

Rescuing Remnants V. Extreme Makeover: Restoring Oak Ecosystems Across Their Range of Historical Variability

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Historical Range of Variability (HROV) of oak savanna grasslands

What is “HROV”?

Why care about it?

What was it?

What happened to it?

What can we do to restore it?



Myths and Texts

- 1) Oak savanna is restricted to relatively harsh environments
- 2) Restoration should focus on sites that have the best current oak habitat
- 3) A connected system of protected reserves is the best landscape-level conservation strategy
- 3) Pre-Euro-American settlement conditions provide a sound restoration goal

Overview of the Use of Natural Variability Concepts in Managing Ecological Systems.

Peter B. Landres; Penelope Morgan; Frederick J. Swanson

Ecological Applications, Vol. 9, No. 4. (Nov., 1999), pp. 1179-1188.

DEFINING NATURAL VARIABILITY

We define natural variability as the ecological conditions, and the spatial and temporal variation in these conditions, that are relatively unaffected by people, within a period of time and geographical area appropriate to an expressed goal.

What Is Ecosystem Management?

R. EDWARD GRUMBINE

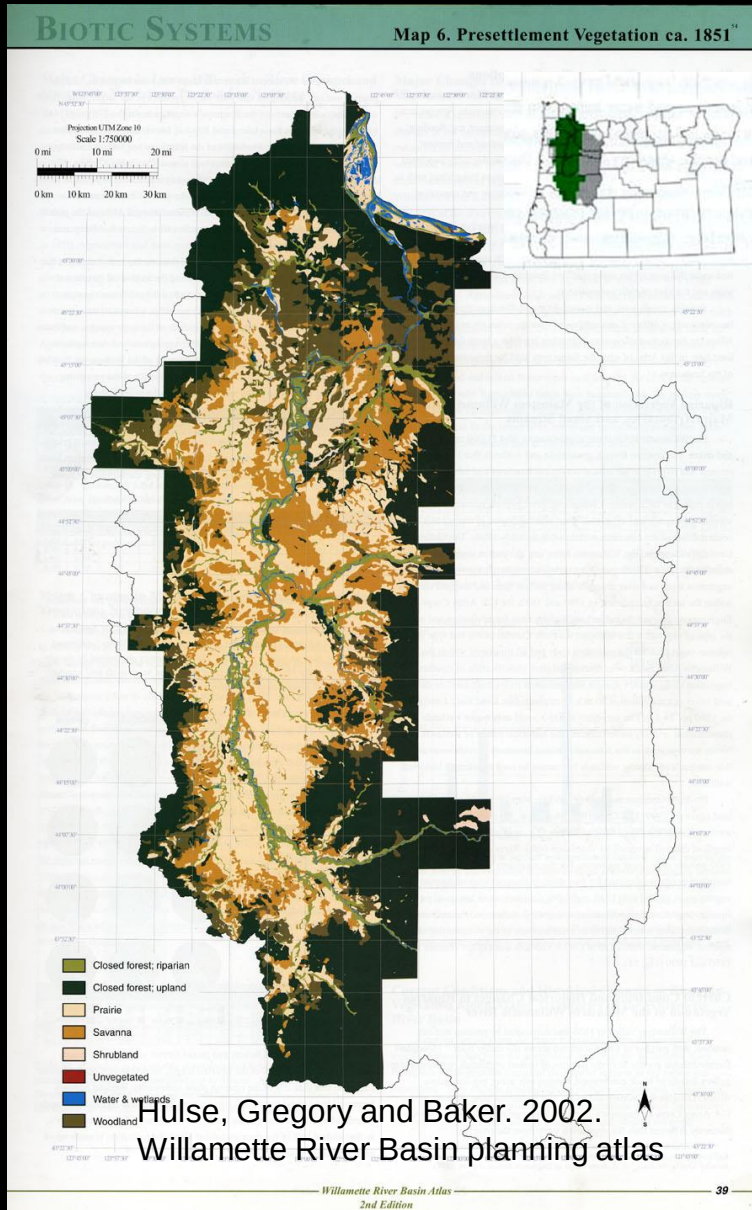
Sierra Institute, UC Extension
740 Front Street, Suite 155
Santa Cruz, CA 95060, U.S.A.

1. Maintain viable populations of all native species in situ.
2. Represent, within protected areas, all native ecosystem types across their natural range of variation.
3. Maintain evolutionary and ecological processes (i.e., disturbance regimes, hydrological processes, nutrient cycles, etc.)
4. Manage over periods of time long enough to maintain the evolutionary potential of species and ecosystems.
5. Accommodate human use and occupancy within these constraints.

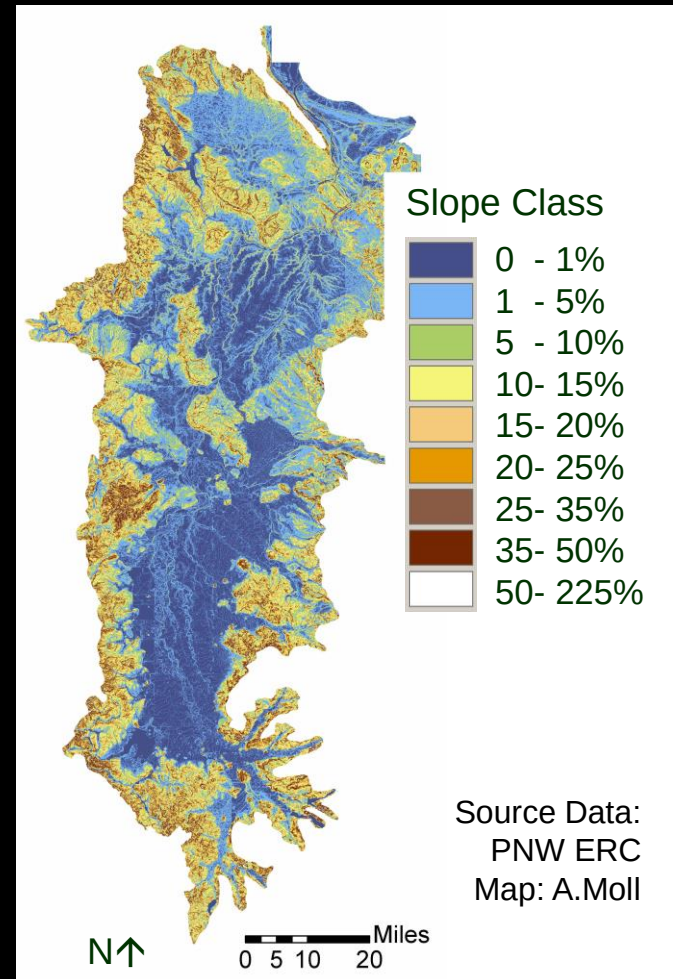
Historic Vegetation (ca.1850)

