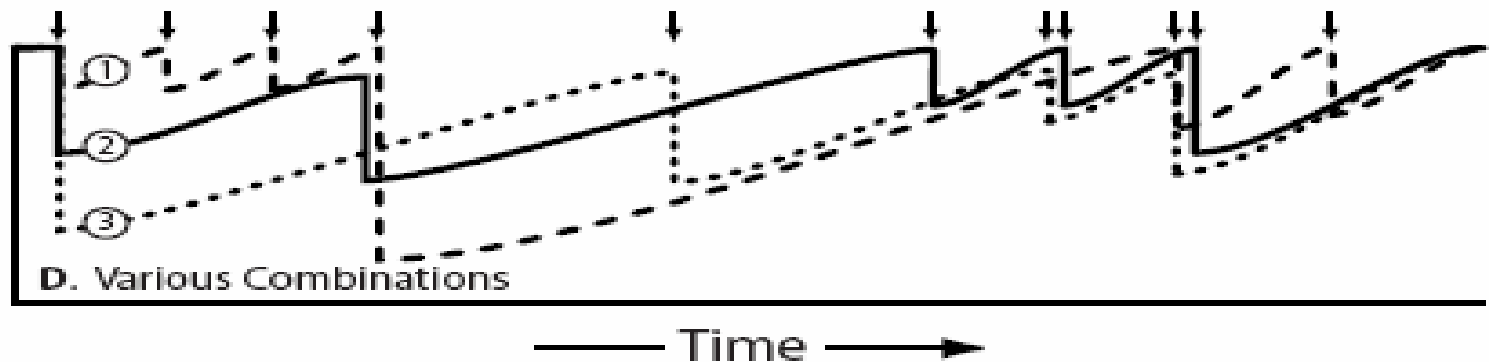
Time →

Inappropriate to repeatedly apply the same disturbance

Use varying combinations of severity and frequency

Variation in stand structure and composition over time under different disturbance (silvicultural) regimes
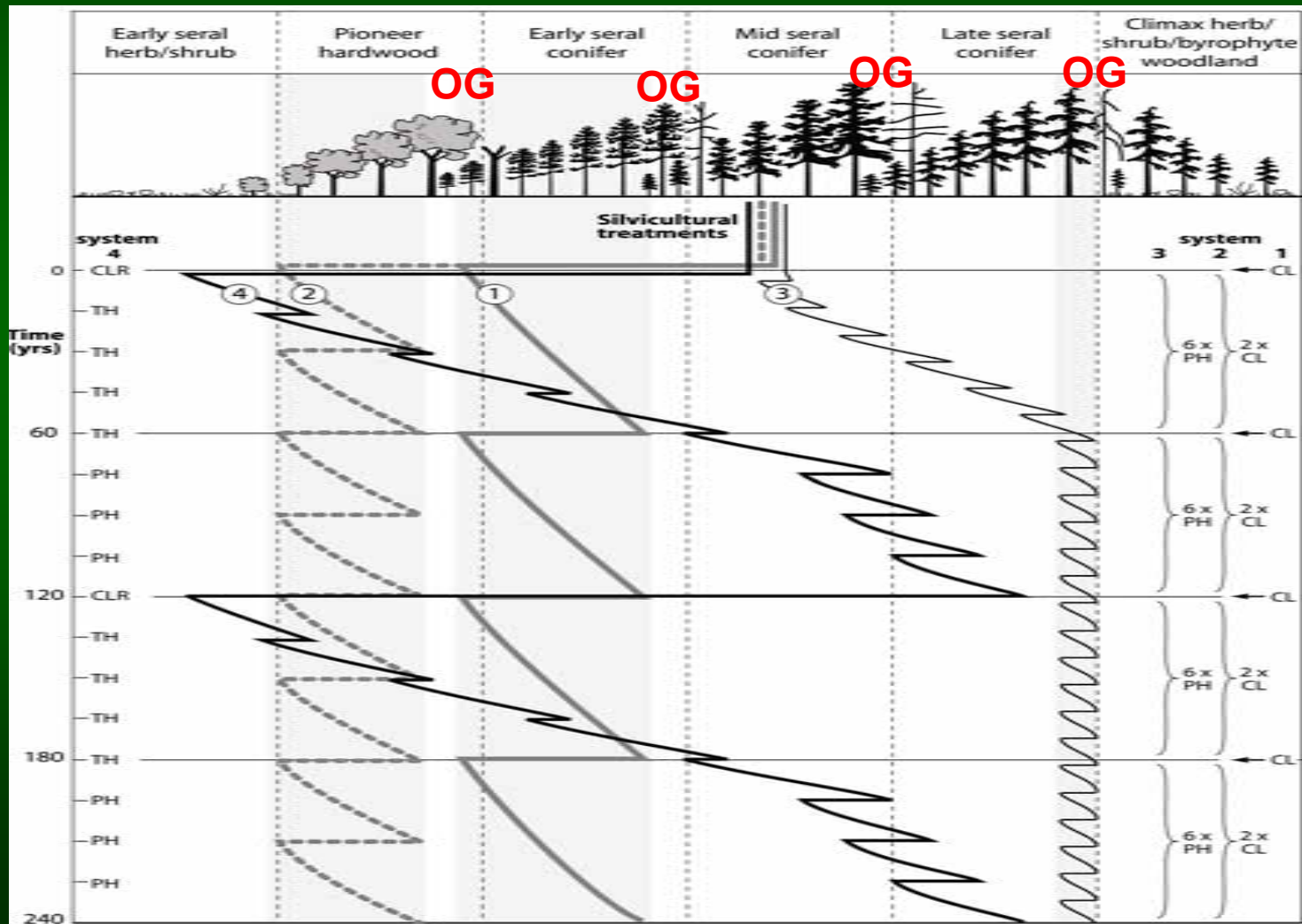
What planning tools are needed?

