

Large-scale forest restoration in the coastal Sitka spruce forest zone:

An experimental approach at Willapa Bay, Washington



Mission Statement

The mission of The Nature Conservancy is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive.

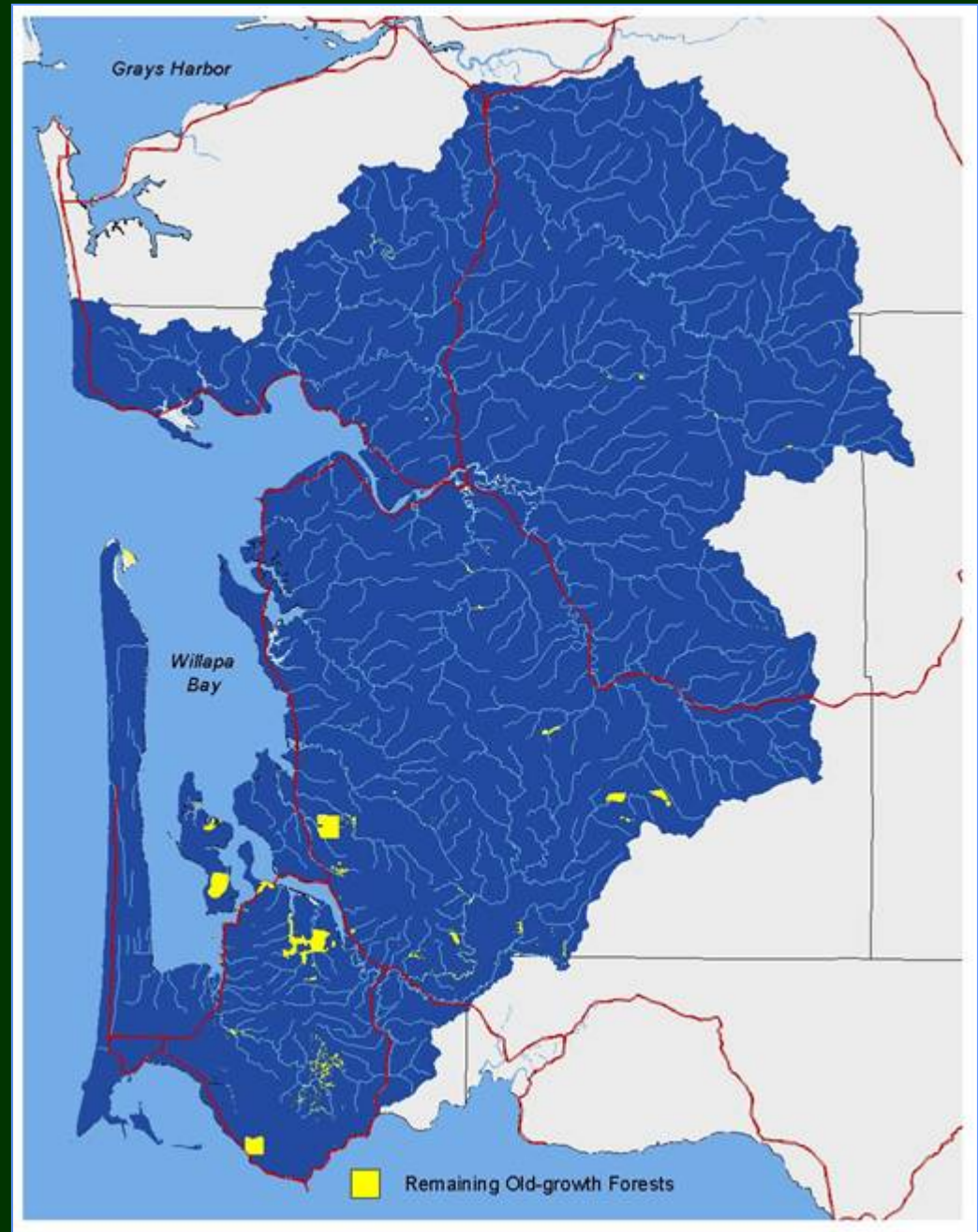


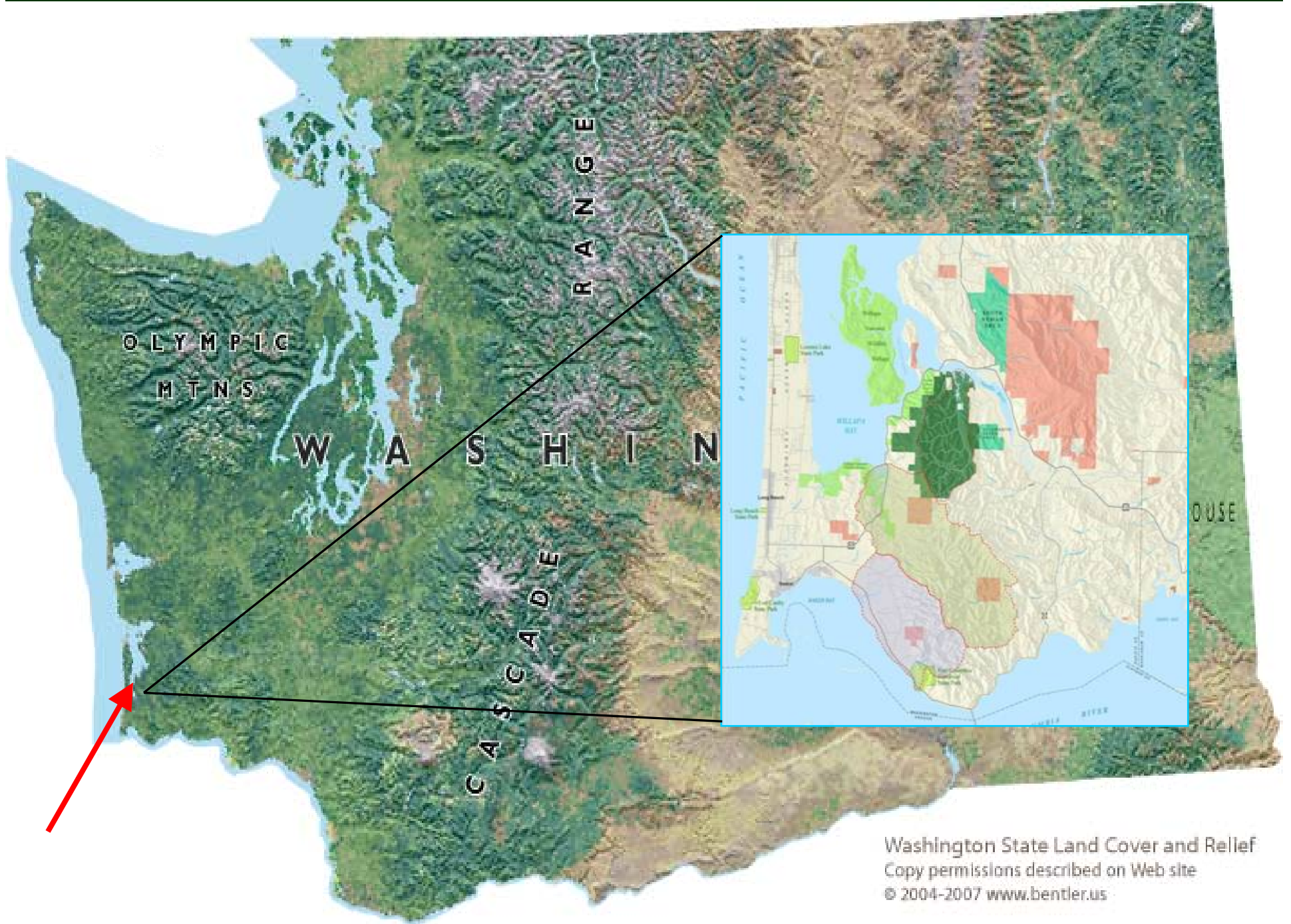