Willamette Valley Ecoregion

200 km



Slope Class



W.V. ecoregion = 13,164 km²
Oak savanna = 2,286 km²

THE PAST: Willamette Valley Ecoregion at Euro-American settlement (circa 1850): A Mosaic of Related Habitats

Wetland Prairie (14%)



Oak Savanna (17%)



Upland Prairie (18%)

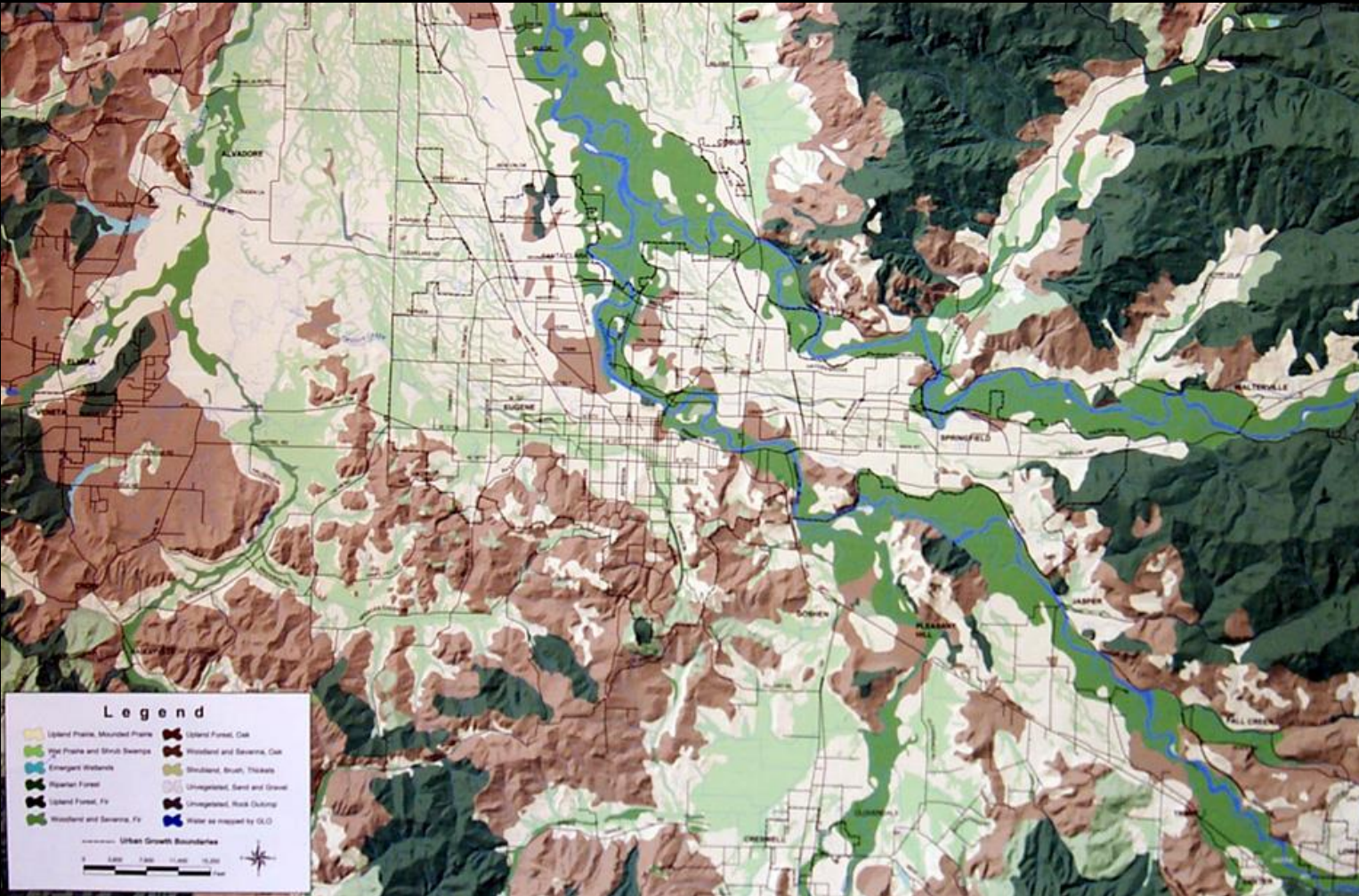


Oak Woodland (13%)

8150 km² grasslands
(62%)

