Climate Change, Resource Management and Adaptation

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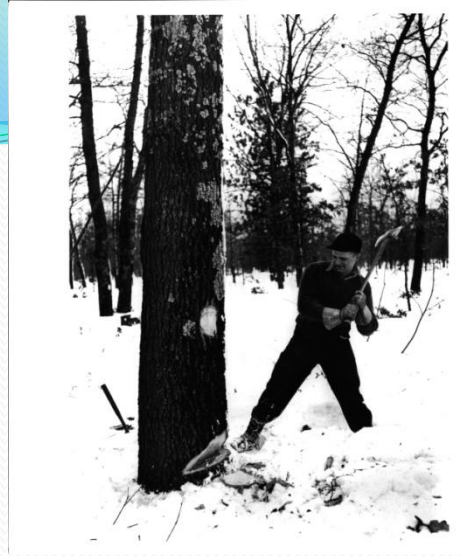
With credit to Connie Millar, Dave Peterson, Ron Neilson

April 27, 2010

Outline



- What is adaptation?
- Developing adaptation options
- Timing of options
- Adaptive capacity

Adaptation to Climate Change

Takes place through adjustments

to reduce vulnerability or to enhance resilience in response to observed or expected changes in climate and associated extreme weather events.

Confederation Bridge

Constructed 1 meter higher to account for sea level rise under climate change

IPCC WGII 2007

Developing Adaptation Options

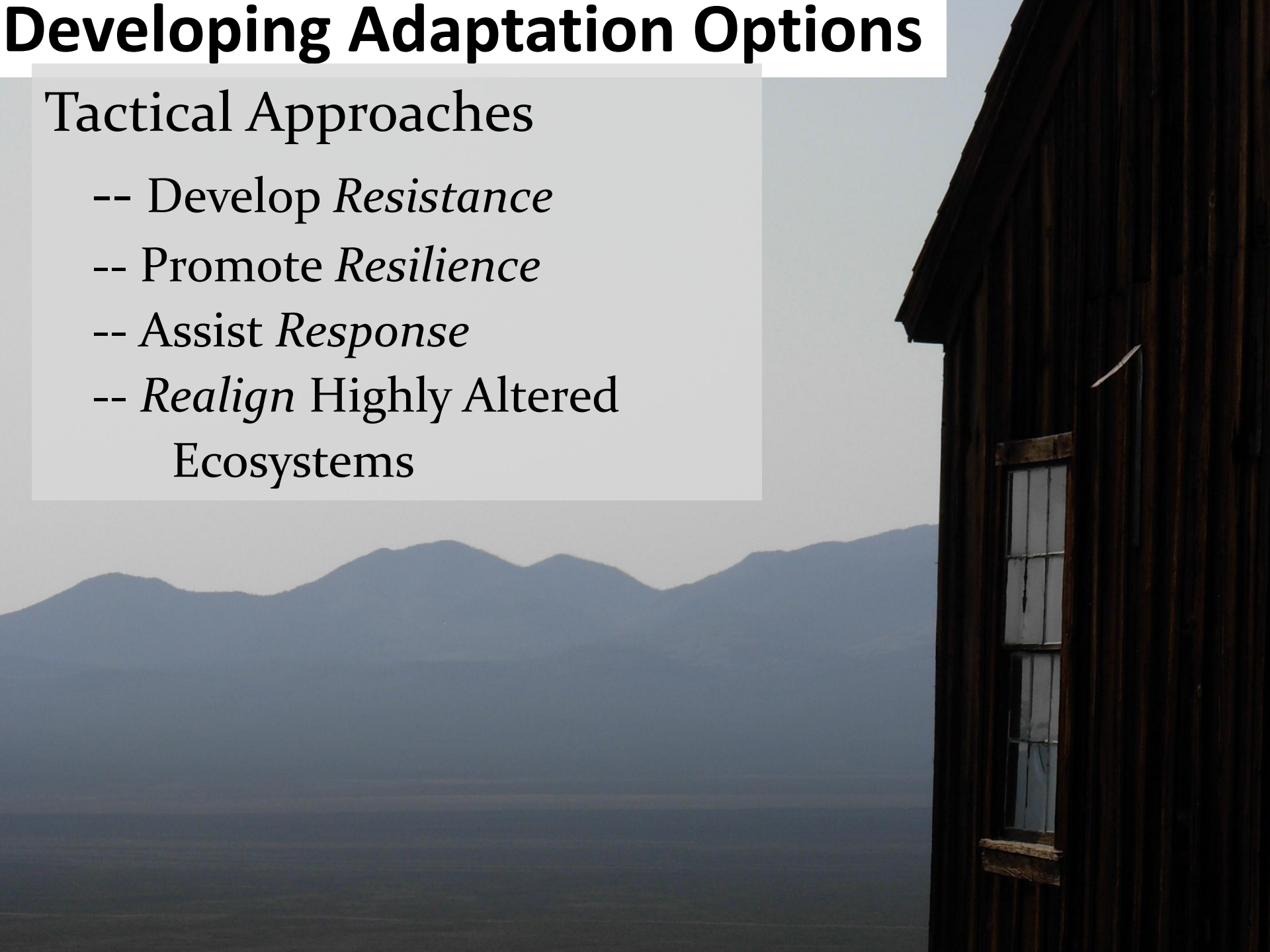
Tactical Approaches

-- Develop *Resistance*

-- Promote *Resilience*

-- Assist *Response*