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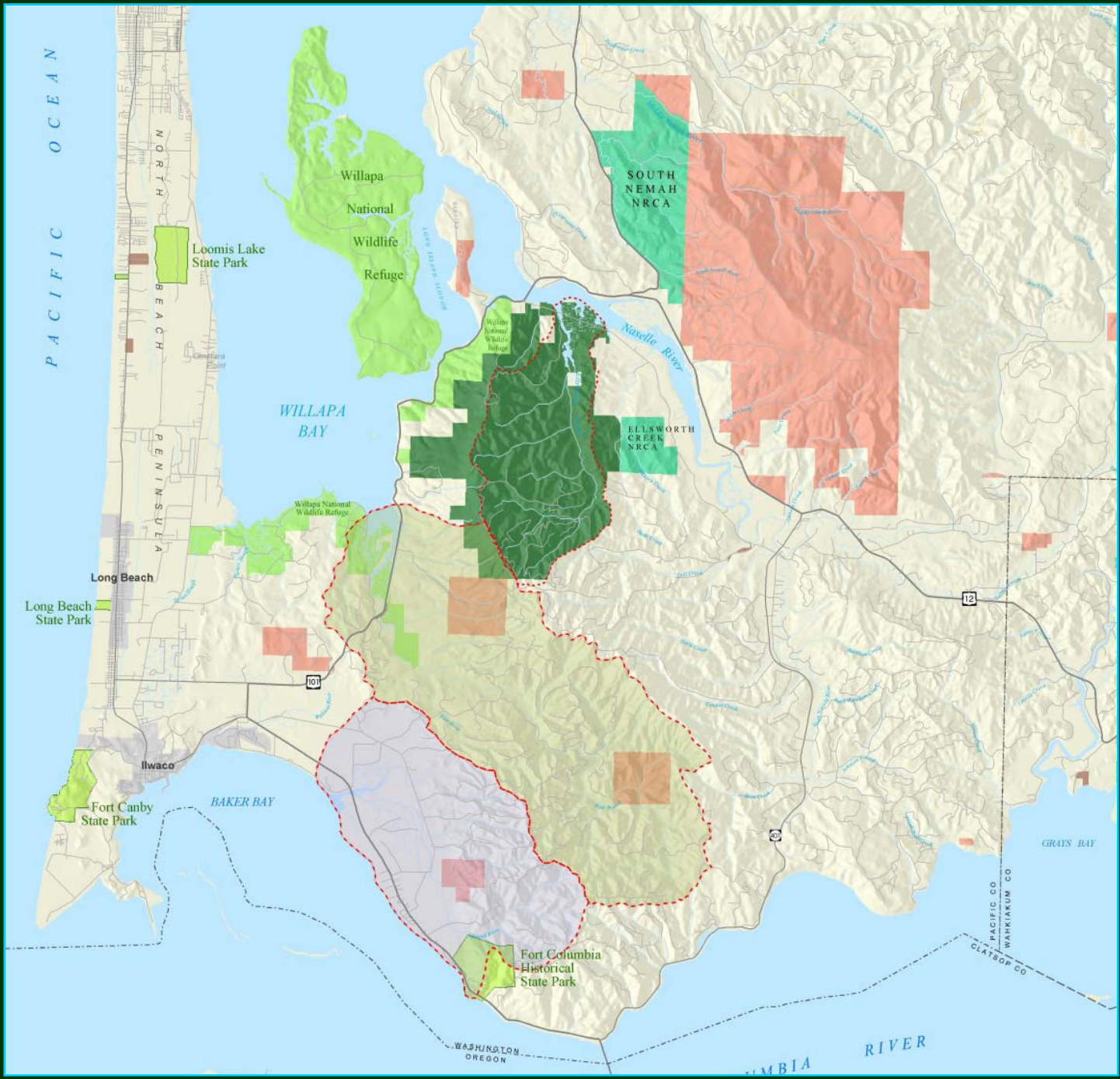
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Remaining old-growth forest in southwest Washington as of 2001





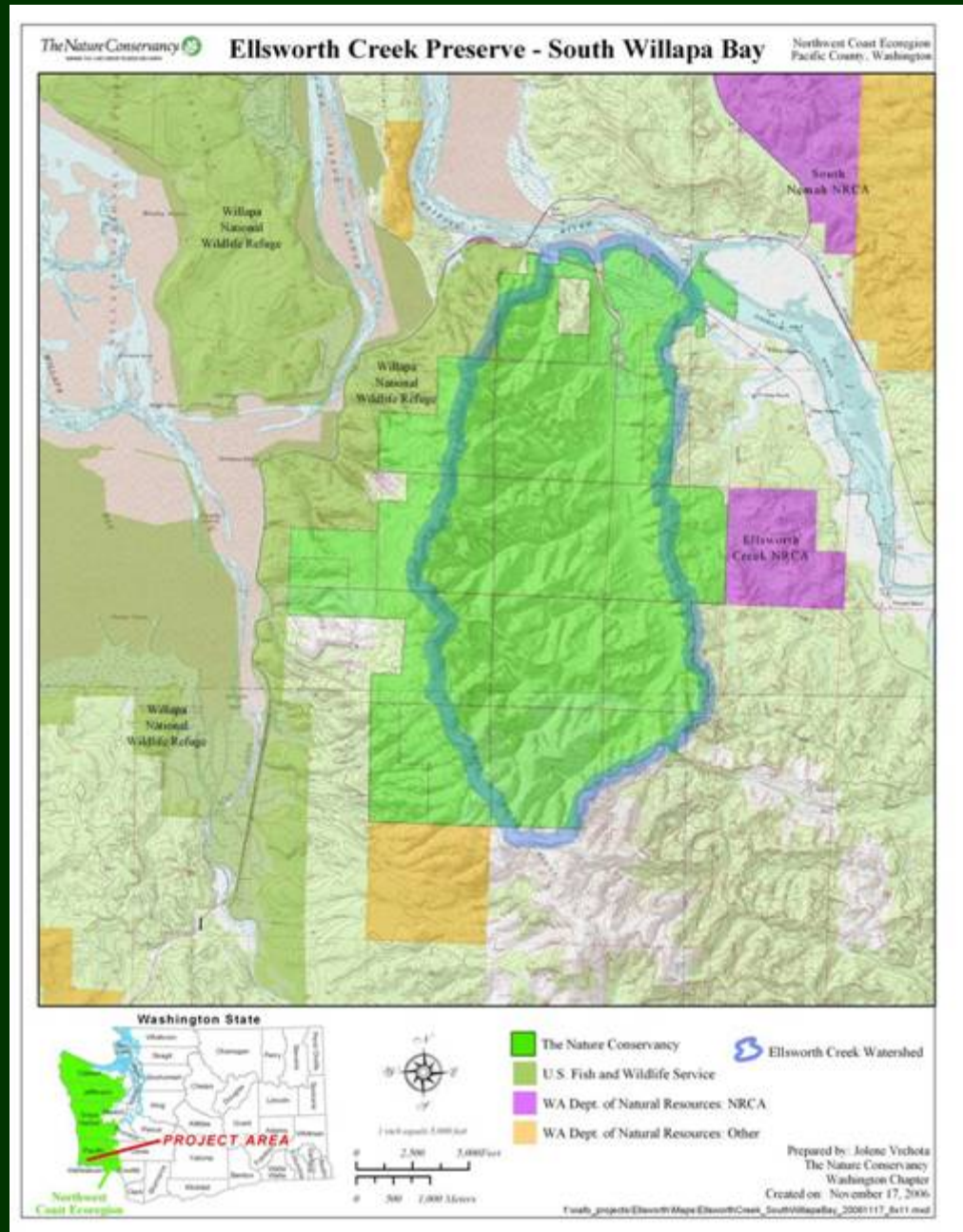
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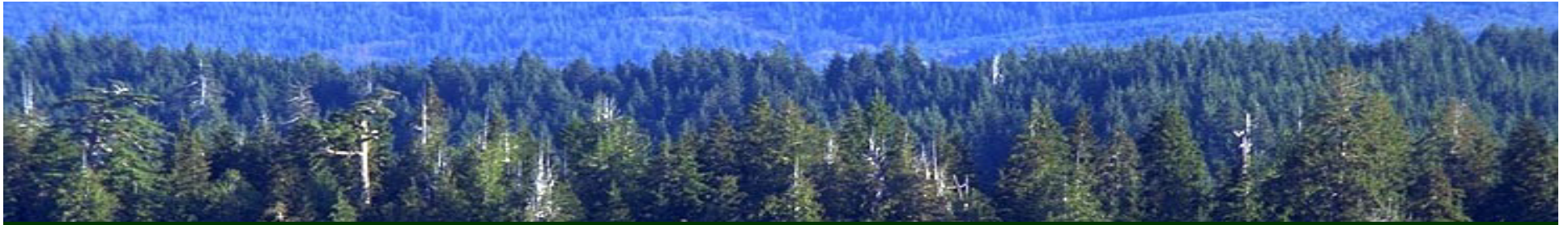