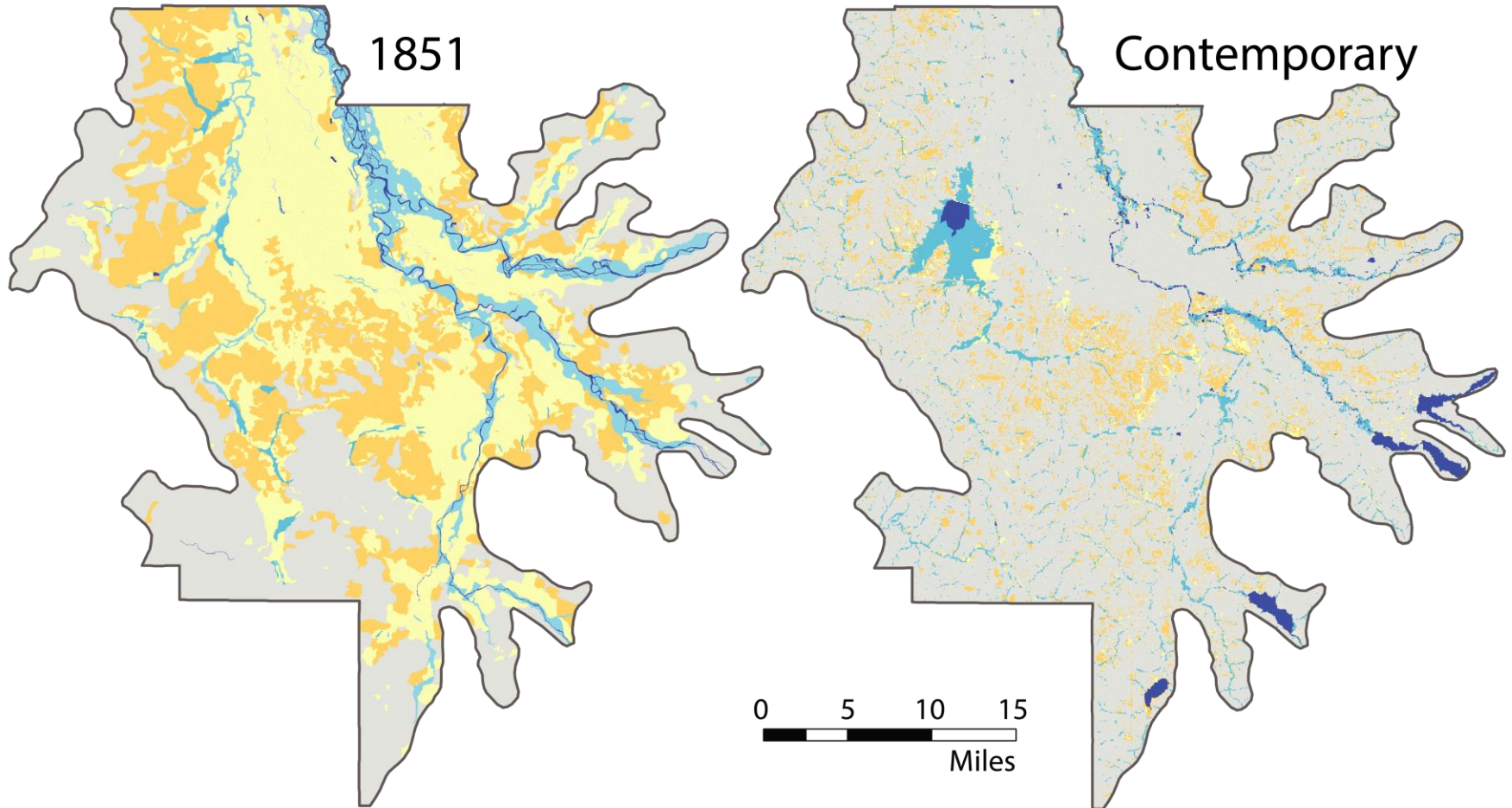
4000 km² acres oak
habitats (30%)

Historic Vegetation Map (ca.1850) – South Valley



Map: Lane Council of Governments
Data: Christy et al. 1999 based on 1850s GLO surveys