- 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

COMPLEXITY ↑

Ecosystem

Community — Understanding

Population — Understanding

Individual

Organ systems — Understanding

Organs, tissues — Understanding

Cell

Sub-cellular — Understanding

- Prediction   Ecosystem

↑

- Prediction   Individual

↑

- Prediction   Cell

↑
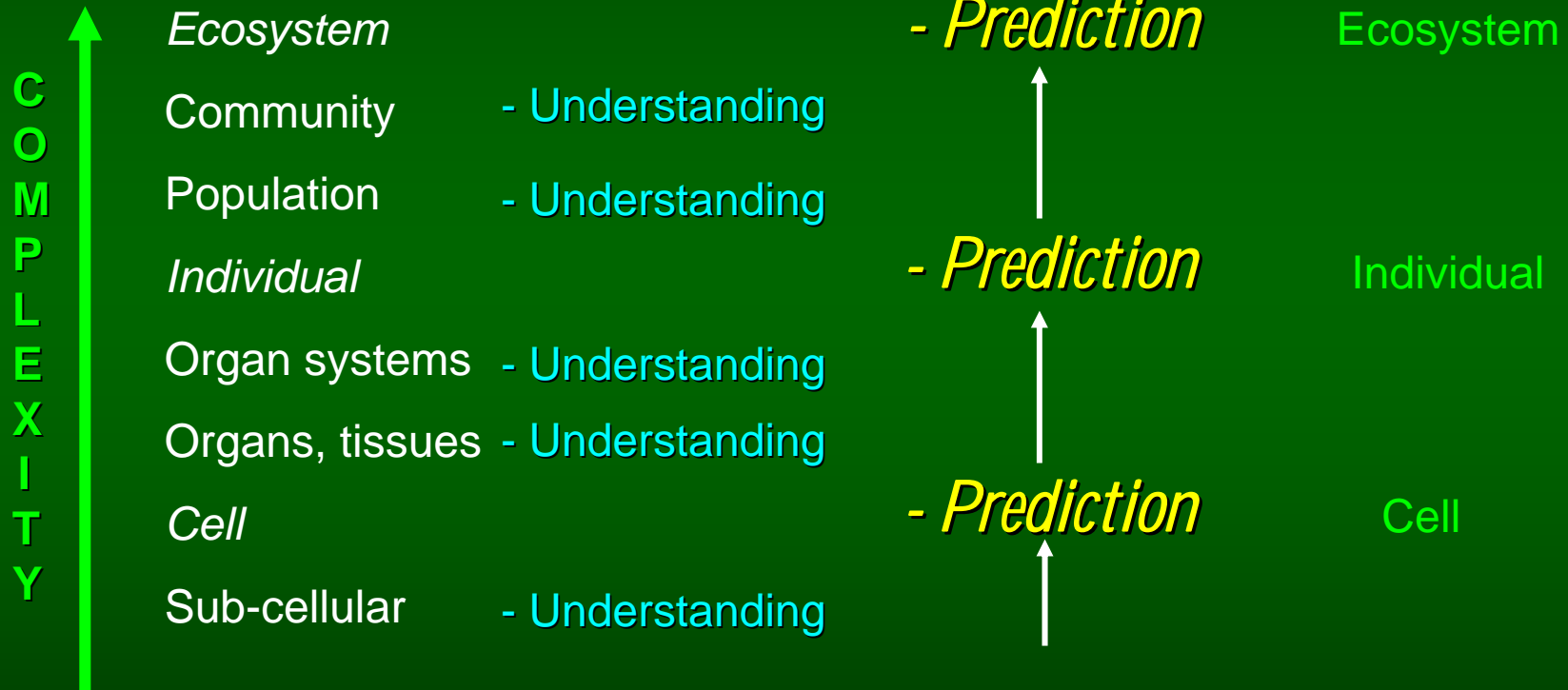
Why Ecosystem management models: PREDICTION

