Adapting Vegetation Management to Climate Change on the Olympic Peninsula

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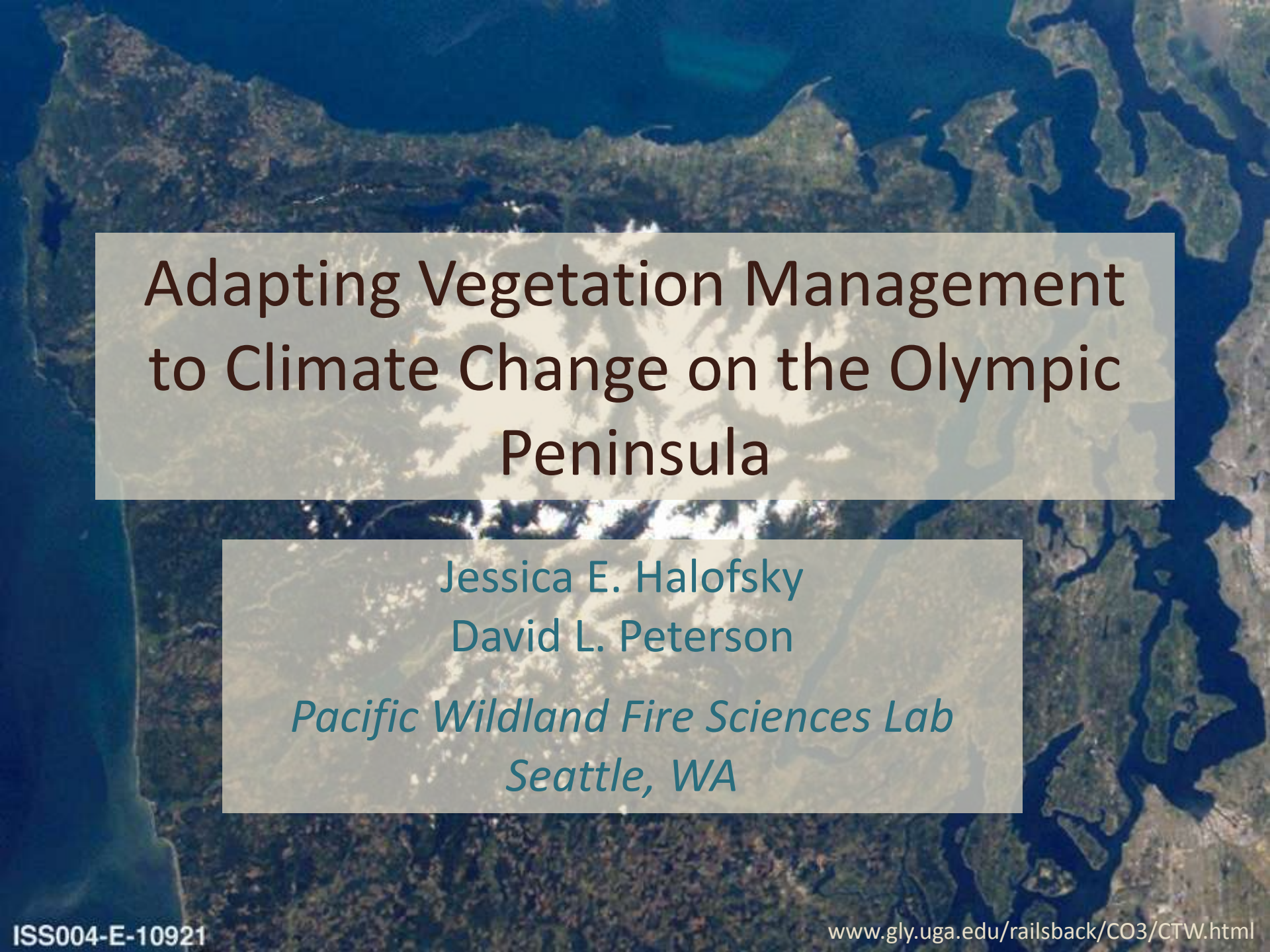

www.gly.uga.edu/railsback/CO3/CTW.html

The Olympic Climate Change Case Study

- A science-management partnership among:
  - Olympic National Forest
  - Olympic National Park
  - Forest Service PNW Research Station
  - Climate Impacts Group (University of Washington)

The WestWide Climate Initiative

- Science-management partnerships working towards climate change adaptation
- Three parallel case studies:
  - Olympic National Forest (Washington)
  - Shoshone National Forest (Wyoming)
  - Inyo National Forest (California)

The Olympic Case Study was focused on four main areas:

- Hydrology and roads management
- Vegetation management
- Wildlife and wildlife habitat management
- Fisheries and fish habitat management