-- *Realign* Highly Altered Ecosystems



TOOLKIT APPROACH

* No single solution fits all situations

* Options differ for short versus long term

* Mix & match tools

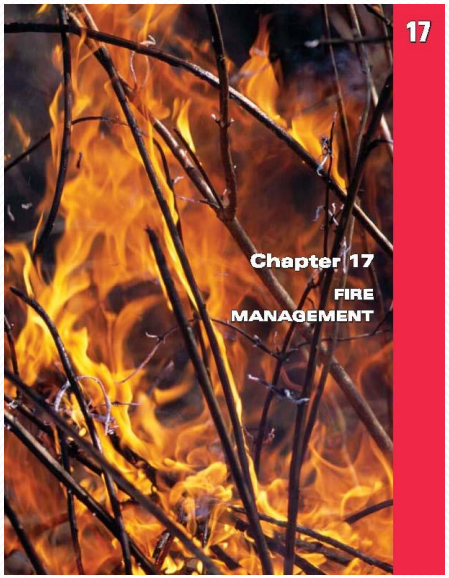
* Be flexible, experimental, innovative;
  take small risks,
  be willing to learn, change approaches

Increase Resistance to Change

Defend highest-value resources

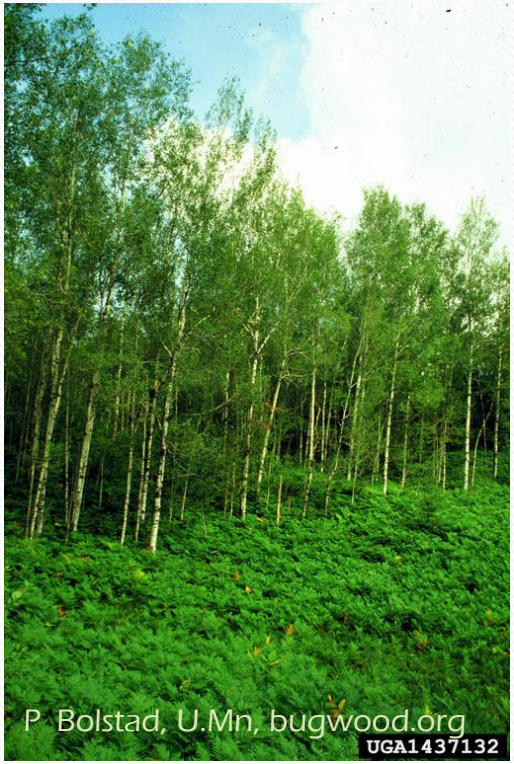
against change

Increase Resistance to Change



Contain wildfires through forest management

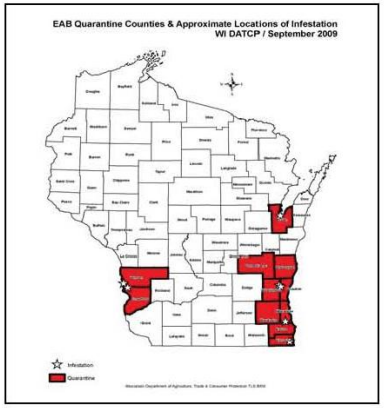
Can fire be manipulated to ensure stand replacement of aspen and still serve to regenerate jack pine, paper birch, red pine?



Establish refugia

Can refugia (cooler, wetter sites or microclimates) be identified on the CNNF for balsam fir, lowland conifer, lowland hardwoods?