Oak-Prairie Vegetation Cover Change

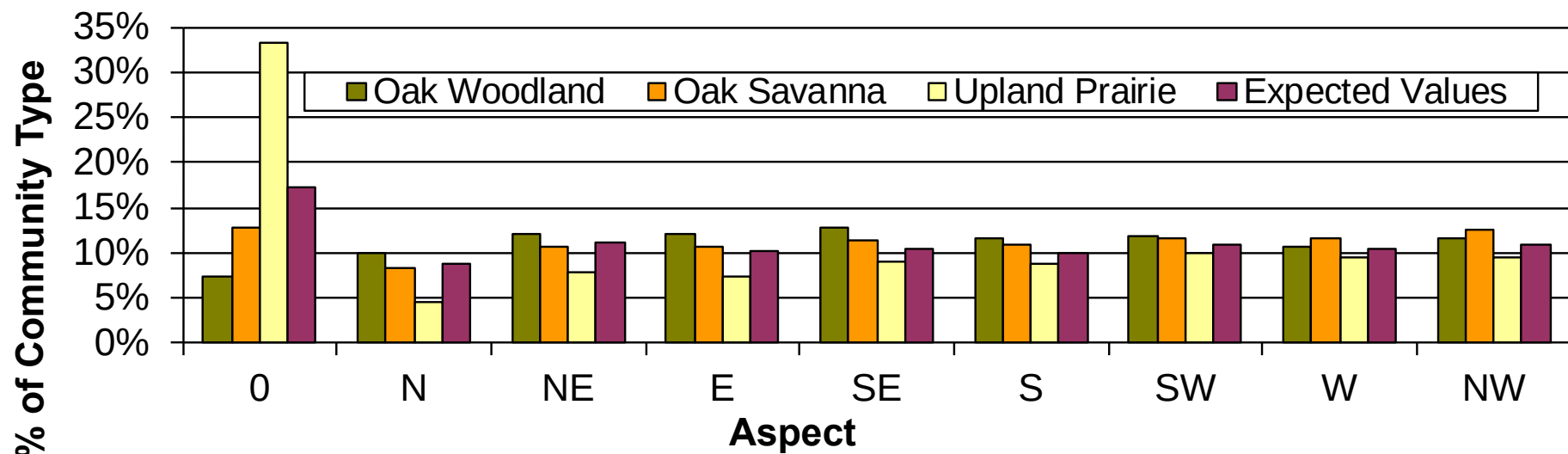


Oaks Prairies Riparian Water Other

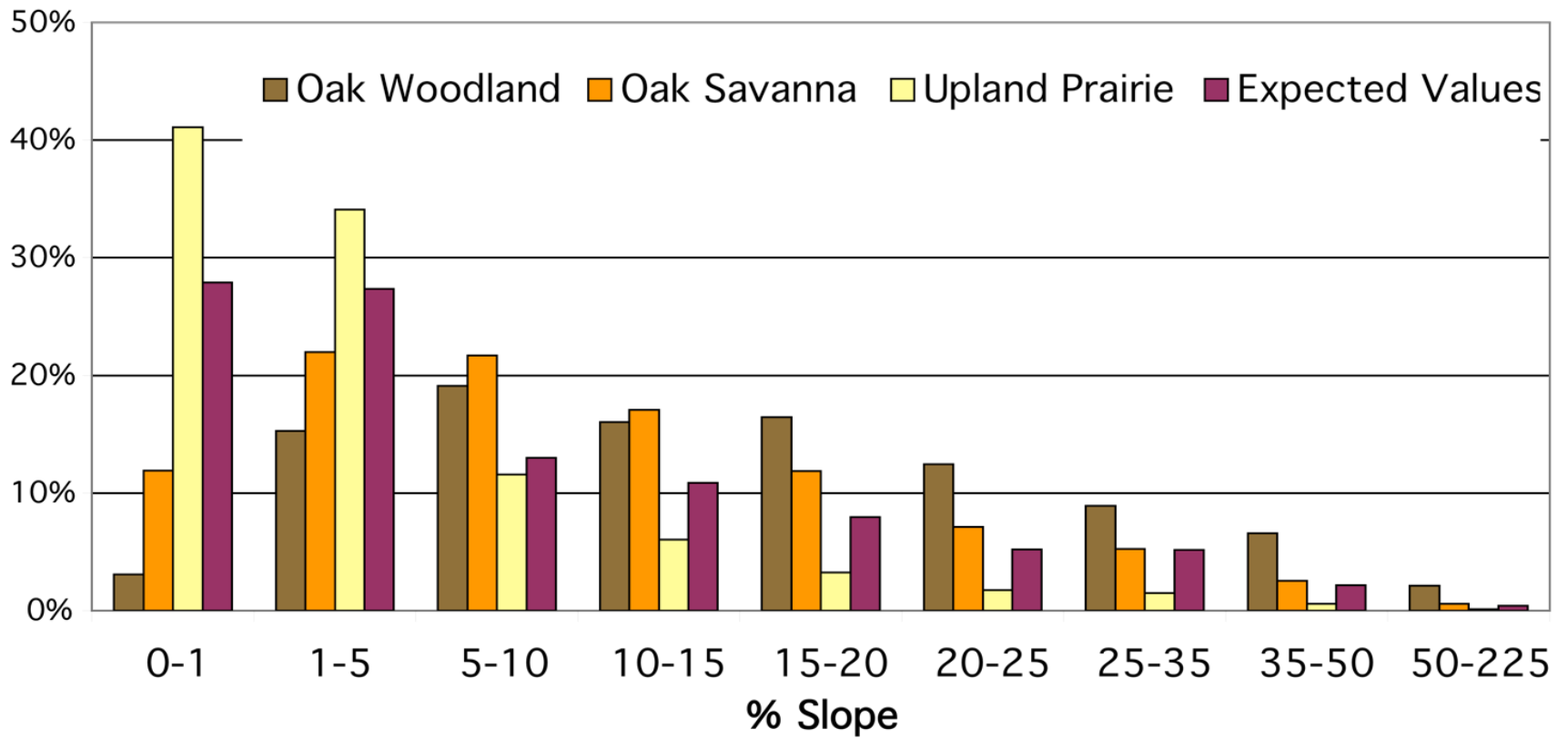
1851 Vegetation Source: Oregon State
Contemporary Vegetation Source:
ORNHC Fish and Wildlife