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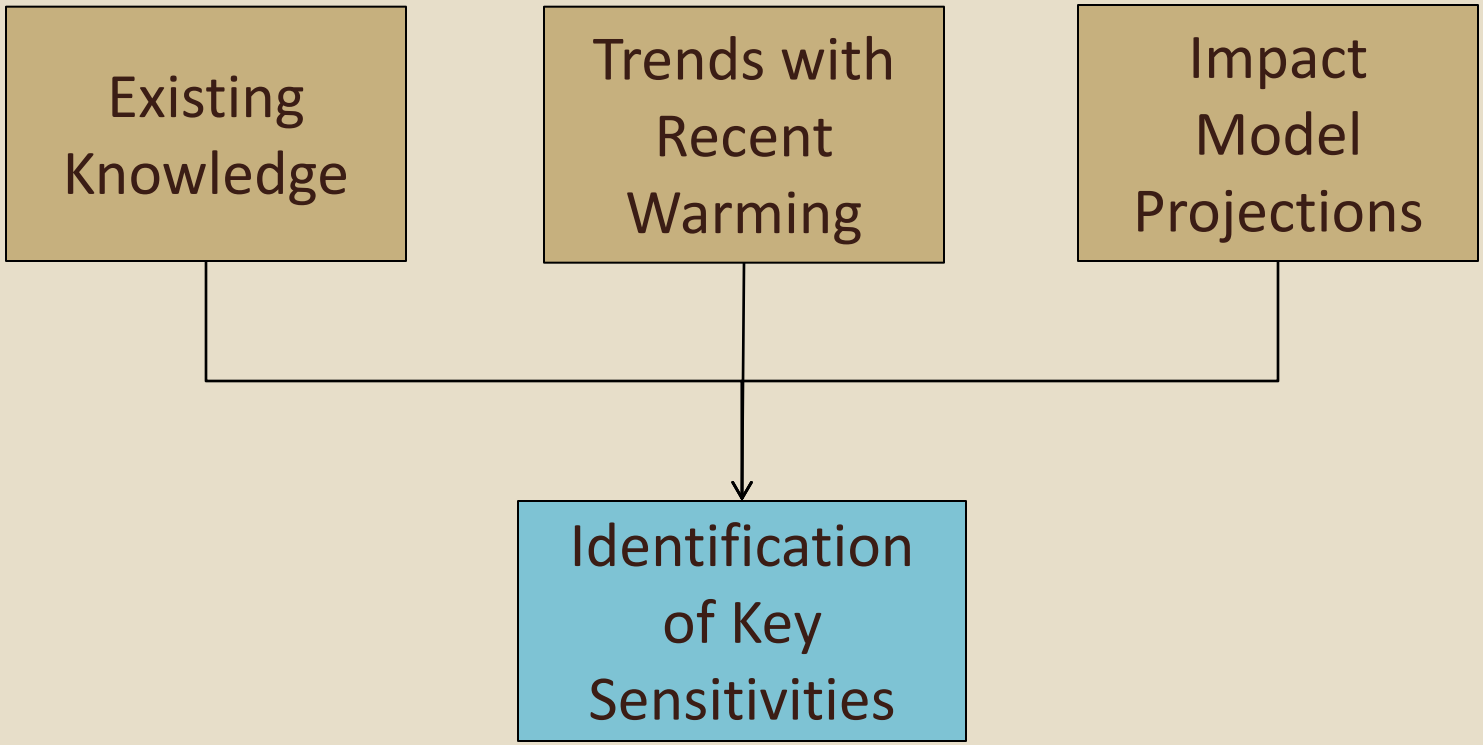
Process for each focus area:

1. Assessment of key sensitivities
2. Review of current management practices and constraints
3. Development of adaptation plans through science-management workshops

