CLIMATE CHANGE AND FOREST BIODIVERSITY:

A VULNERABILITY ASSESSMENT AND ACTION PLAN FOR NATIONAL FORESTS IN WASHINGTON

USDA Forest Service, Pacific Northwest Region

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The question:

Can the national forests in Washington conserve biodiversity and increase resilience, given predicted changes in climate?

The goal:

A 5-year, practical action plan to implement in partnership w/ NPS, WDNR, PNW Research Station

The focus:

- Forest tree species, both widespread and rare
- Non-forested habitats vulnerable to climate change

Initial Project

Objective: find a flexible, transparent system of rating vulnerability of tree species to climate change

Examined 3 Vulnerability Indices:

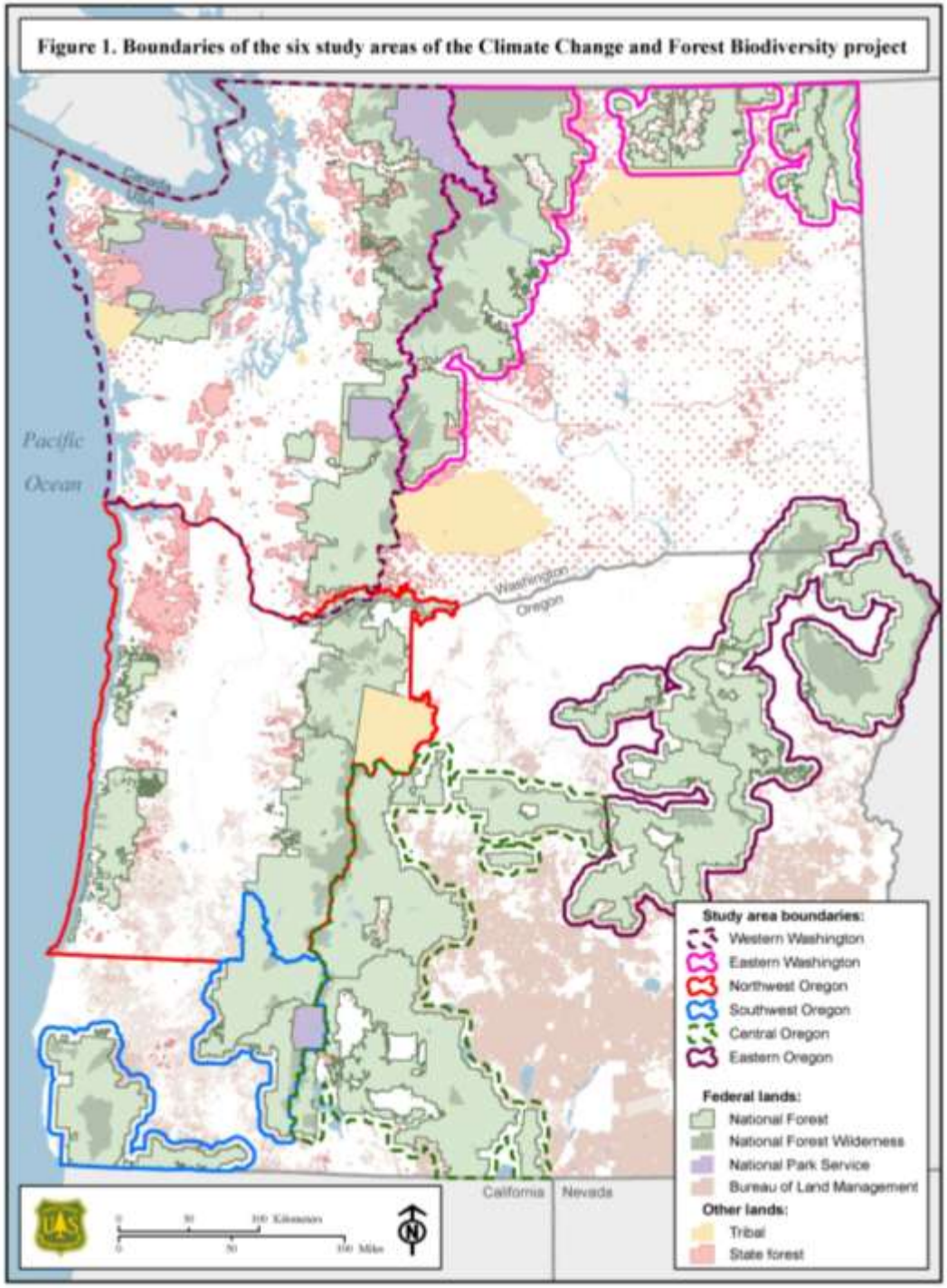
- NatureServe Climate Change Vulnerability Index version 2.0
- Climate Change Sensitivity Database (part of the Pacific Northwest Climate Change Vulnerability Assessment)
- Forest Tree Genetic Risk Assessment System, ForGRAS (Potter & Crane; Eastern Forest Environmental Threat Assessment Center)

Applied ForGRAS: Western Washington Forests

Now: Expanding to all forests within region based on six study areas

Completion Date: June 2012

Figure 1. Boundaries of the six study areas of the Climate Change and Forest Biodiversity project