FORECAST
Non-spatial ecosystem management stand model

LLEMS Visualization software – stand and landscape
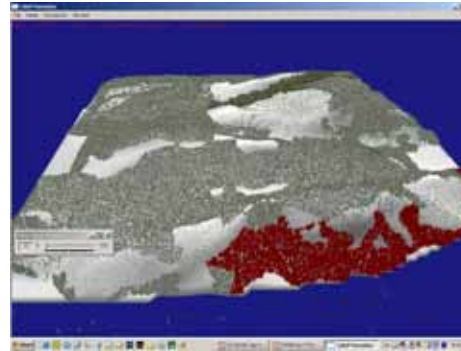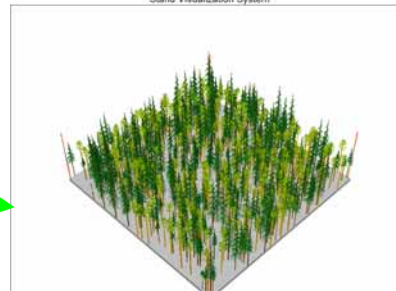
POSSIBLE FOREST FUTURES: watershed landscape management model

Stand visualization
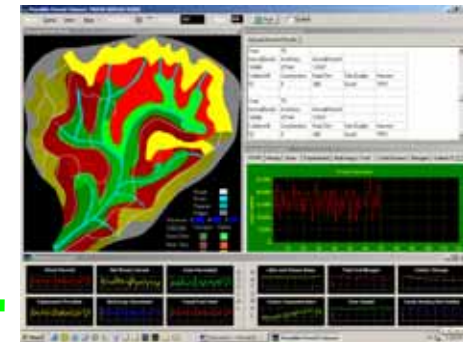
LLEMS: local landscape/complex cutblock simulator

FORCEE: Individual tree, complex stand model

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?

Trees Ecotone Open

Large landscape model driven by stand-level ecosystem management model

Forest-level Timber Supply Model (ATLAS)

Wildlife Habitat Supply Model (SimFor)

Polygon-Based
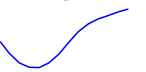
Raster-Based
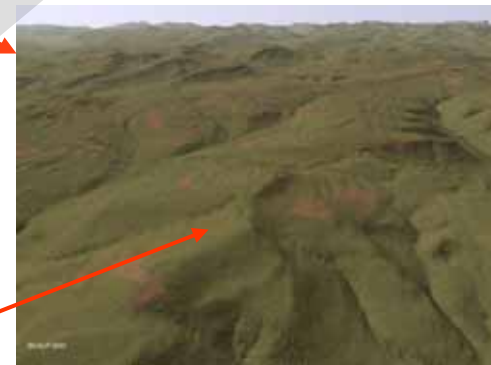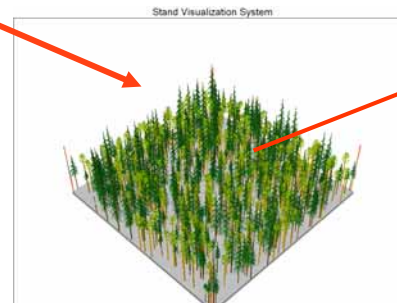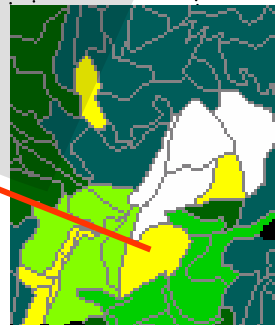
Stand-level Model (FORECAST)