1. Sensitivity Assessment



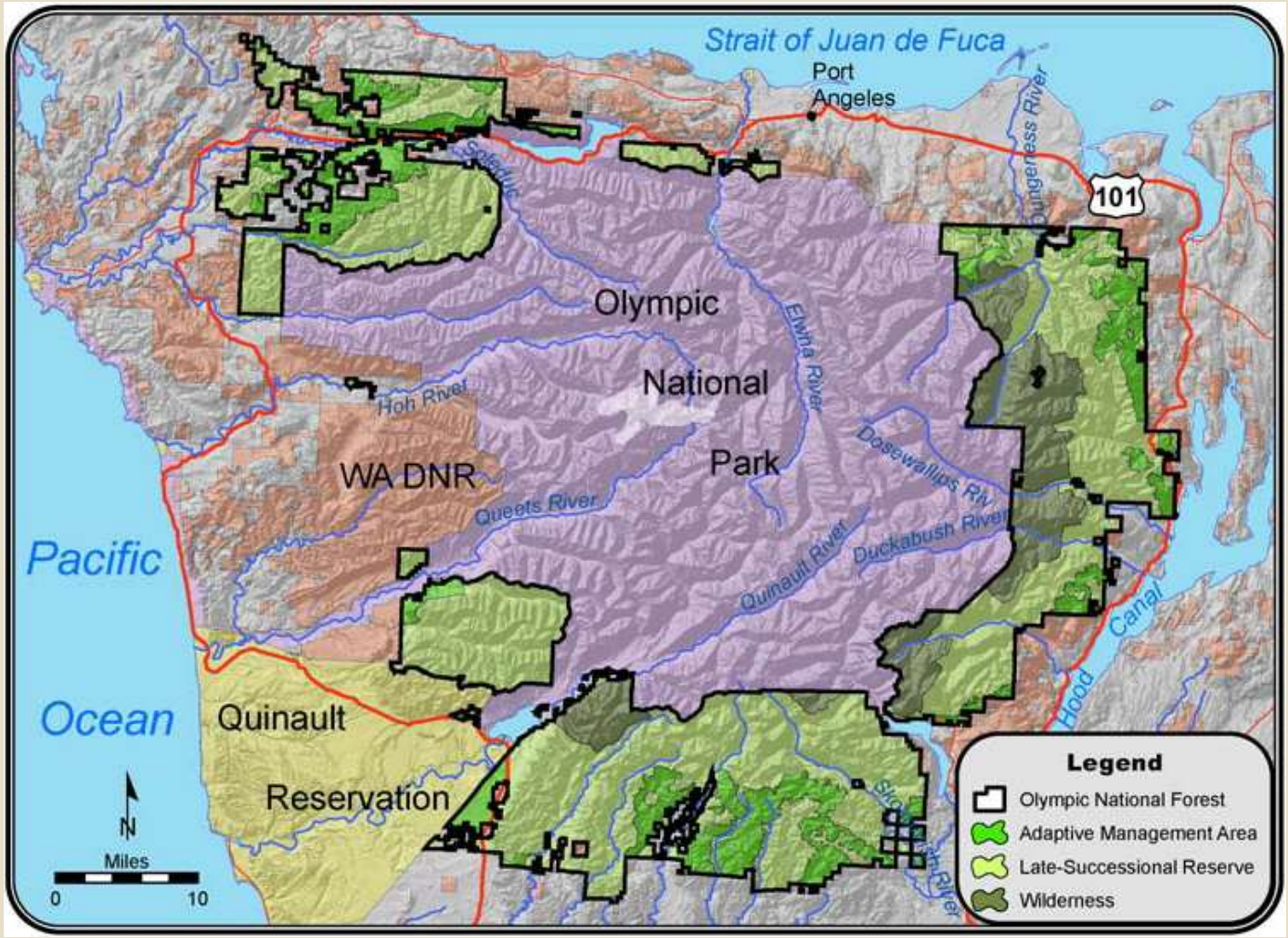
2. Review of Current Management

- Review of current management strategies
- Identification of major management activities
- Identification of constraints

3. Scientist-Manager Workshops

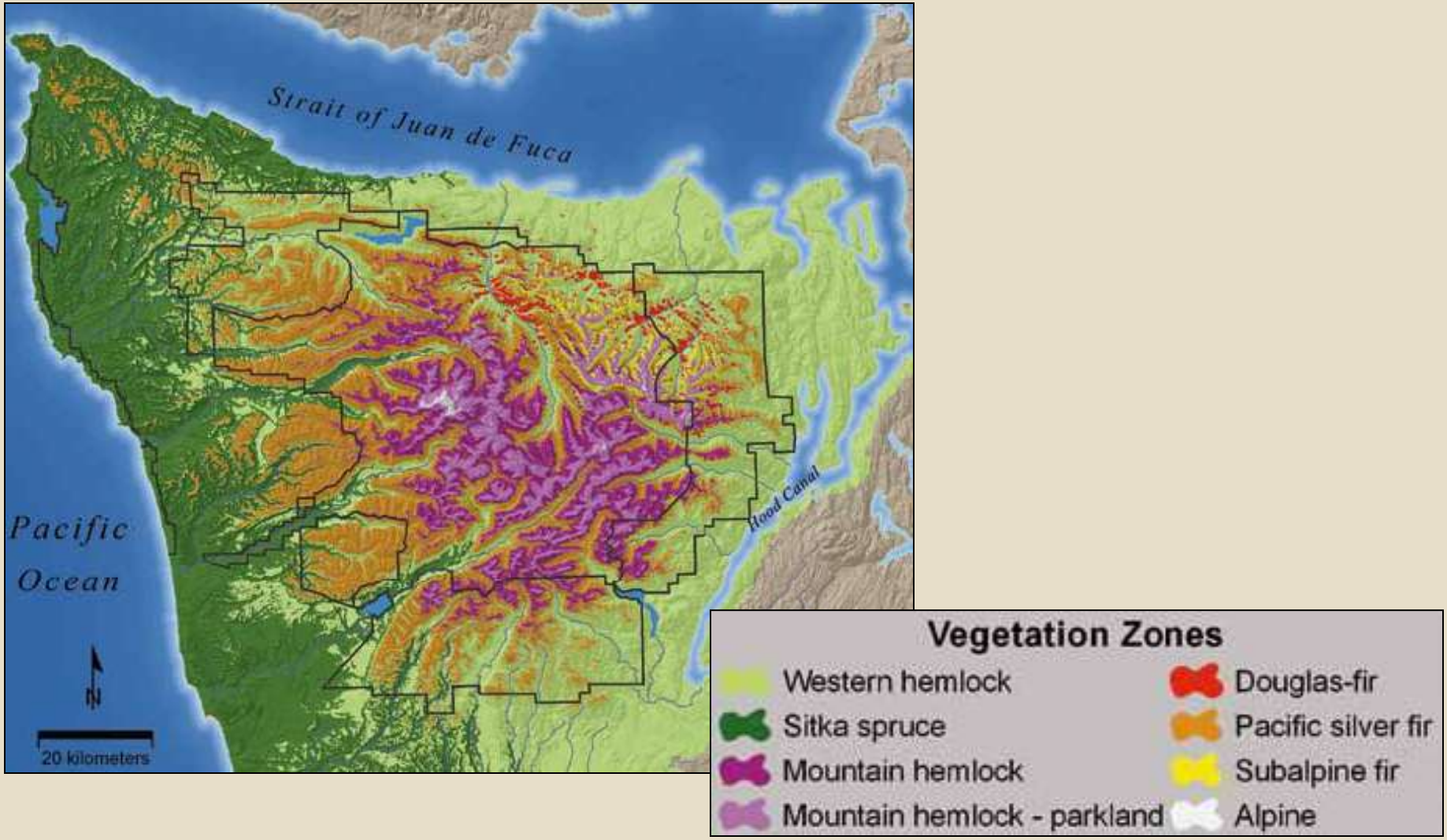
- Reviewed results of sensitivity assessments and current management
- Developed adaptation strategies and action items through facilitated dialog