South Willapa Bay - 2006

Ellsworth Creek Preserve
(approx. 7,436 acres)

- Total cost approx. \$19.5 million
 - Individuals 43%
 - Public 36%
 - Foundations 20%
 - Corporations 1%



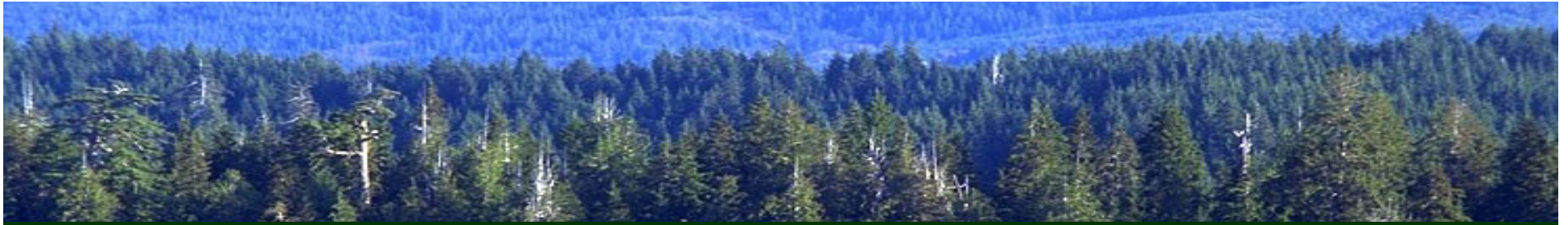


Primary Goal for the South Willapa Bay Conservation Area



“To restore ecologically functional estuarine, freshwater, and upland forest habitats that are capable of supporting species and ecological processes typically found within late-successional forest landscapes of the Pacific Northwest coast”





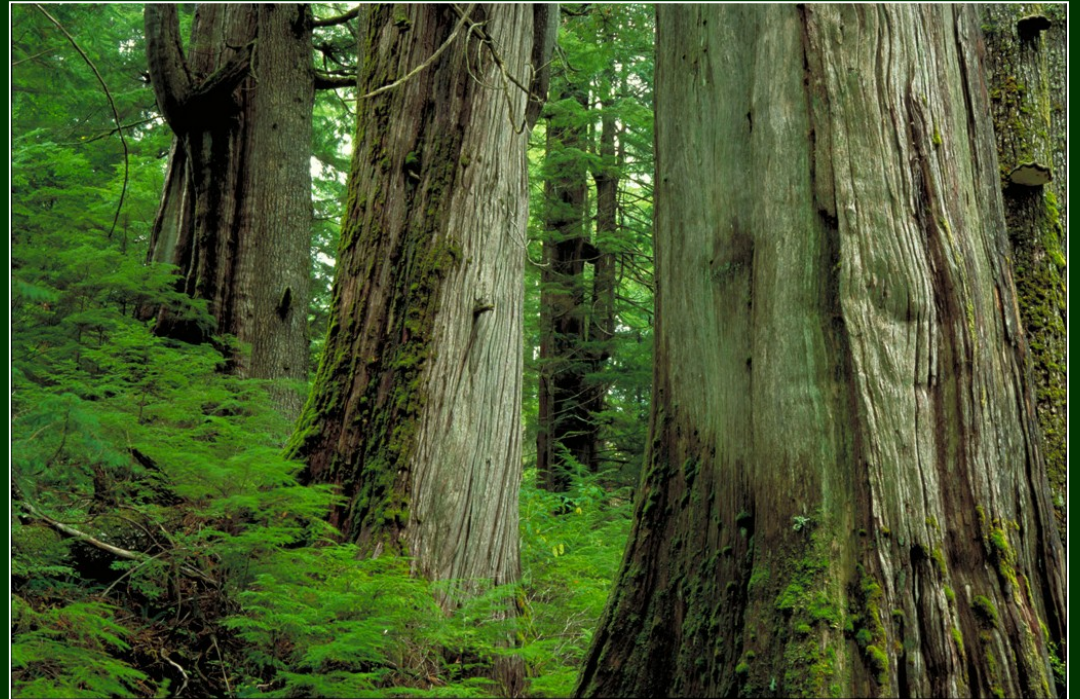
Desired Future Conditions

- Ecosystem resistance and resilience
 - Wind disturbance
 - Climate change
- Spatial and Temporal Variability across the landscape
- Functional Landscape Linkages – *Upland Forest*
...Freshwater
- Habitat for Late-successional species – *i.e. murrelets*
- Ultimately...Natural processes shape the landscape