Increase Resistance to Change



Emerald Ash Borer and Forest Management
Revised February 2010

Remove non-native insects

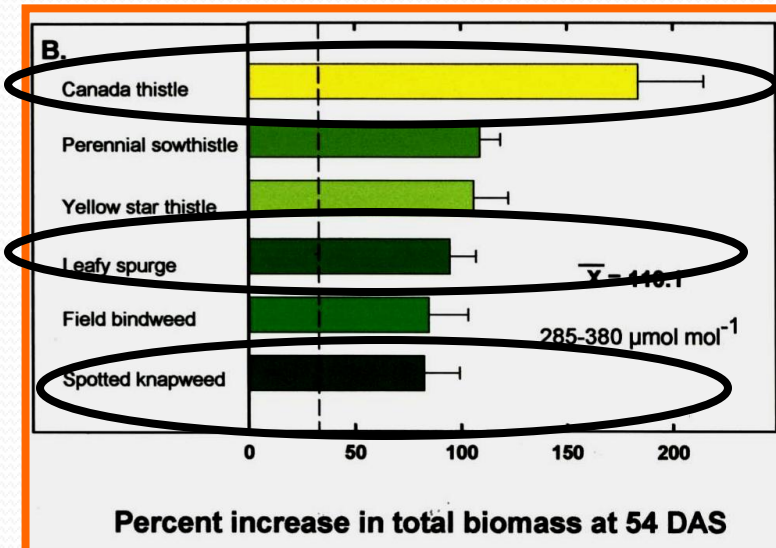
Is the rapid detection sufficient to remove non-native insects that this can be a resistance strategy?

Remove invasive plants

Existing programs but……

Reduce current stresses

- What others exist on CNNF?
  - Air quality?
  - Legacy of management?
  - Water quality?



Promote Resilience to Change

Improve the capacity of ecosystems to return to prior conditions after disturbance

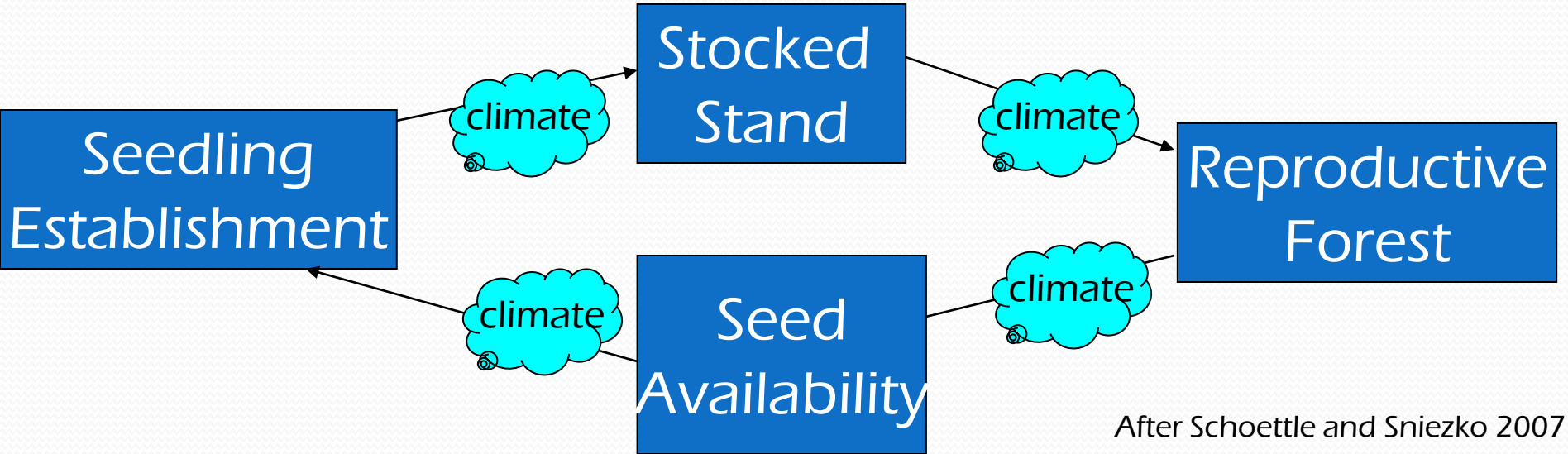
Promote Resilience to Change

Examples – emphasis on regeneration

- Thin Forest Stands
- Prescribe Fires
- Stock Seed Banks

Work with disturbance processes – natural and managed –

to increase structural diversity and promote genetic adaptation



After Schoettle and Sniezko 2007

Resilience is also the capacity of a system or species to absorb external challenges without change in state

Northern Hardwoods

Is there a threshold for tree species diversity within this type that is sufficient to buffer the decline of some individual species in this type?

And if there is, can those areas be managed under the changing climate to minimize the loss of some species?

Enable Ecosystems to Change Adaptively (Response)

Assist the transition of ecosystems to new environmental states

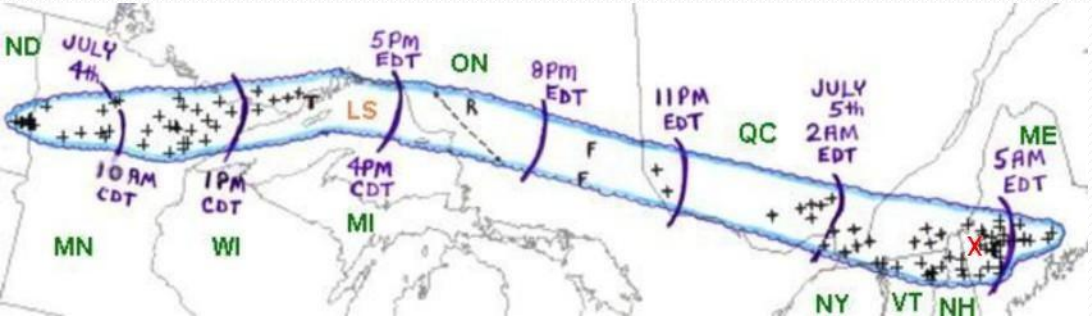
Enable Ecosystems to Change Adaptively (Response)