The Olympic Peninsula



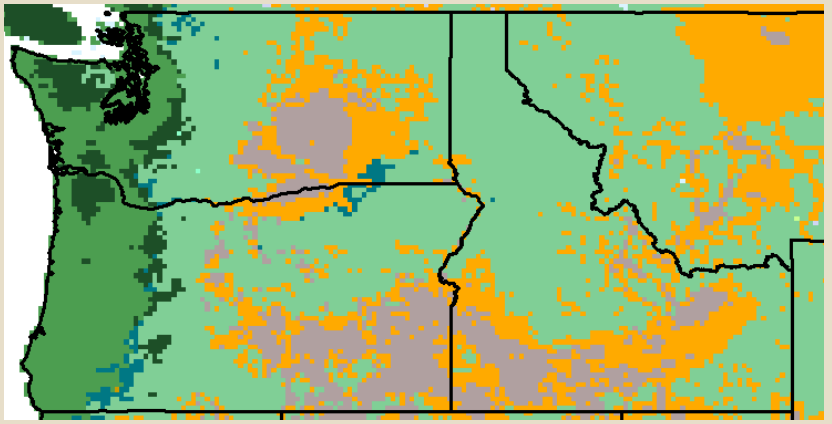
Map by R. Norheim

Olympic Peninsula Vegetation



Information sources on vegetation response to climate change:

- The paleoecological record
- Tree ring records of tree growth and fire
- Observed trends with recent warming
- Model projections



The paleoecological record

- During warm periods in the past, tree species moved poleward and upward in elevation
- Other common species during past warm periods and times of rapid change include:
  - Douglas-fir
  - lodgepole pine
  - Oregon white oak
  - red alder

Modern records of climate and tree growth

- Tree growth and productivity are sensitive to annual climatic variation
- Growth responses to climate vary by species, and with elevation and topography

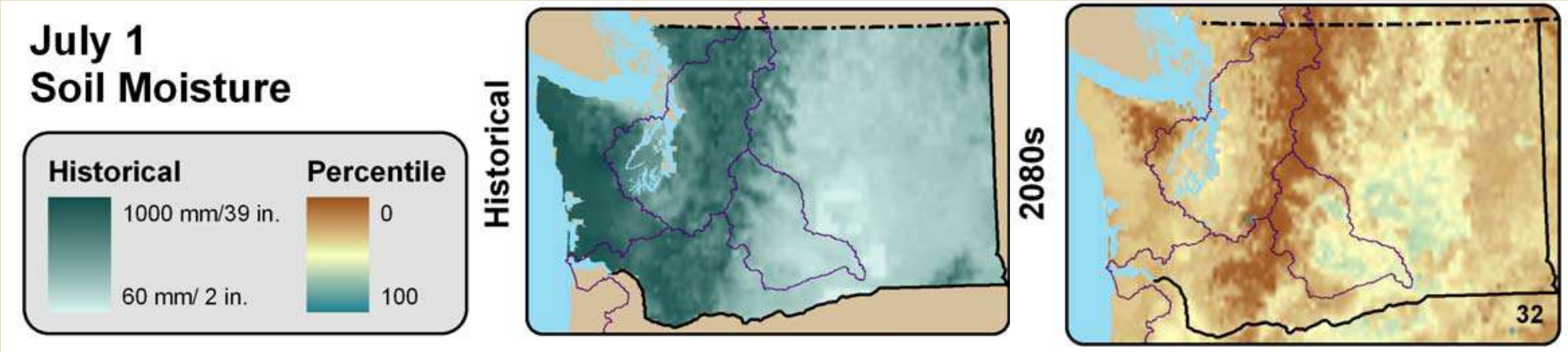


Growth response to climate in high elevation forests

- Growth increases when limiting factors are reduced:
  - Growth increases with lower snowpack
  - Growth increases with increasing length of growing season