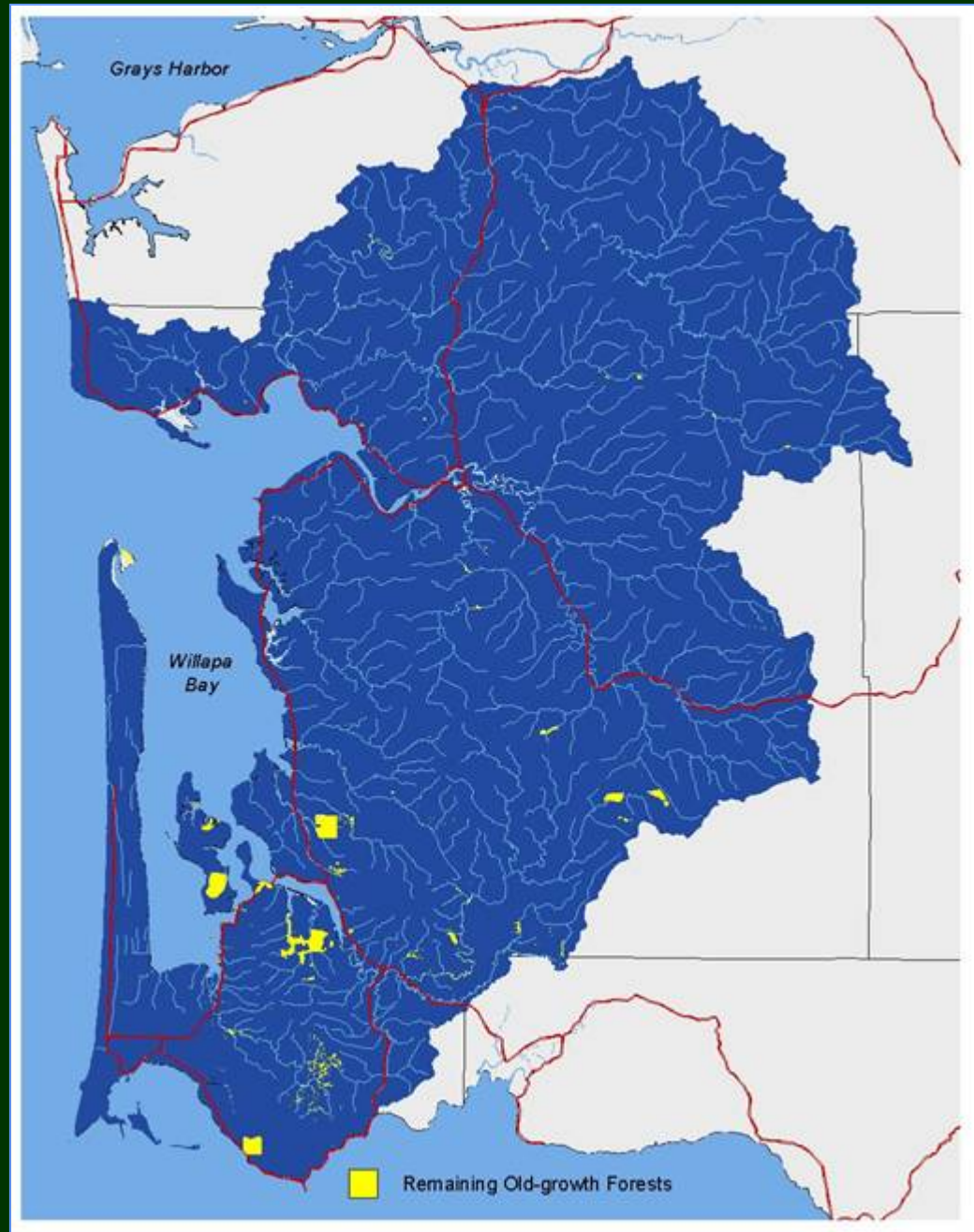


Outline

- Adaptive management design
- Forest Conditions & management direction
- Treatment objectives
- Challenges

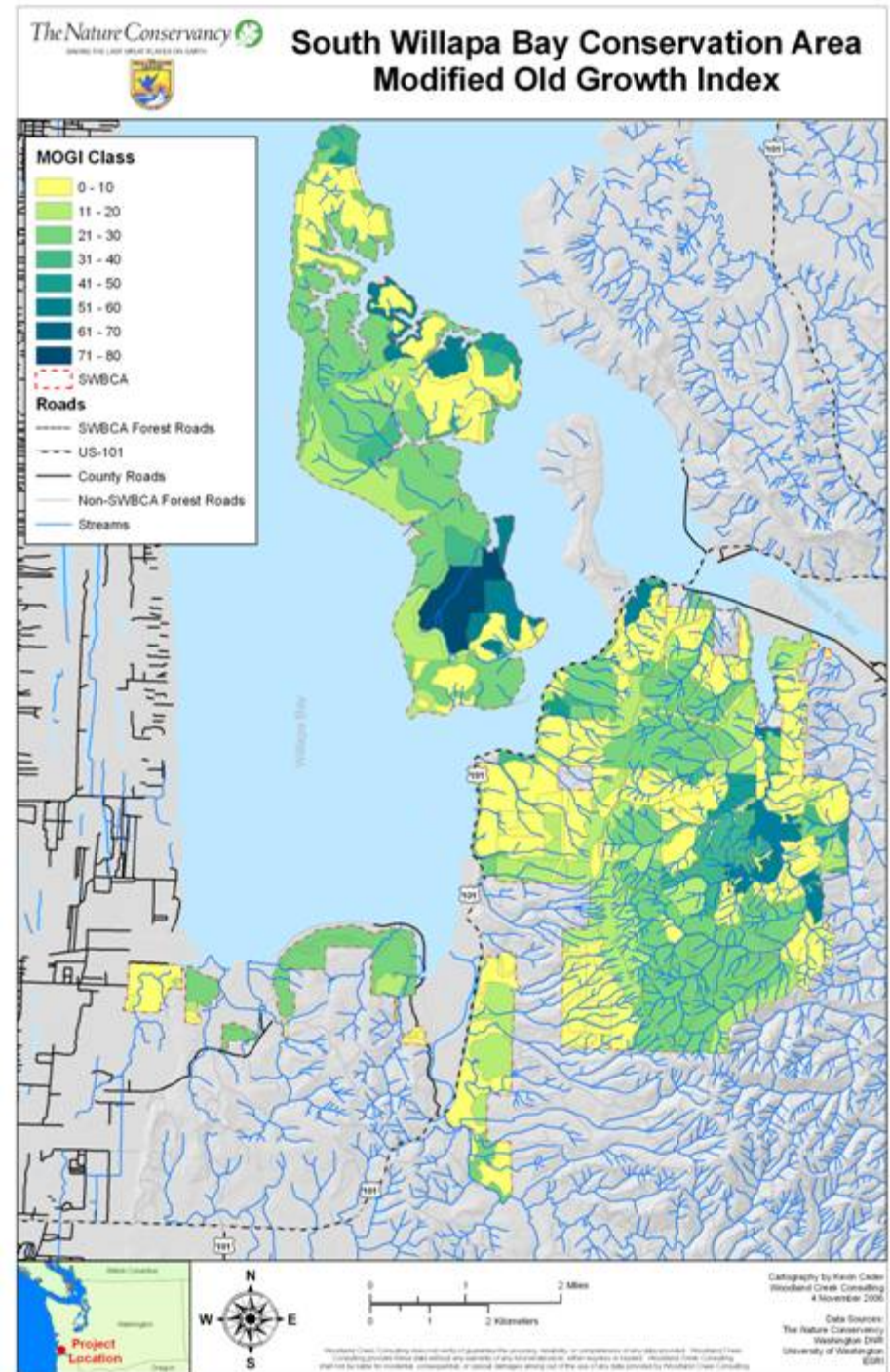


Remaining old-growth forest in southwest Washington as of 2001



Remaining Old Growth

- Large trees (number per acre > 100 cm dbh [40 inches])
- Large snags (number per hectare > 50 cm dbh and > 15 m tall [20 inches dbh; 49 feet tall])
- Volume of down woody debris (cubic meters per hectare)
- Tree size diversity: (# of trees in the following 4 diameter classes: 2-9.9", 10-19.9", 20-39.9", 40"+)