Five Risk Factors (ForGRAS Model)

- Distribution

  frequency of occurrence, distribution of occurrences

- Reproductive Capacity

  seed production, min. seed-bearing age, seed dispersal distance

- Adaptive Genetic Variation

  generalist vs. specialist, disjunct populations

- Habitat Affinities

  drought tolerance, successional stage

- Insect and Disease Threats

  ID'd by USFS Forest Health Protection

Identified species in each study area and assigned to groups:

- Common overstory
- Limited distribution or understory
- Rare species

Table 3. Native tree species of eastern Washington

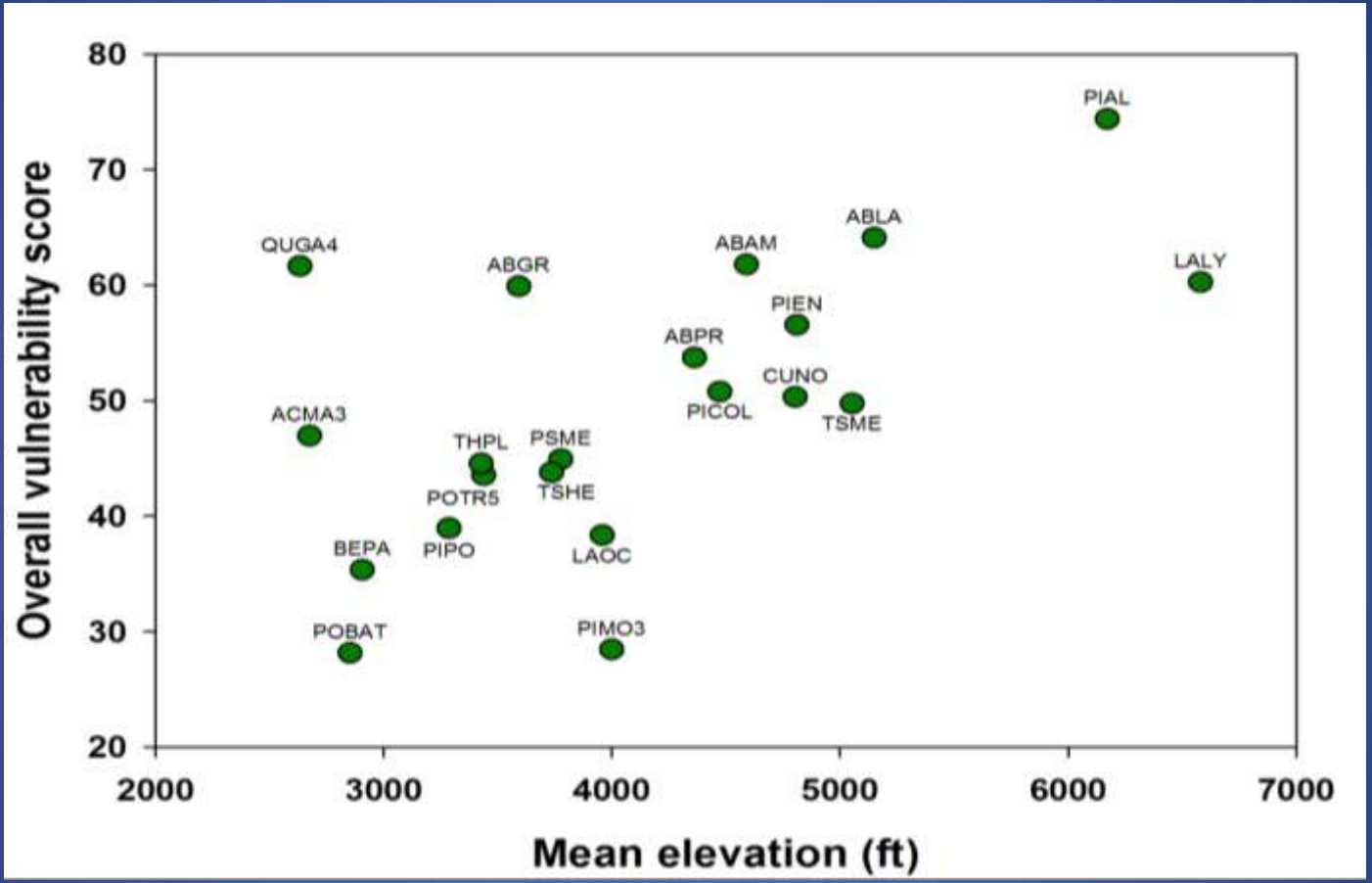
Scientific name	Common name	Symbol	Group	Division	Type
Abies amabilis	Pacific silver fir	ABAM	1	Conifer	Evergreen
Abies grandis	Grand fir	ABGR	1	Conifer	Evergreen
Abies lasiocarpa	Subalpine fir	ABLA	1	Conifer	Evergreen
Abies procera	Noble fir	ABPR	1	Conifer	Evergreen
Acer macrophyllum	Bigleaf maple	ACMA3	1	Broadleaf	Deciduous
Betula papyrifera	Paper birch	BEPA	1	Broadleaf	Deciduous
Cupressus nootkatensis	Alaska yellow-cedar	CUNO	1	Conifer	Evergreen
Larix lyallii	Subalpine larch	LALY	1	Conifer	Deciduous
Larix occidentalis	Western larch	LAOC	1	Conifer	Deciduous
Picea engelmannii	Engelmann spruce	PIEN	1	Conifer	Evergreen
Pinus albicaulis	Whitebark pine	PIAL	1	Conifer	Evergreen
Pinus contorta var. *latifolia*	Lodgepole pine	PICOL	1	Conifer	Evergreen
Pinus monticola	Western white pine	PIMO3	1	Conifer	Evergreen
Pinus ponderosa	Ponderosa pine	PIPO	1	Conifer	Evergreen
Populus balsamifera ssp. trichocarpa	Black cottonwood	POBAT	1	Broadleaf	Deciduous
Populus tremuloides	Quaking aspen	POTR5	1	Broadleaf	Deciduous
Pseudotsuga menziesii vars. *menziesii* and *glauca*	Douglas-fir	PSME	1	Conifer	Evergreen
Quercus garryana	Oregon white oak	QUGA4	1	Broadleaf	Deciduous
Thuja plicata	Western redcedar	THPL	1	Conifer	Evergreen
Tsuga heterophylla	Western hemlock	TSHE	1	Conifer	Evergreen
Tsuga mertensiana	Mountain hemlock	TSME	1	Conifer	Evergreen
Acer glabrum, A. glabrum var. *douglasii*	Rocky Mountain maple, Douglas maple	ACGL, ACGLD4	2	Broadleaf	Deciduous
Alnus rubra	Red alder	ALRU2	2	Broadleaf	Deciduous
Betula occidentalis	Water birch	BEOC2	2	Broadleaf	Deciduous
Celtis laevigata var. reticulata	Netleaf hackberry	CELAR	2	Broadleaf	Deciduous
Frangula purshiana	Cascara	FRPU7	2	Broadleaf	Deciduous
Juniperus scopulorum	Rocky Mountain juniper	JUSC2	2	Conifer	Evergreen
Prunus emarginata	Bitter cherry	PREM	2	Broadleaf	Deciduous
Salix lucida ssp. lasiandra	Pacific willow	SALUL	2	Broadleaf	Deciduous
Salix scouleriana	Scouler's willow	SASC	2	Broadleaf	Deciduous
Taxus brevifolia	Pacific yew	TABR2	2	Conifer	Evergreen