Growth response to climate in drier forest types

- Growth decreases when limiting factors intensify:
  - Growth decreases with decreasing summer soil moisture



Elsner et al. 2009

Climate and fire in the western US

- Warmer and drier spring conditions =
  - early snowmelt
  - lower summer soil and fuel moisture
  - longer fire seasons
  - increased fire frequency and extent

Trends with recent warming

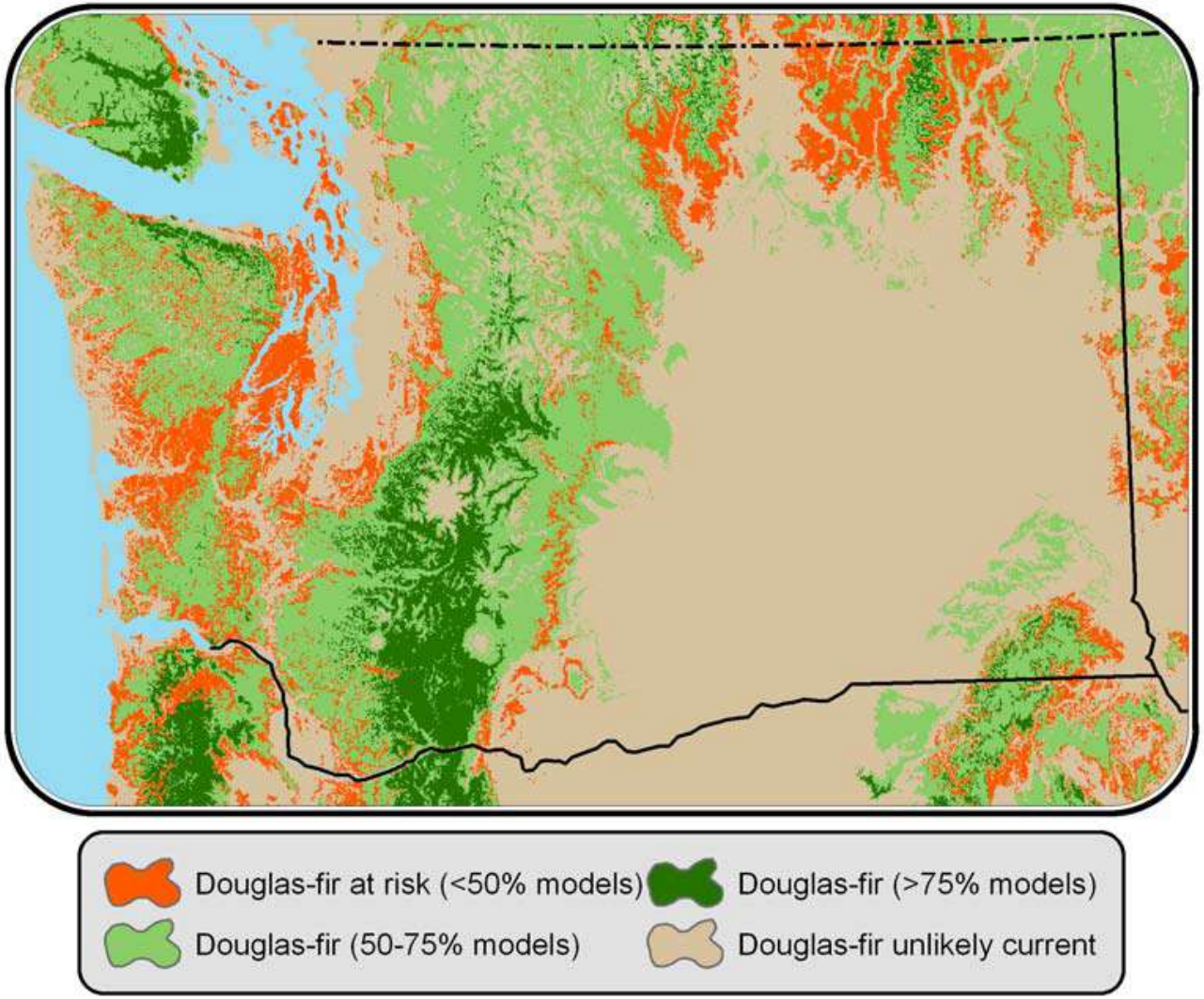
- Changes in species phenology
- Shifts in species distribution upward in elevation and poleward
- Increased frequency and extent of fire and insect outbreaks
- Tree growth declines and mortality events

Projections for future vegetation change on the Peninsula: Gap model results

- In the wetter southwest, dominant tree species will shift upwards 300–600 m
  - subalpine meadows and mountain hemlock forests will be invaded by Pacific silver fir
  - Pacific silver fir forests will be invaded by western hemlock
- In the drier northeast, drought-tolerant species will become dominant at lower elevations
  - subalpine fir will dominate north aspects
  - lodgepole pine will dominate south aspects