Merchantable Volume

Snags (>25cm dbh)

Ecosystem C Storage

Early Seral Shrub Cover (%)

Stand Visualization System

Visualization Software
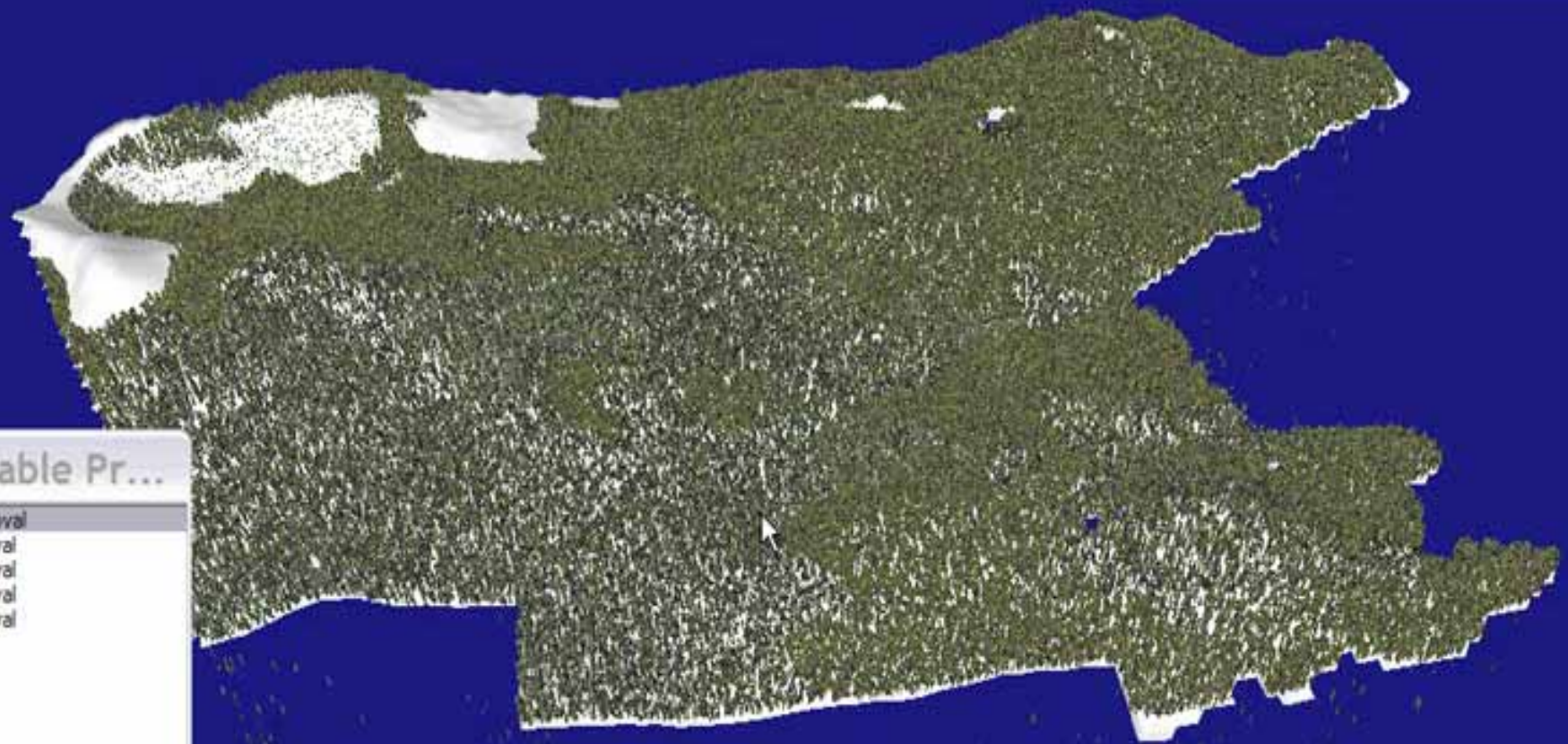
Conclusions

- 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

Conclusions

- Good stewardship involves balancing respect for Nature and society's values

- Foresters must confront ecological and social complexity

- Biodiversity is one of many values that must be sustained

Forestry is not rocket science – it is much more complex   Fred Bunnell

Don't do the same thing everywhere and all the time

Manage for all acts of appropriate "ecological plays"