Summary of 5 risk factor scores, and overall vulnerability scores, in a climate change vulnerability assessment of major eastern Washington tree species

Species	Common name	Risk factor scores					Overall score[1]
		Distribution	Reproductive capacity	Habitat affinity	Adaptive genetic variation	Insects and disease	
Pinus albicaulis	Whitebark pine	57	100	45	100	70	**74**
Abies lasiocarpa	Subalpine fir	33	75	71	67	74	**64**
Abies amabilis	Pacific silver fir	56	75	83	67	28	**62**
Quercus garryana	Oregon white oak	89	100	15	100	5	**62**
Larix lyallii	Subalpine larch	59	75	100	67	0	**60**
Abies grandis	Grand fir	53	75	23	67	81	**60**
Picea engelmannii	Engelmann spruce	43	75	68	67	30	**57**
Abies procera	Noble fir	100	75	47	33	14	**54**
Pinus contorta var. *latifolia*	Lodgepole pine	28	25	31	100	70	**51**
Cupressus nootkatensis	Alaska yellow-cedar	76	75	68	33	0	**50**
Tsuga mertensiana	Mountain hemlock	66	50	70	33	30	**50**
Acer macrophyllum	Bigleaf maple	54	25	49	100	7	**47**
Pseudotsuga menziesii	Douglas-fir	0	0	25	100	100	**45**
Thuja plicata	Western redcedar	60	50	39	67	7	**45**
Tsuga heterophylla	Western hemlock	62	25	58	67	7	**44**
Populus tremuloides	Quaking aspen	66	50	39	33	30	**44**
Pinus ponderosa	Ponderosa pine	38	0	20	67	70	**39**
Larix occidentalis	Western larch	50	0	26	67	49	**38**
Betula papyrifera	Paper birch	75	25	0	33	44	**35**
Pinus monticola	Western white pine	71	0	44	0	28	**28**
Populus balsamifera ssp. *trichocarpa*	Black cottonwood	60	0	34	33	14	**28**

[1] Calculated by averaging the scores from the five risk factors, each with a range of 0 to 100. Higher scores indicate greater vulnerability.

Results



Overall Pattern: Higher Elevation Species are more Vulnerable

Recommendations

3 Categories of Action Items:

- Learn about and track changes in plant communities as climate changes
- Maintain and enhance biodiversity and increase resilience
- Prepare for future

Caution:

Look beyond Vulnerability Score & use risk factors

Example: Douglas fir has low score but is at a higher risk for insect and diseases on the east side