*** Anticipate and plan for associated risks such as extreme events, large dieback**

Cottonville fire, WDNR

Increased fire return intervals

Severe wind events on shorter return intervals



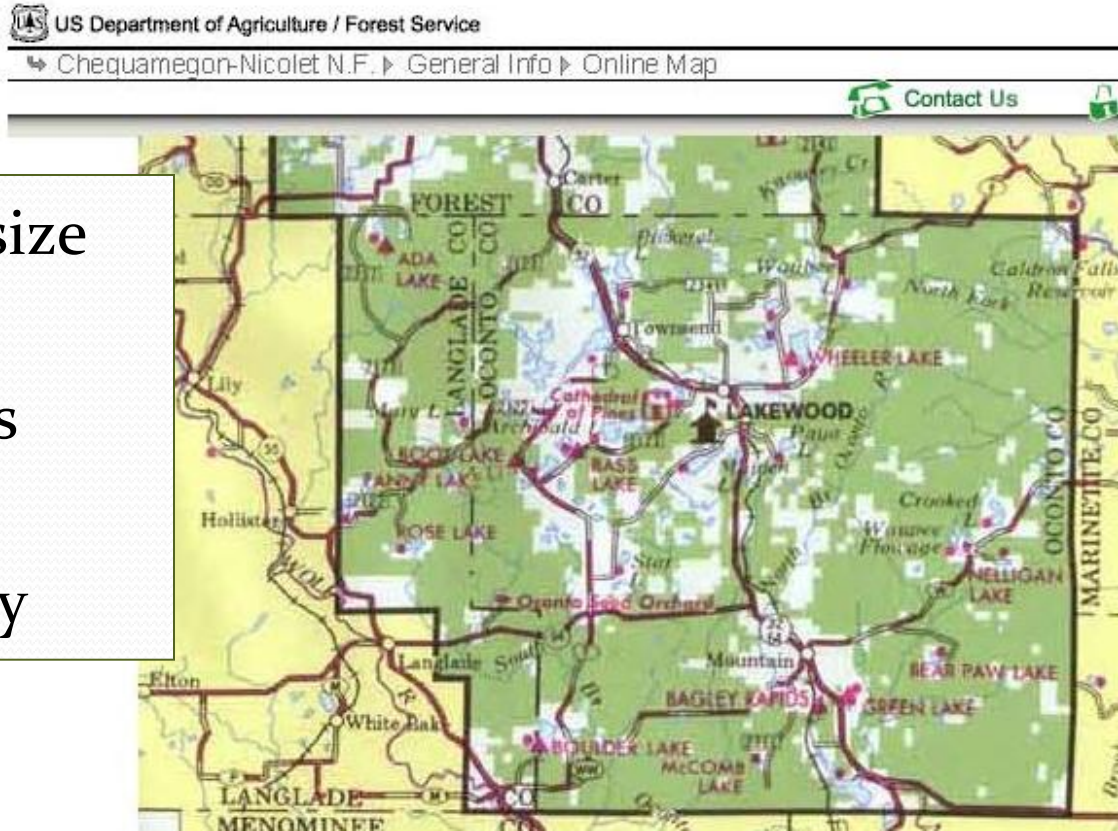
Forest dieback

Enable Ecosystems to Change Adaptively (Response)

* Promote Connected Landscapes

- Larger management unit size
- Lower fragmentation
- Continuous riparian zones
- All-lands, landscape scale

  Greater decision flexibility



Enable Ecosystems to Change Adaptively (Response)