Science Review Panel

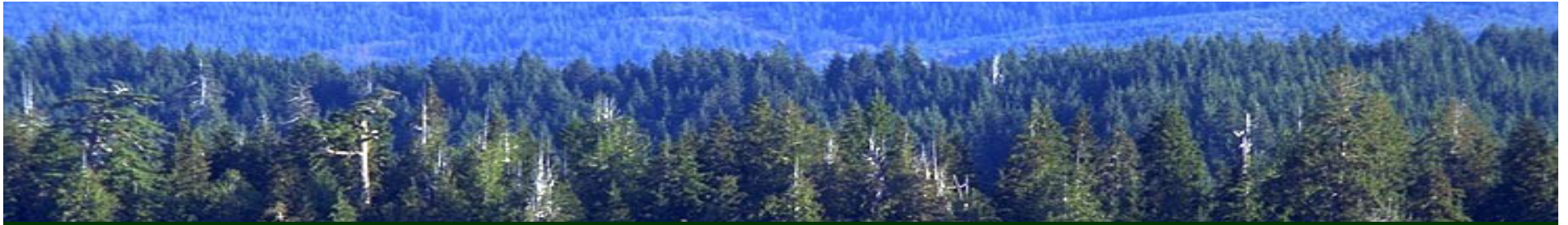
- **Dr. Timothy Beechie - NOAA, Northwest Fisheries Science Center**
- **Dr. Robert Bilby - Weyerhaeuser Company**
- **Dr. Michelle Marvier - Santa Clara University**
- **Dr. Nalini Nadkarni - Evergreen State College & Int. Canopy Network**
- **Dr. Nathan Poage - USFS Portland Forestry Sciences Laboratory**
- **Dr. Martin Raphael - USFS Olympia Forestry Sciences Laboratory**
- **Dr. Daniel Schindler - University of Washington**
- **Dr. Thomas Spies - USFS Corvallis Forestry Sciences Laboratory**

Acknowledging Uncertainties

Big questions about...

- Ecology of Sitka-spruce forests and response to restoration activities
- Effectiveness of restoration techniques, including thinning, and development of late-successional forest structure
- Restoration at larger scales (e.g., multiple stands, watersheds)
- Ecological interactions of freshwater and terrestrial systems
- Cost





Key Study Questions

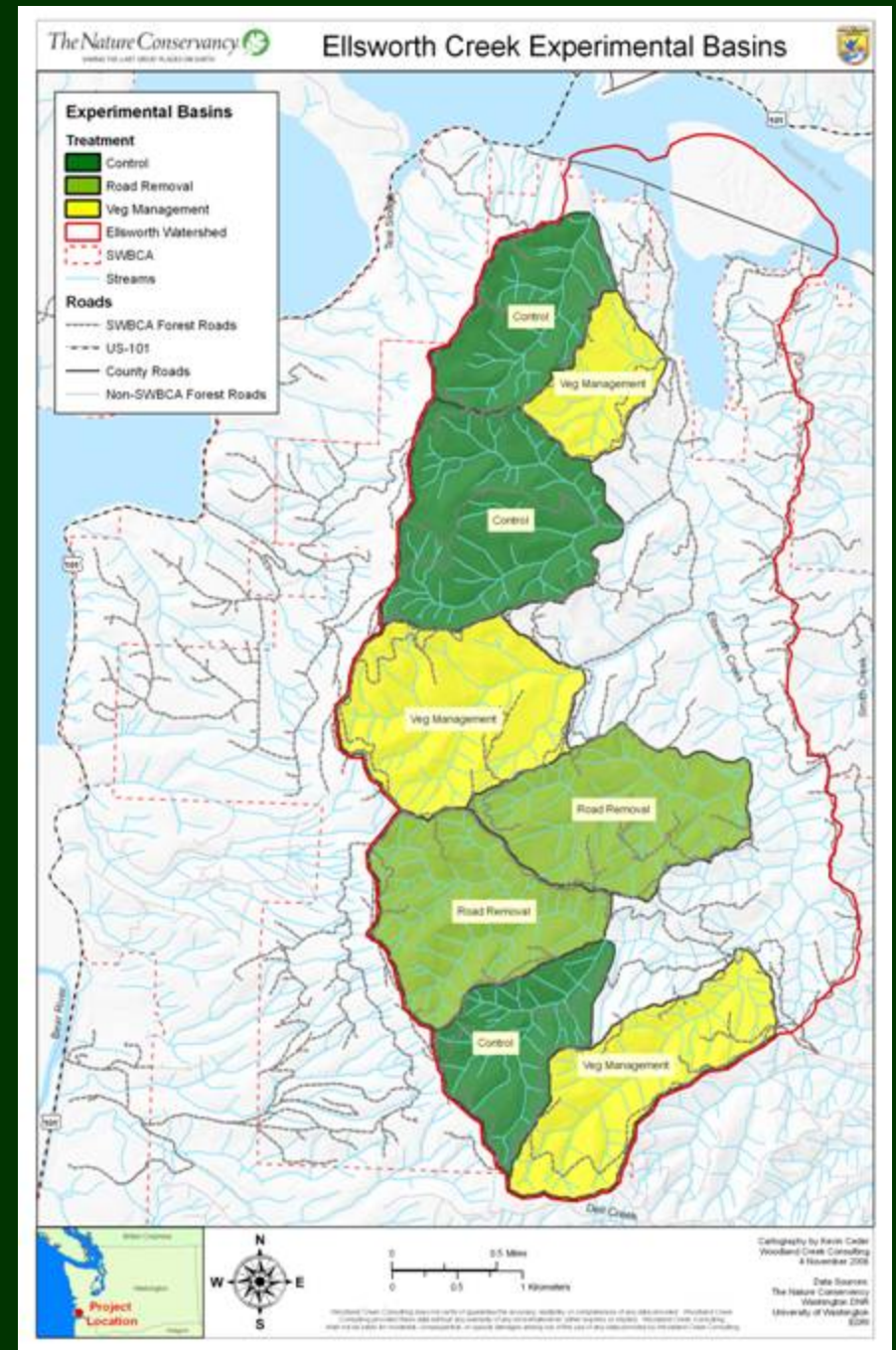
- Can systems resembling natural late-successional landscapes be restored from plantation forests?
- Can a management system be designed and implemented to accelerate ecosystem recovery?
- How do you restore a landscape cost effectively?