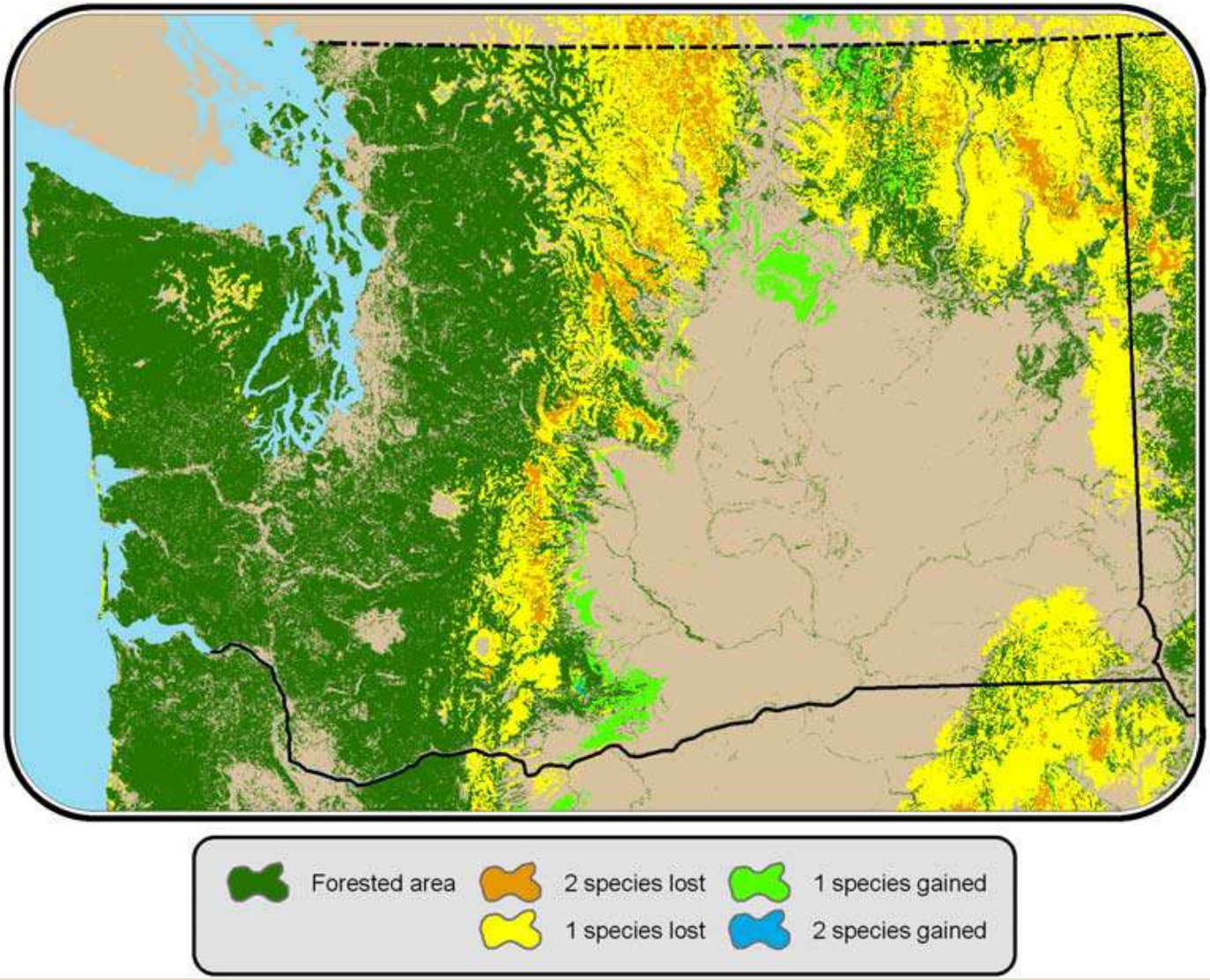
Zolbrod and Peterson 1999

Climate envelope model results for Douglas-fir in the 2060s



Littell et al. 2009

Climate envelope model results for pine species in the 2060s



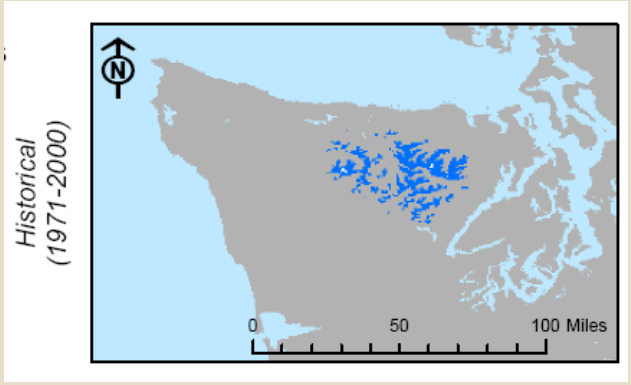
Littell et al. 2009