* Evaluate projected climate and ecological change

Identify vulnerabilities

Assess cumulative effects and uncertainties

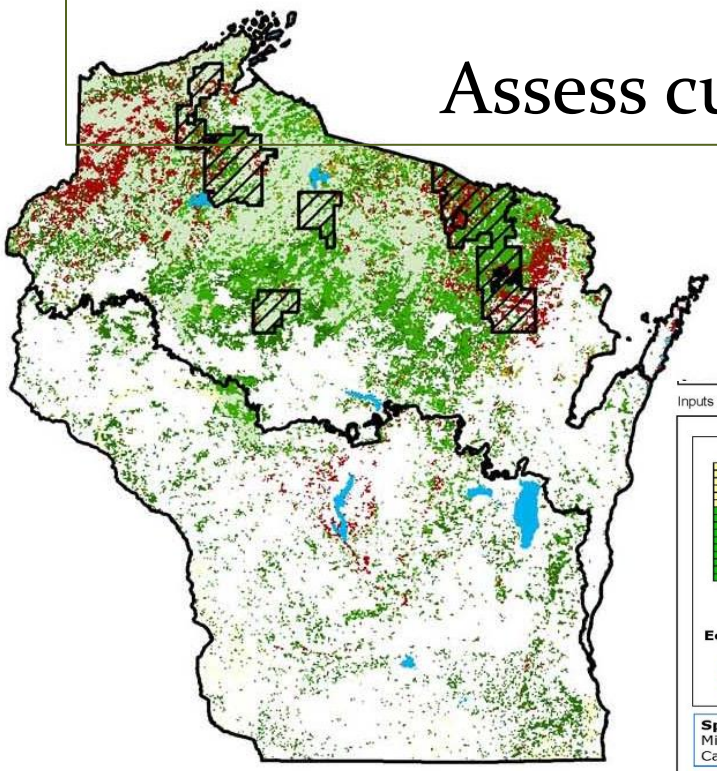
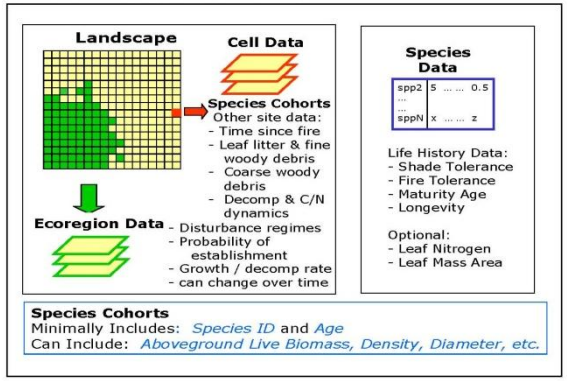


Figure 2. The location of the Chequamegon-Nicolet National Forest (CNNF) in the forested landscape of northern Wisconsin (USFS Forest Cover 1992, USGS 2003).

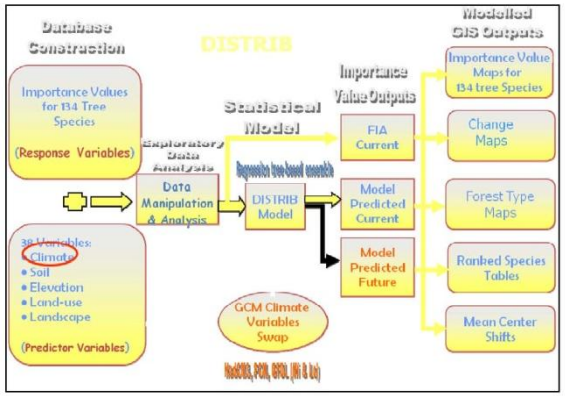
Inputs to LANDIS-II (Image courtesy D. Mladenoff)



APPENDIX 3:

Figures of Model Inputs

Inputs and Outputs to DISTRIB used to develop the Climate Change Atlas (Image courtesy L. Iverson)



Enable Ecosystems to Change Adaptively (Response)

*** Experiment Creatively, Learn From Experiments**

1. Use protected areas as experiments in natural regeneration under climate change

Spread-the-risk and bet-hedging approaches

2. Implement experimental treatments

3. Manage 'novel' ecosystems

Enable Ecosystems to Change Adaptively (Response)

*** Consider Alternative Genetic Diversity Options**

1. Relax Genetic Management Guidelines

2. Clonal nature of Aspen

Can this genetic difference be manipulated to maintain aspen?

3. New Species Mixes

Species within the area and …..

Enable Ecosystems to Change Adaptively (Response)

* Assist Migration

Move species to favorable future locations

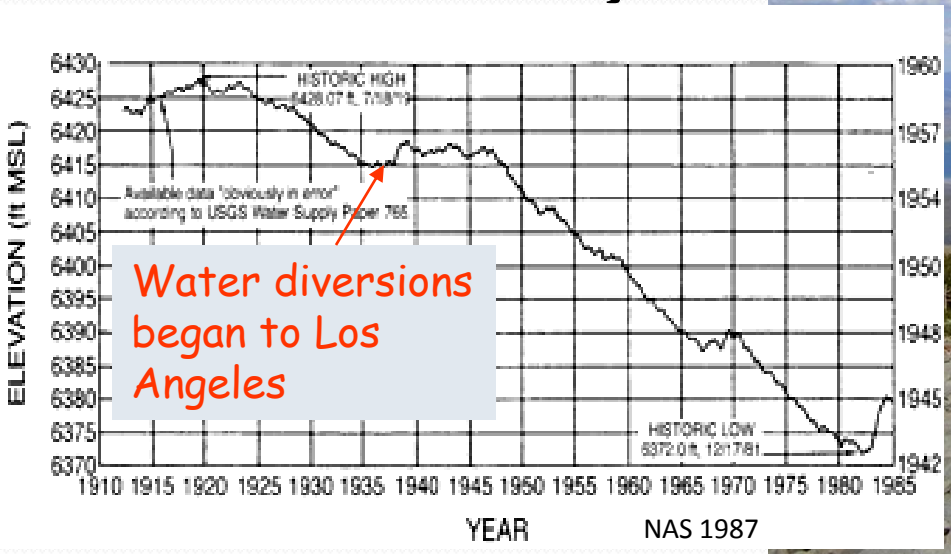
Warmer and drier – loss of habitat for many tree species, and loss of species on these sites.