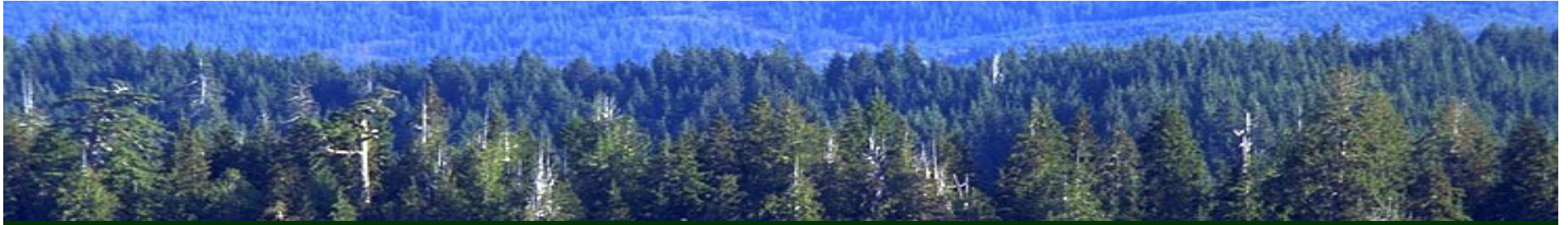


Experimental Design

Unbalanced Randomized Block Design

- Eight experimental basins
- Basin size 75 – 220 ha
- Three blocks (N, C, S)
- Three treatments
 - Control (3)
 - Thin (vegetation manipulation) (3)
 - Road removal (2)



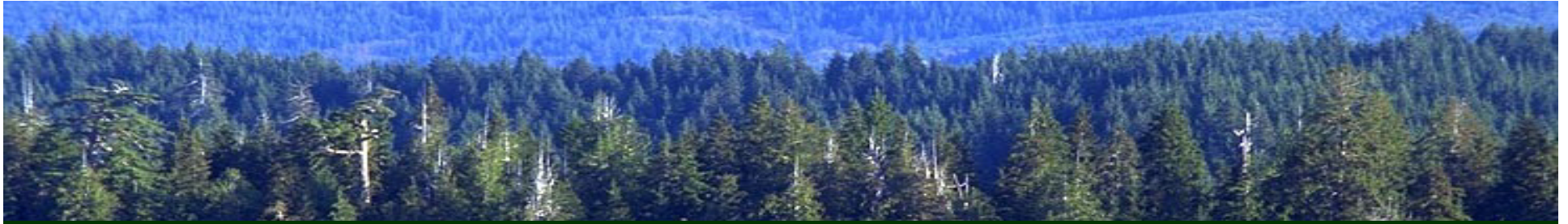


Restoration Pathways

CONTROL

- Leave forests to develop without management intervention
- Maintain an appropriate road system (adhere to legal and management objectives; permit future management without increasing threat of road related hazards)
- Reevaluate treatment in 10 years in context of adaptive management strategy





Restoration Pathways

THIN (VEGETATION MANAGEMENT)

- Actively thin forest stands to low residual stand densities (wide range of prescriptions)
- Limited planting of trees/shrubs, not expected to be extensive
- Maintain an appropriate road system (adhere to legal and management objectives; permit future management without increasing threat of road related hazards)





Restoration Pathways

ROAD REMOVAL

- Retain only roads necessary for management or legal purposes
- Remove and re-contour all other roads
- Leave forests to develop without management intervention



Baseline Monitoring Variables

Habitat/Structure

- Forest Vegetation – 224 permanent plots, LIDAR
- Stream Reaches – 48 index reaches

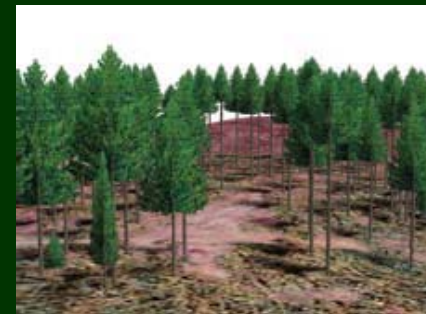
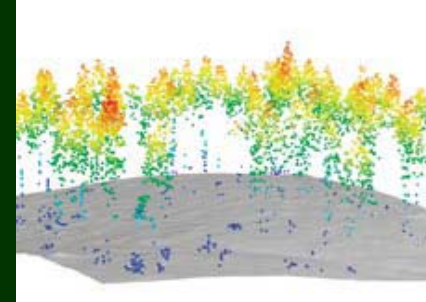
Bio-indicators

- Forest understory vegetation
- Forest birds – variable circular plots (112)
- Headwater stream amphibians - spotlight
- Salmonids – spawning counts
- Stream macroinvertebrates
- Fish community – electrofish/snorkel survey

Ecological Processes

- Natural disturbance (windthrow, disease, landslides) – LIDAR/aerial photos
- Watershed hydrology – stream flow gauges, road connectedness