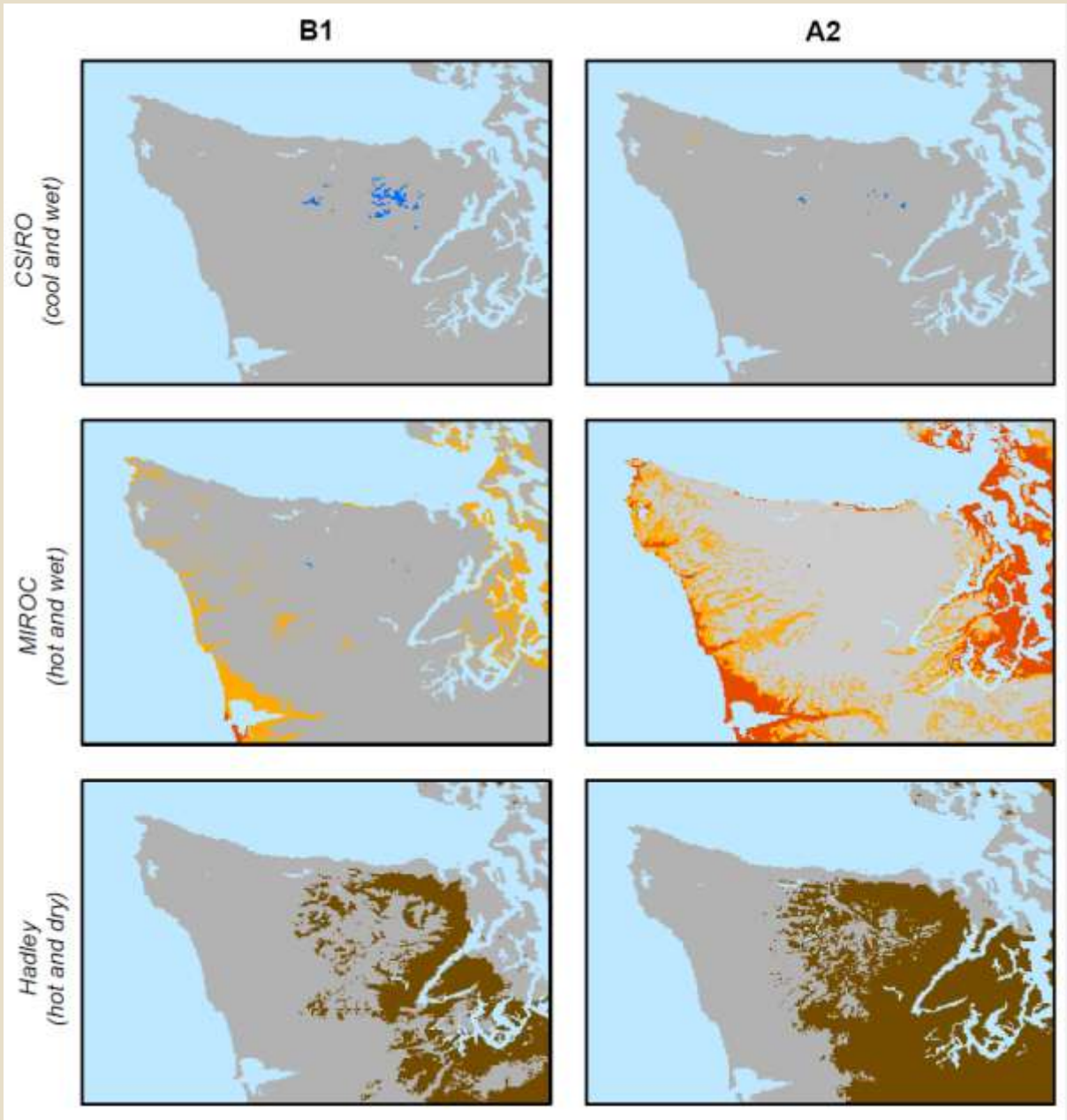
MC1 Model Vegetation Output

2070-2099 Modal Vegetation Type

Legend

- Tundra
- Subalpine Forest
- Maritime Evergreen Needleleaf Forest
- Temperate Evergreen Needleleaf Forest
- Temperate Warm Mixed Forest
- Subtropical Mixed Forest