Oaks may be favored by warmer and drier conditions, but current limits of dispersal, competition, browsing. *Case for assisted migration?*

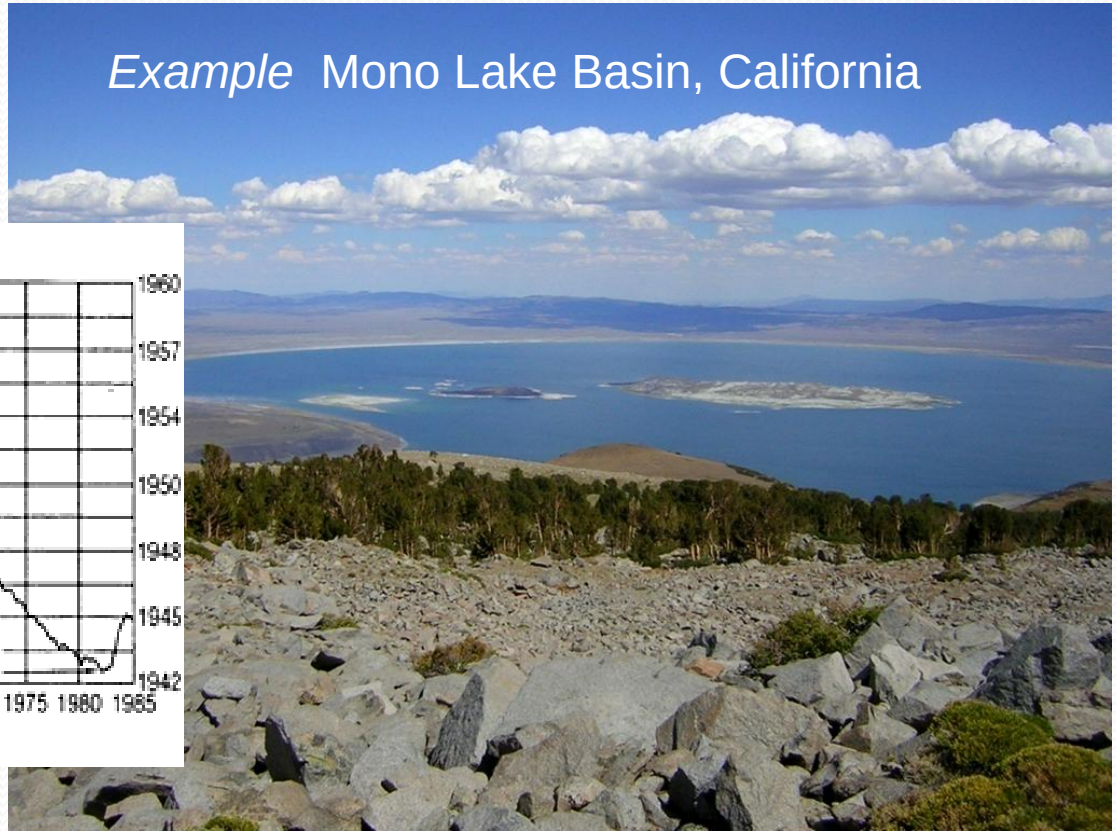
Realign Systems to Current and Future Dynamics

An option when resources are far beyond the range of natural variability

What is the analogue here?