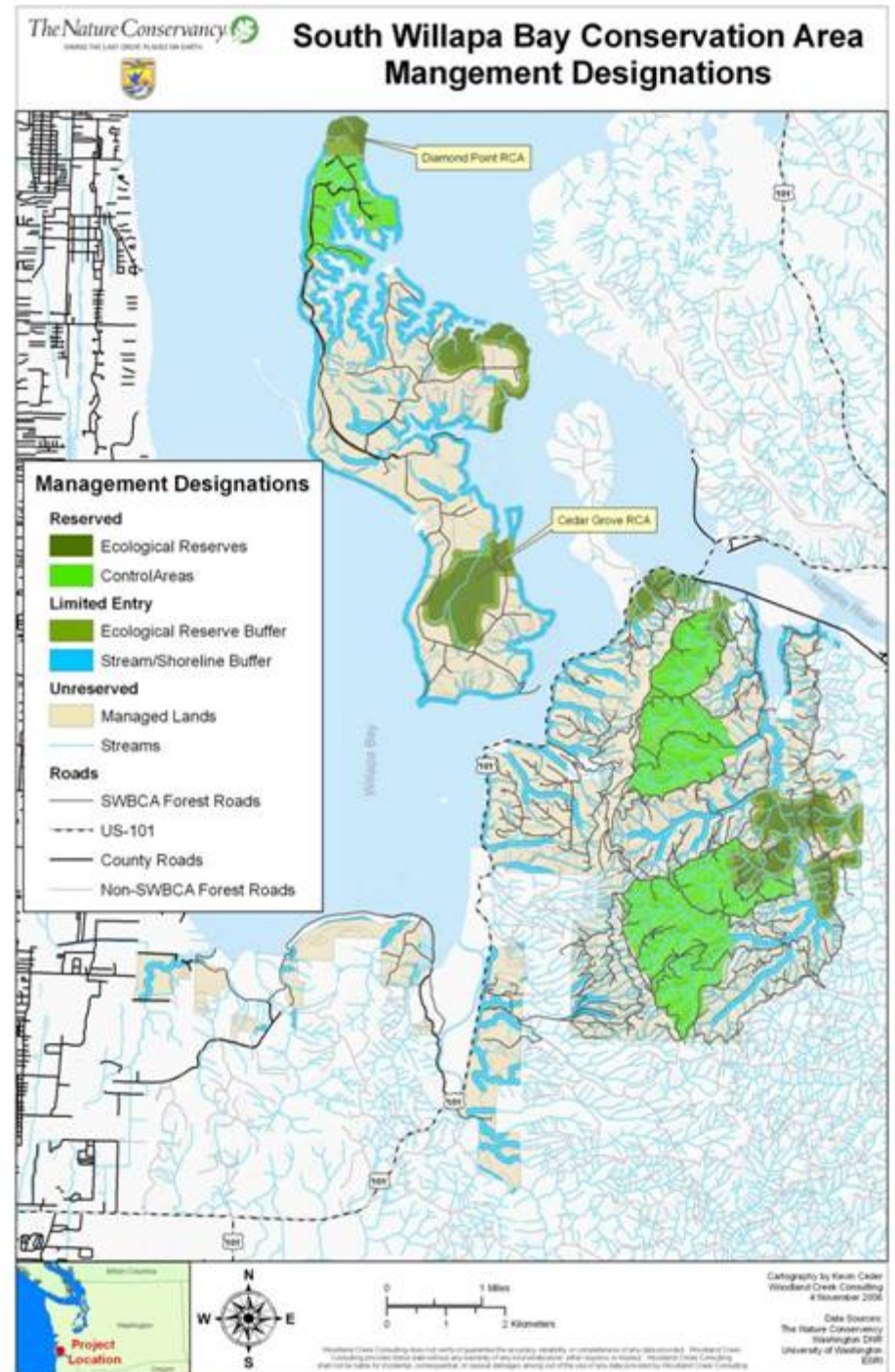
Cost



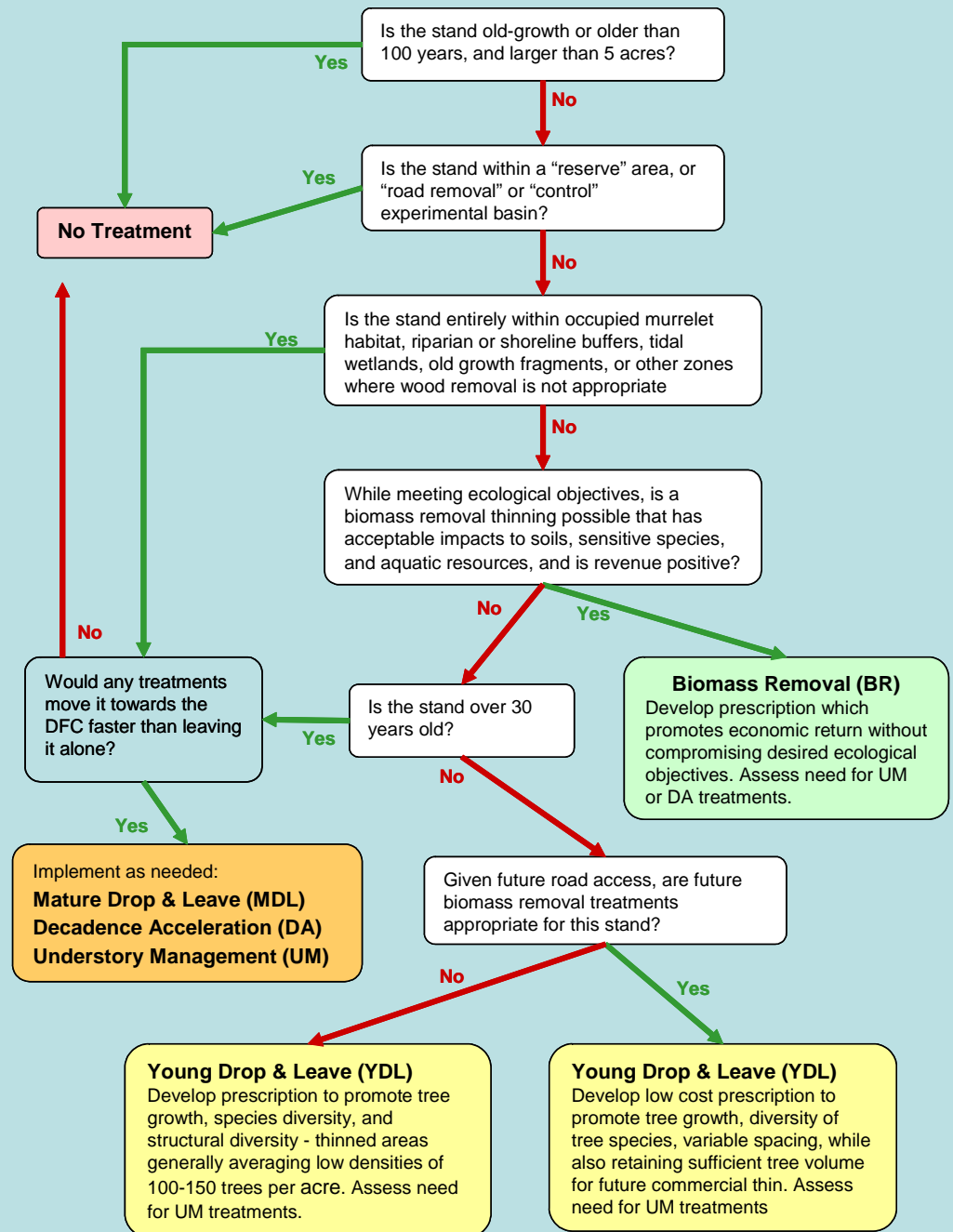
LIDAR data and model (USFS)

Management Zones

- Ecological Reserves (965 ac.)
- Control Areas (2,418 ac.)
- Limited Entry Buffers (3,961 ac.)
- Managed Lands (6,824 ac.)