Courtesy Alejandro Brambila

1851 Aspect-Community Observed/Expected Relationship

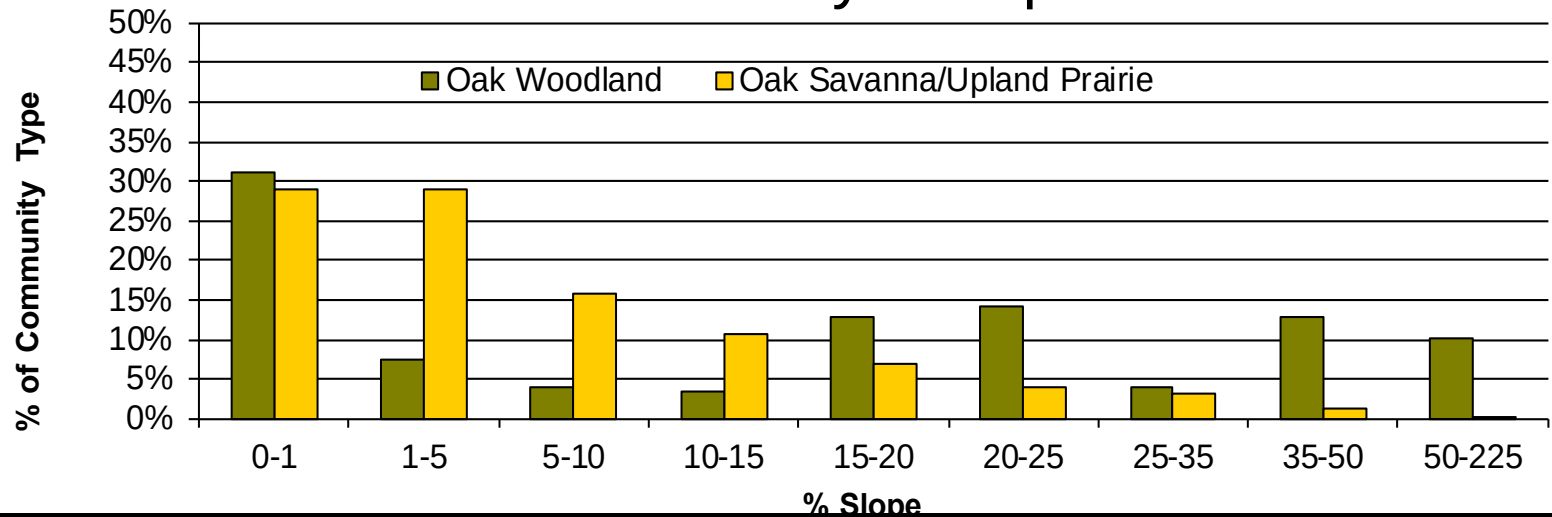


1851 Oak - Slope Observed/Expected Relationsh

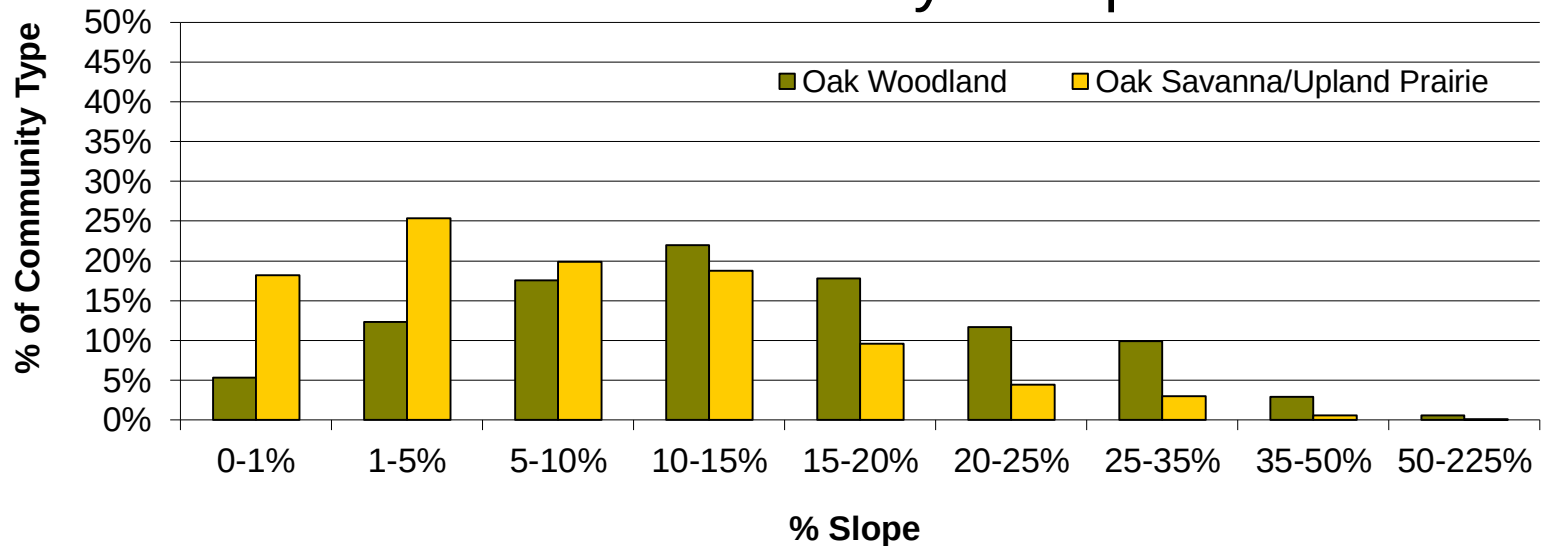


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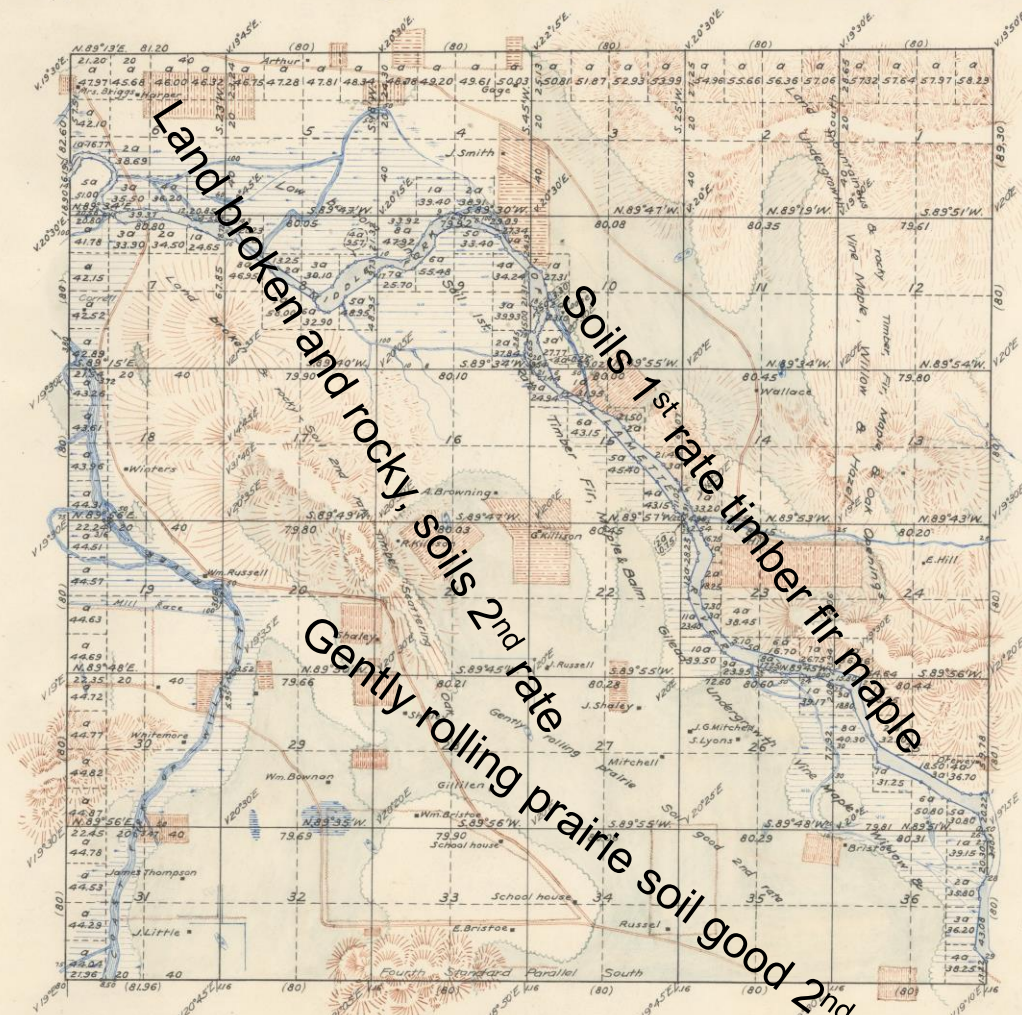
1851 Community x Slope



2004 Community x Slope



Township No. 18 South, Range No. 2 West, Willamette Meridian, Oregon.



Public Survey Office
Portland, Oregon
September 3, 1835.
I certify this to be a correct
copy of the original plat on file
in this office.
Joseph A. Gaudin,
Office Cadastral Engineer

Scale 40 chains to an inch
True Meridian
True Town 24.5 to 30.40 East

Surveys designated	By whom surveyed	Contract		Amt of surveys		When charged in	
		No.	Date	Miles	chains links	When surveyed	Sur. Gen's. Accounts
Township Lines	D & M. O. C. Murphy	43	April 26th, 1854	6	09 30	Aug 1st 1853	3rd Qr 1853
Subdivisions	D & M. O. C. Murphy	43	April 26th, 1854	60	40 20	Sept 7th 1853	3rd Qr 1853
Meanders				19	16 06		
Reclaiming State's	Parl.			6	01 36		
Total number of Acres	23,012.04						