NAS 1987



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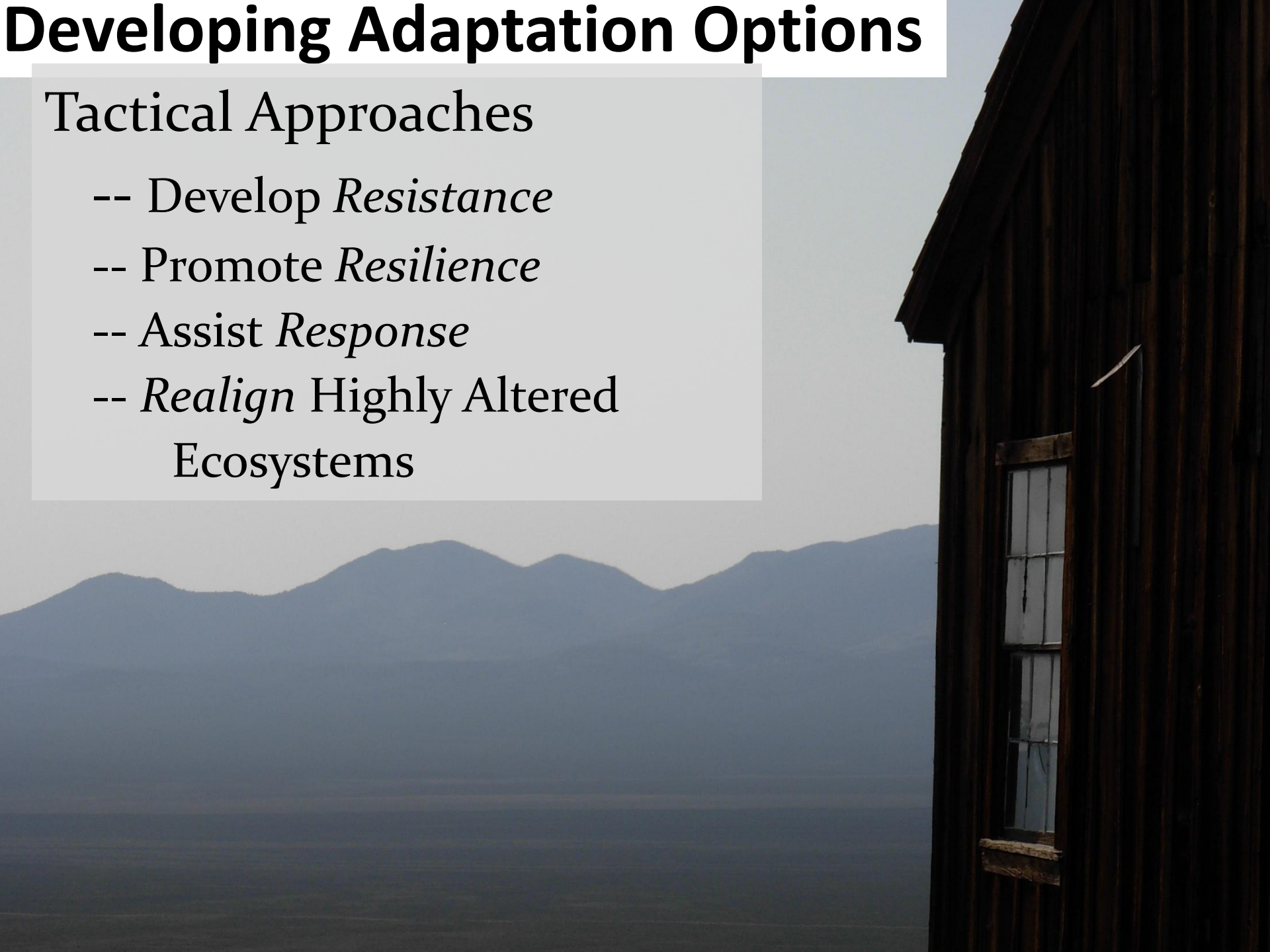


OVERALL: Set Priorities

Confront What Can and Cannot be Done

Practice triage as appropriate

TRIAGE: *"Sort & Tag"*

Red Urgent, treatable

Yellow Mid urgency; soon to become red

Green Stable, low priority

Untreatable, lowest priority: = no action

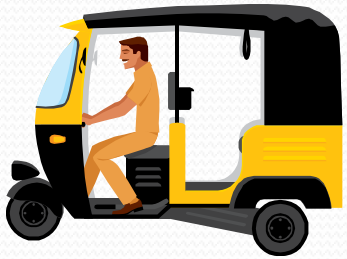
****

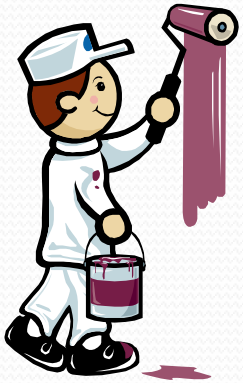
Re-assess frequently

Photos:
Tom Moris, Linda Parker

Adaptation in Human Systems: When to Wait, When to Act

versus





Adaptation in Human Systems: Timing

Management or Planning

No Adaptation Actions
- Impacts low <u>or</u>
- Risks low <u>or</u>
- Projects near-term <u>or</u>
- Triage - options better elsewhere

Actions associated with current goals and objectives
- Resistance
- Resilience

Proactive Change - Action now
- After exhausting all near-term efforts
- Or
- Starting now to transition to new environmental conditions

<u>Implement Action Post-Disturbance and Plan before!</u>
- Identify that disturbances are changing
- Plan how to begin the transition
- Implement post-disturbance
- Objectives and goals may have to change

Observe (Monitor and Adapt)

What are the trends?