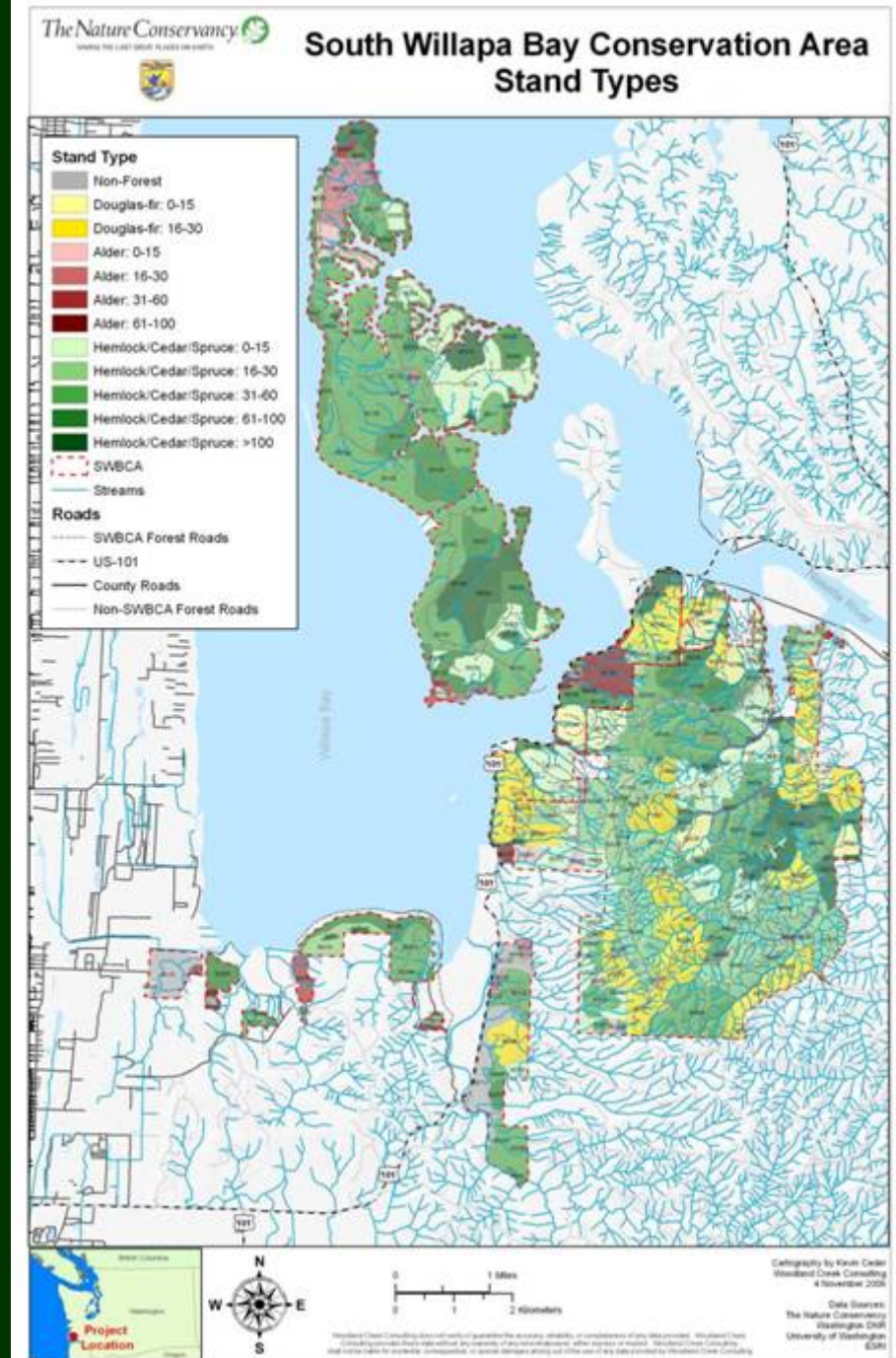
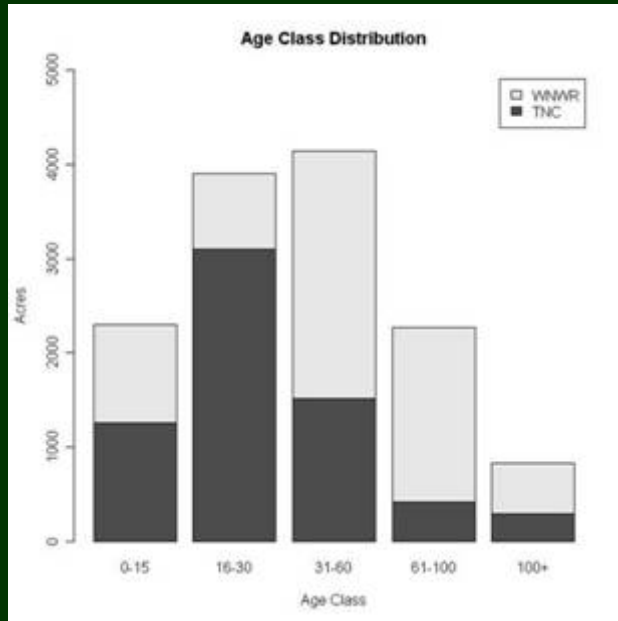


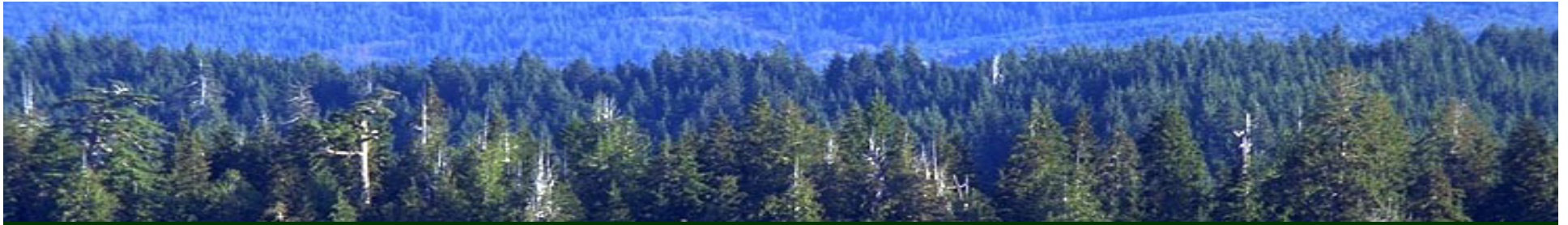
Decision-making Process



Stand Types

Stand Type	All	
	Total Number of acres & (stands)	
WH-SS-RC-1 (0-15yr)	1,719	(33)
WH-SS-RC-2 (15-30)	1,818	(34)
WH-SS-RC-3 (30-60)	4,009	(52)
WH-SS-RC-4 (60-100)	2,048	(51)
WH-SS-RC-5 (100+)	826	(13)
Douglas-fir-1 (0-15yr)	564	(12)
Douglas-fir-2 (15-30)	1,882	(21)
Red Alder-1 (0-15yr)	150	(5)
Red Alder-2 (15-30)	222	(6)
Red Alder-3 (30-60)	253	(16)
Red Alder-4 (60-100)	220	(6)
Non-forest	458	(11)
Totals	14,170	(260)





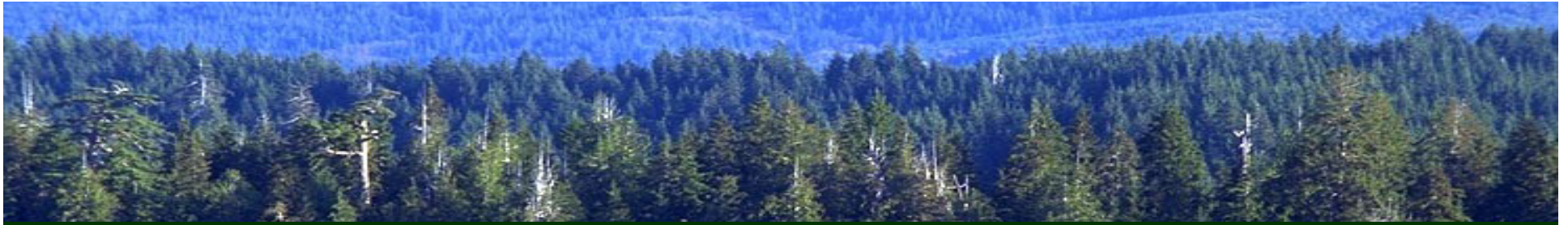
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Application of Treatments

- Increase forest stand resistance to wind disturbance
 - Promote western red cedar through selective thinning
 - Decrease height-diameter ratios
- Develop late-successional habitat characteristics
 - Density management, promote growth of large trees
 - Maintain decadence (e.g., mistletoe brooms)
- Enhance spatial heterogeneity
 - Variable-density thinning and uniform thinning
- Restore landscape linkages
 - Thin in riparian areas and mass-wasting zones

Challenges

- Cost Effectiveness and Transferability
 - Balancing ecological outcomes vs. financial returns
 - Feasible restoration model?
- Different ownership management objectives (refuge, TNC)
- Incorporating natural processes (wind, disease, insects) into restoration design.
- Considering effects of climate change
- When are we done? How many treatments?

Questions?