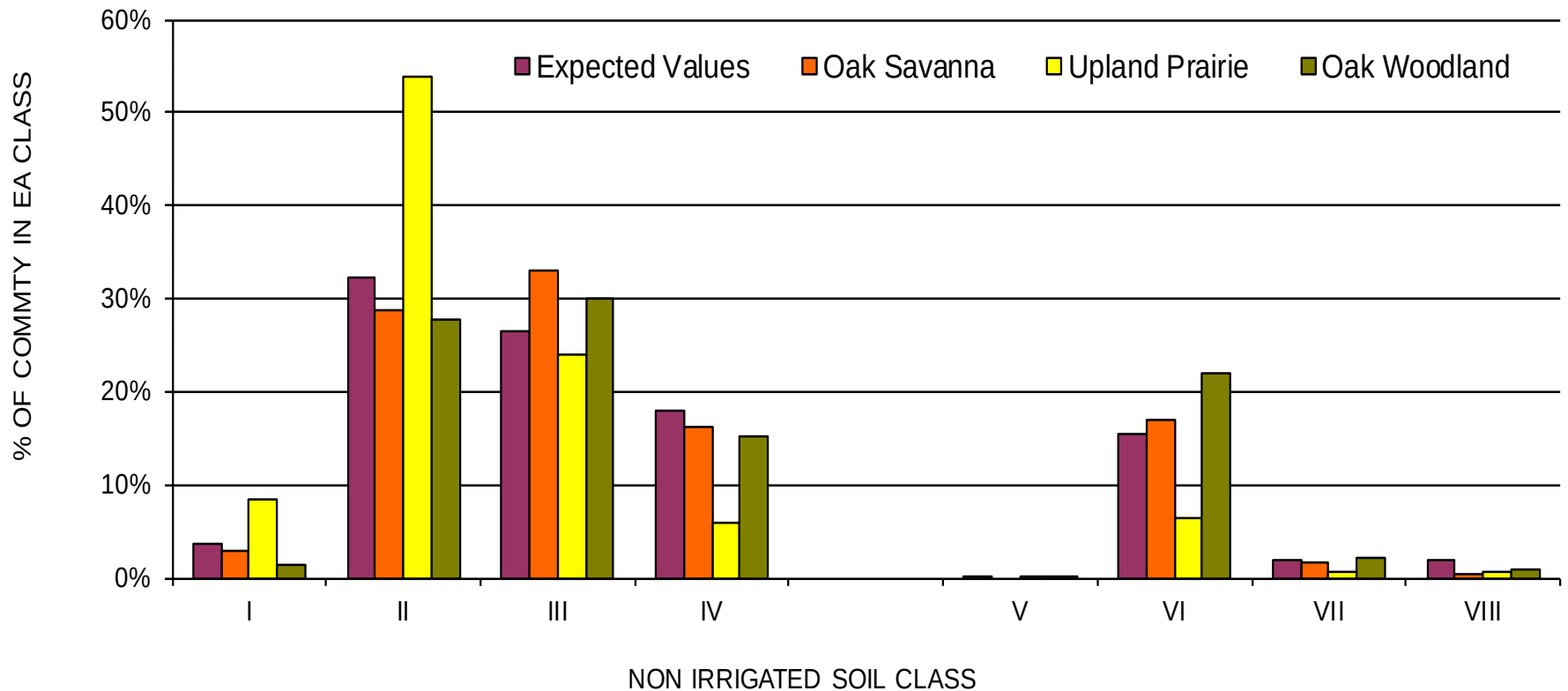
The above map of No. 18 South of Range No. 2 West of the Willamette Meridian, Territory of Oregon is strictly conformable to the field notes of the survey thereof on file in this office which have been examined and approved.
Surveyor General's Office
Salem, September 7th, 1853
C.K. Gardner
Sur. Gen. of Oregon

Basic Land Capability Class Definitions

- Class I contains soils having few limitations for cultivation;
- Class II contains soils having some limitations for cultivation;
- Class III contains soils having severe limitations for cultivation;
- Class IV contains soils having very severe limitations for cultivation;
- Class V contains soils unsuited to cultivation, although pastures can be improved and benefits from proper management can be expected;

1851 Community x Agricultural Soil Class

Observed v. Expected Values within Study Area



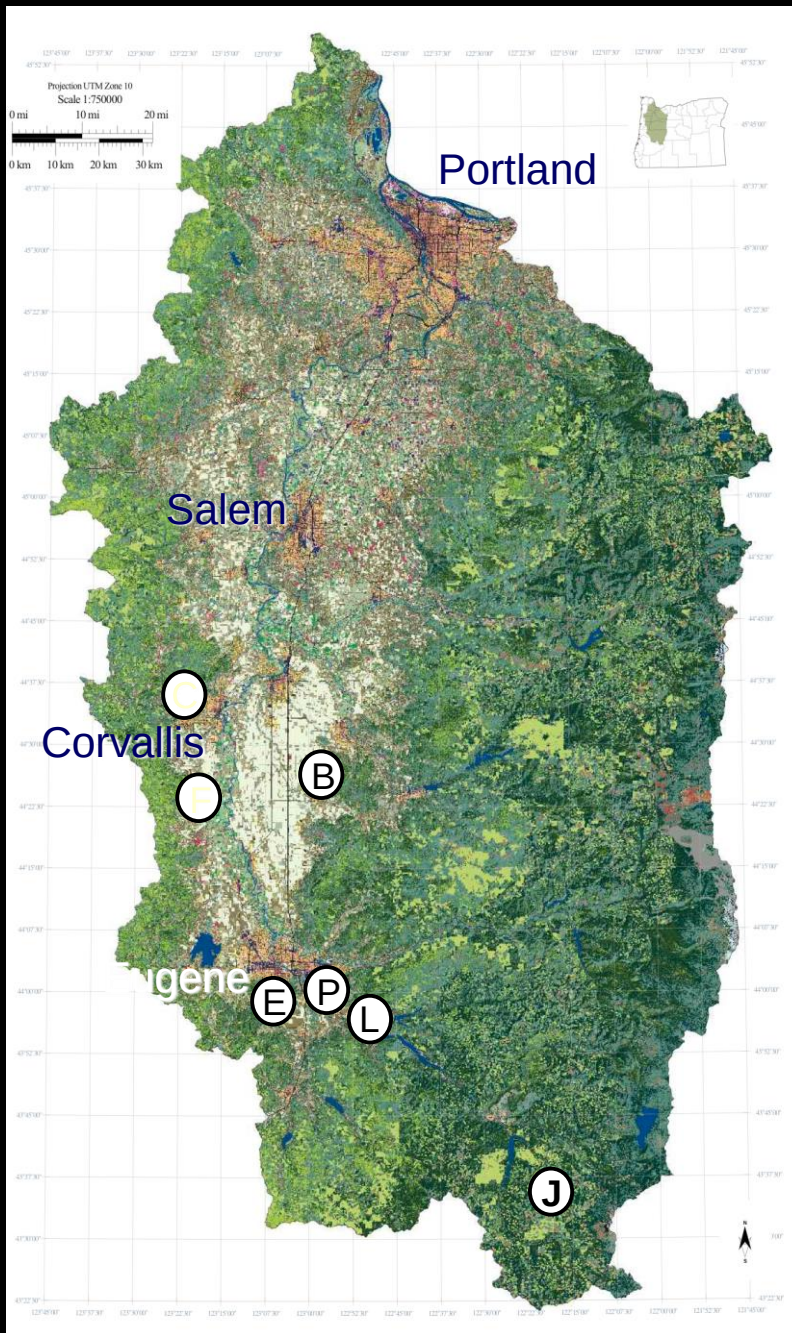
PAST TO PRESENT: What has happened to oak savanna?