How has climate affected species and resources?

Did plans and treatments have desired outcomes?

Adaptive Capacity

The ability of a system to adjust to clim

to moderate potential damages

to take advantage of oppor

or to cope with consequen

Adaptation – What you know from EVAS

Forest Type	Potential impacts most relevant to forest type	Potential vulnerabilities most relevant to forest type	Responses that may accommodate change
Aspen	▪ Increase in medium- and large-scale disturbances	▪ Decline in abundance or productivity ▪ Low within-stand diversity increases risk ▪ Medium-scale disturbances may not adequately allow for reestablishment ▪ Lack of genetic diversity within clones may be a disadvantage	▪ Reliance on large-scale and stand-replacing disturbances may buffer some impacts ▪ Wide ecological amplitude and clonal nature of aspen may increase resilience
Balsam Fir		▪	▪
Hemlock	▪	▪	▪
Jack Pine	▪	▪	▪
Lowland Conifer	▪	▪	▪

Adaptation – Identify options & unknowns

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Balsam Fir		▪	▪	▪	▪
Hemlock	▪	▪	▪	▪	▪
Jack Pine	▪	▪	▪	▪	▪
Lowland Conifer	▪	▪	▪	▪	▪

Questions?

L Parker, USFS

T Moris, USFS

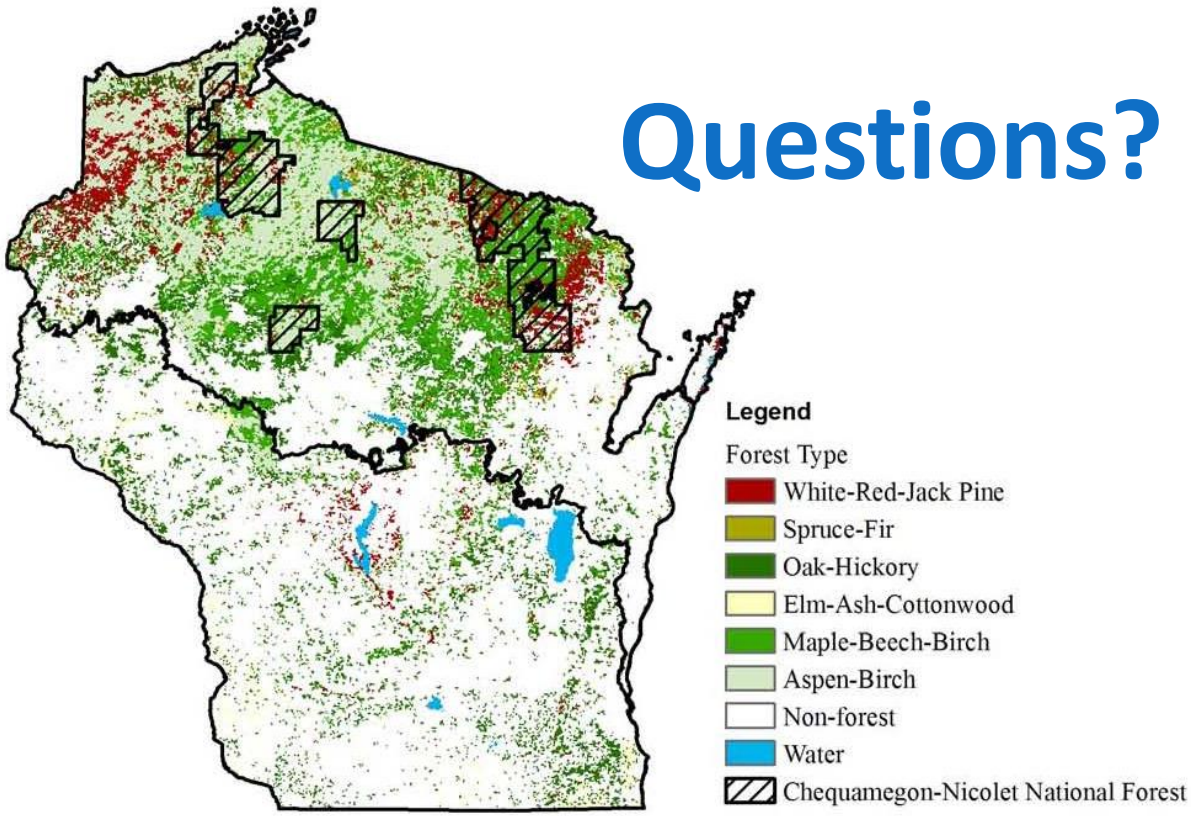

Figure 2. The location of the Chequamegon-Nicolet National Forest (CNNF) in the forested landscape of northern Wisconsin (USFS Forest Cover 1992, USGS 2003)

S Poser, USFS

J Olson