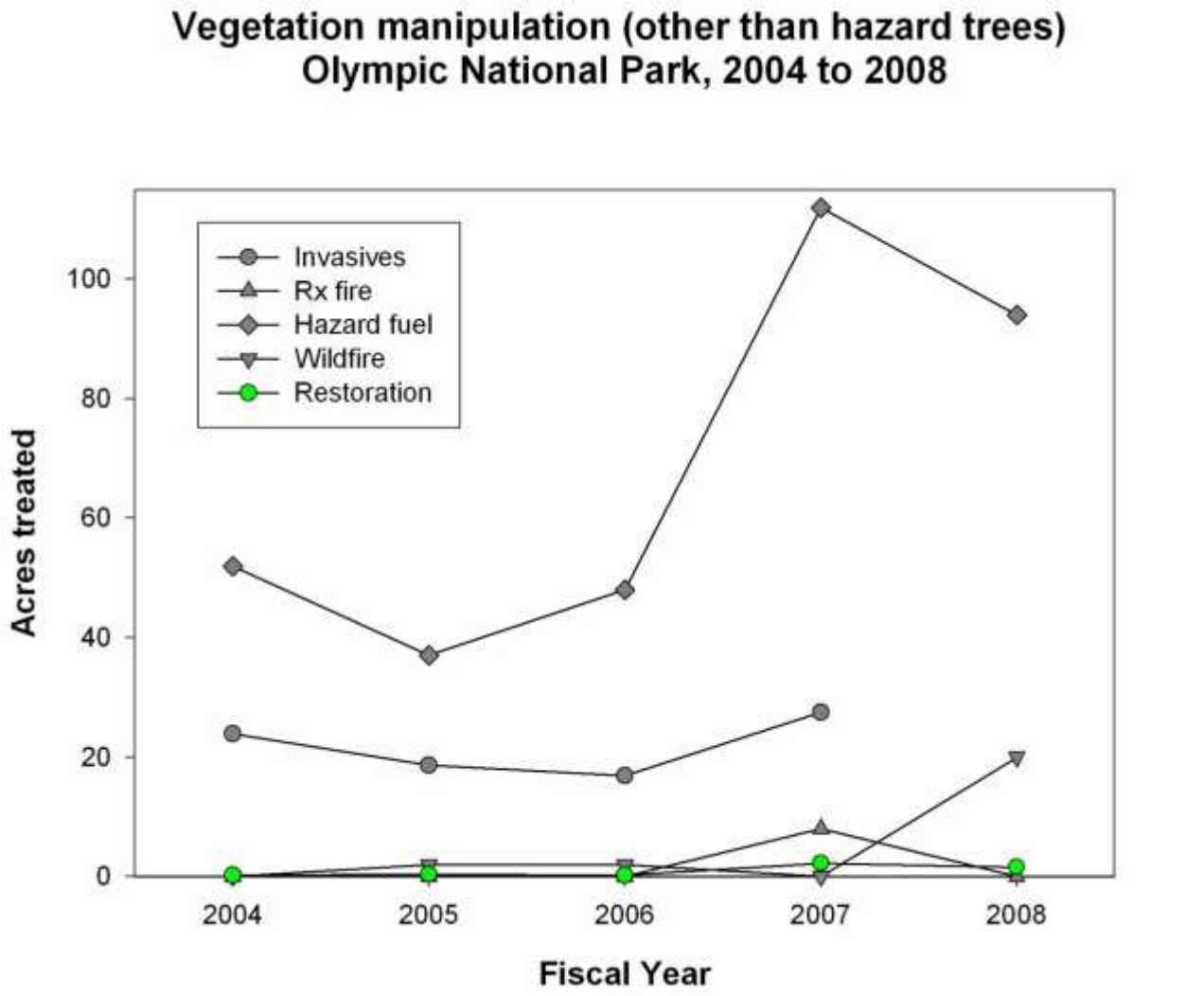




Vegetation Management at ONF

- Conifer planting
  - Seed production
- Disease resistance development
- Gene conservation
- Native plant restoration
- Threatened, Endangered and Sensitive species protection
- Invasive plant treatment
- Thinning

Vegetation Management at ONP



Key vegetation sensitivities to climate change on the Olympic Peninsula

- Altered ecosystem structure and potential disruption of process and function
- Increased opportunity for invasive species establishment
- Potential for mortality events and regeneration failures
- Increased forest drought stress and decreased forest productivity at lower elevations

Sensitivity: Altered ecosystem structure and potential disruption of process and function

Adaptation strategies and actions:

- Prioritize actions that will help maintain ecosystem function
- Focus on actions that will help minimize mass die-off and effects of major disturbances
- Create structures and processes that are viable over the long term

Sensitivity: Increased opportunity for invasive species establishment

Adaptation strategies and actions:

- Continue to implement early detection/rapid response for exotic species treatment (ONF)
- Increase exotic species control efforts (ONP)
- Continue to exchange information on exotic species spread and control between ONF and ONP

Sensitivity: Potential for mortality events and regeneration failures, particularly after large disturbances

Adaptation strategies and actions:

- Develop a gene conservation plan for ex situ collections for long-term storage
- Identify areas important for in situ gene conservation
- Maintain a tree seed inventory with high-quality seed for a range of species
- Increase production of native plant materials for post-flood and post-fire plantings

Sensitivity: Increased forest drought stress and decreased forest productivity at lower elevations

Adaptation strategies and actions:

- Increase thinning activities (ONF)
- Use girdling, falling and leaving trees, prescribed burns, and wildland fire (ONP) to reduce stand densities and drought stress
- Maximize tree species diversity and resilience by retaining minor species during thinning
- Include larger openings in thinning prescriptions and plant seedlings in the openings to create seed sources for native drought-tolerant species

Sensitivity: All of the above

Adaptation strategies and actions:

- Conduct integrated and consistent inventory and monitoring of vegetation
- Focus monitoring on sensitive locations such as wetlands and high elevations, on endemic or at-risk species, and on plant phenology
- Use feedback from monitoring in implementation of adaptive management

Dealing with uncertainty in the Olympic Case Study

- Focused on changes that have already been observed with recent warming
- Focused on similarities between different future climate and impacts scenarios and most likely trends
- Used local knowledge to help predict system response to changing climate
- Focused on ‘no regrets’ strategies

For more information on the Olympic Case Study, see:

http://www.fs.fed.us/pnw/pubs/pnw_gtr844.pdf