- 44% Agriculture
- 30% Forest
- 14% Other natural vegetation
- 8% Built features
- 4% Unknown

Hulse, Gregory and Baker. 2002.
Willamette River Basin Planning Atlas.



150 years: >90% loss, 2-10% remains, 90-95% on private land

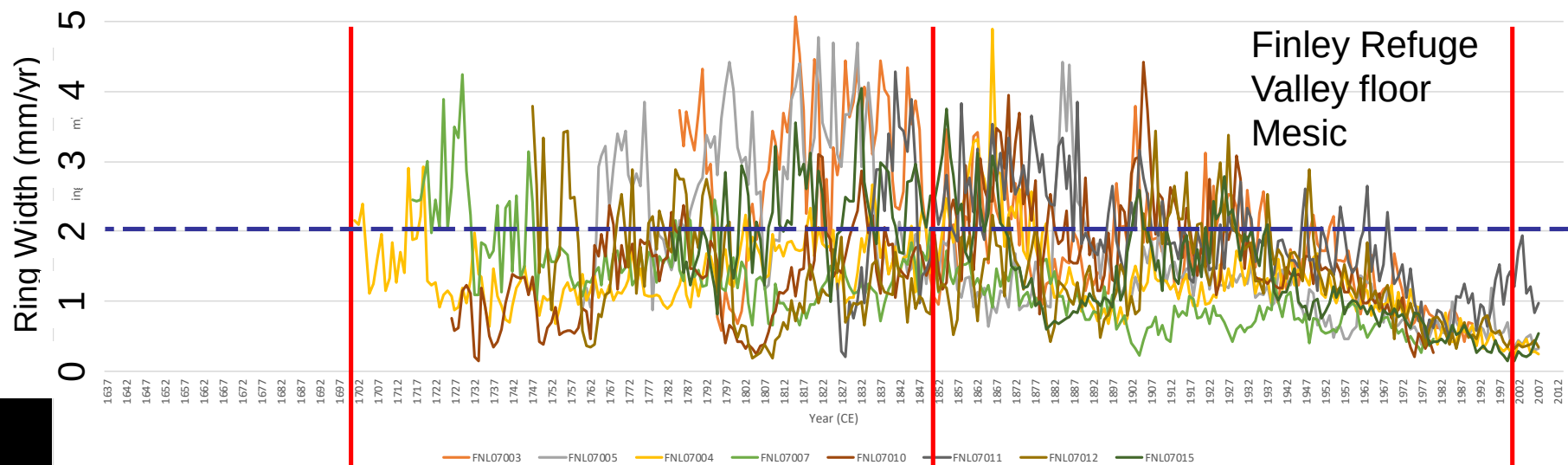


Joint Fire Science Project Sites

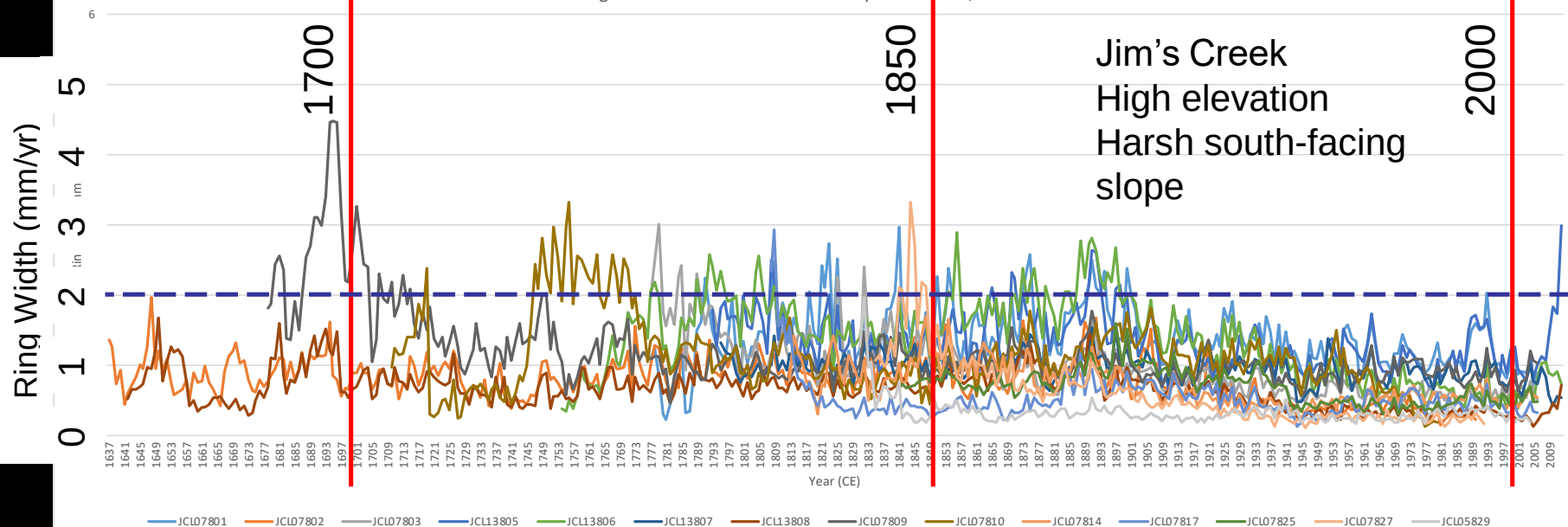
Finley Wildlife Refuge



Annual tree ring growth rates, 1637-2012, trees established before 1840



Annual growth rate for trees established prior to 1840, Jim's Creek OR





Loss of oaks due to conifer invasion

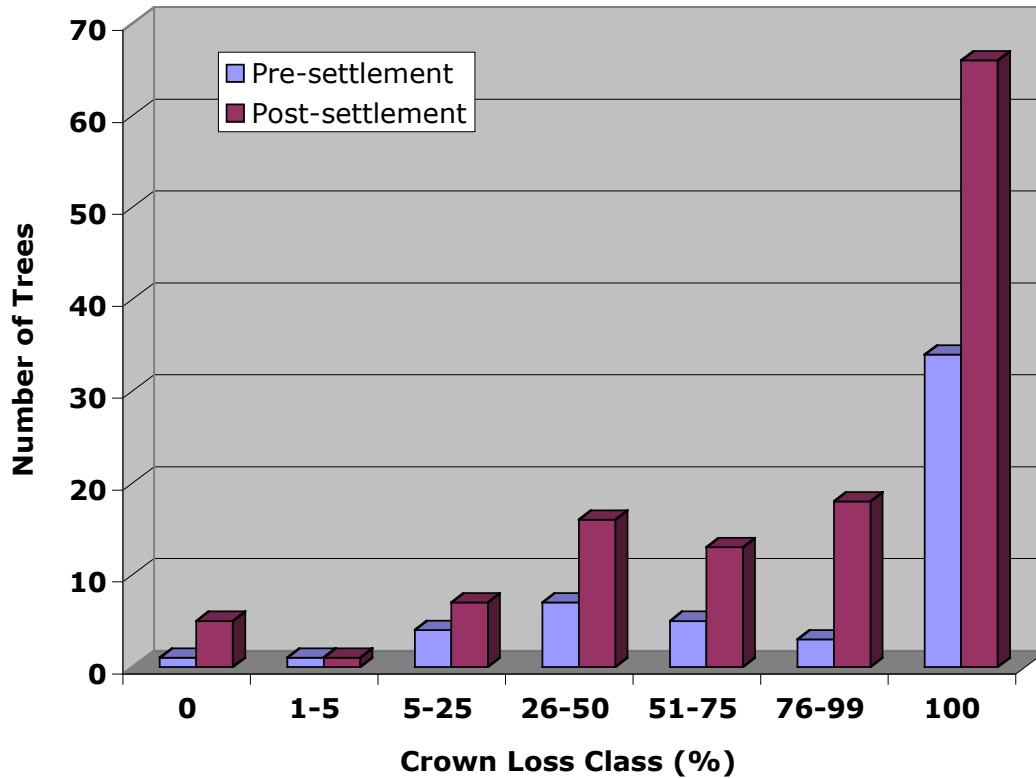


Photos

Above: Bart Johnson

Right: Bruce Newhouse

Oak Crown Loss



Crown loss index

4° branches & twigs

3° limb

2° limb

1° limb

Trunk



ANSEL ADAMS

Finley Wildlife Refuge



- Effects of ROV of environmental conditions on ROV of ecological structure & function
 - Tree Growth Rates
 - Productivity
 - Vegetation Structure
 - Plant Species Composition
 - Plant Functional Groups
 - Wildlife Values: foliage, roots & tubers
 - Nectar and Pollen: amount, timing & diversity
 - Carbon Sequestration
 - Fire Hazard

Effects of site productivity on ground layer

Point intercept plant cover and functional group variation



Food Web Source Points

- Diverse source of foliage, seeds, roots and tubers throughout the year for and insects, birds, mammals and reptiles
- Insects for songbirds, small mammals and reptiles



Native bunchgrasses provide nesting habitat missing from exotic grasslands

Table 8. Cost estimates and BMPs for initial restoration. Low cost: ≤\$1000 per acre, medium cost: \$1001-\$1500 per acre, high cost: \$1501-2000 per acre, and very high cost: >\$2001 per acre.

Restoration Scenario	BMP1	BMP2	BMP3	BMP4	BMP5	Cost Estimate (per acre)	Cost Ranking
Savanna/Prairie Existing Conditions							
to: Full Savanna DFC	shear/mow	broad herbicide	burn	drill seed		\$1,600	HIGH
to: Savanna Structure DFC	shear/mow	spot herbicide	drill grass			\$870	LOW
to: Full Woodland DFC	shear/mow	broad herbicide	drill seed			\$1,250	MEDIUM
to: Woodland Structure DFC	shear/mow	spot herbicide	drill grass			\$870	LOW
to: Fire Hazard DFC	N/A					N/A	N/A
Woodland Existing Conditions							
to: Full Savanna DFC	harvester	cut stumps	broad herbicide	burn	drill seed	\$2,280	VERY HIGH
to: Savanna Structure DFC	harvester	cut stumps	spot herbicide	broadcast grass		\$1,680	HIGH
to: Full Woodland DFC	harvester	cut stumps	spot herbicide	drill seed		\$1,930	HIGH
to: Woodland Structure DFC	harvester	cut stumps	spot herbicide	broadcast grass		\$1,680	HIGH
to: Fire Hazard DFC	harvester					\$1,000	LOW
Broadleaf Forest Existing Conditions							
to: Full Savanna DFC	harvester	cut stumps	spot herbicide	burn	broadcast seed	\$2,755	VERY HIGH
to: Savanna Structure DFC	harvester	cut stumps	spot herbicide	broadcast grass		\$1,880	HIGH
to: Full Woodland DFC	harvester	cut stumps	spot herbicide	broadcast seed		\$2,405	VERY HIGH
to: Woodland Structure DFC	harvester	cut stumps	spot herbicide	broadcast grass		\$1,880	HIGH
to: Fire Hazard DFC	harvester					\$1,200	MEDIUM
Mixed Forest Existing Conditions							
to: Full Savanna DFC	harvester	cut stumps	spot herbicide	burn	broadcast seed	\$2,555	VERY HIGH
to: Savanna Structure DFC	harvester	cut stumps	spot herbicide	broadcast grass		\$1,680	HIGH
to: Full Woodland DFC	harvester	cut stumps	spot herbicide	broadcast seed		\$2,205	VERY HIGH
to: Woodland Structure DFC	harvester	cut stumps	spot herbicide	broadcast grass		\$1,680	HIGH
to: Fire Hazard DFC	harvester					\$1,000	LOW
Conifer Forest Existing Conditions							
to: Full Savanna DFC	harvester	cut stumps	spot herbicide	burn	broadcast seed	\$2,355	VERY HIGH
to: Savanna Structure DFC	harvester	cut stumps	spot herbicide	broadcast grass		\$1,480	MEDIUM
to: Full Woodland DFC	harvester	cut stumps	spot herbicide	broadcast seed		\$2,005	VERY HIGH
to: Woodland Structure DFC	harvester	cut stumps	spot herbicide	broadcast grass		\$1,330	MEDIUM
to: Fire Hazard DFC	harvester					\$800	LOW

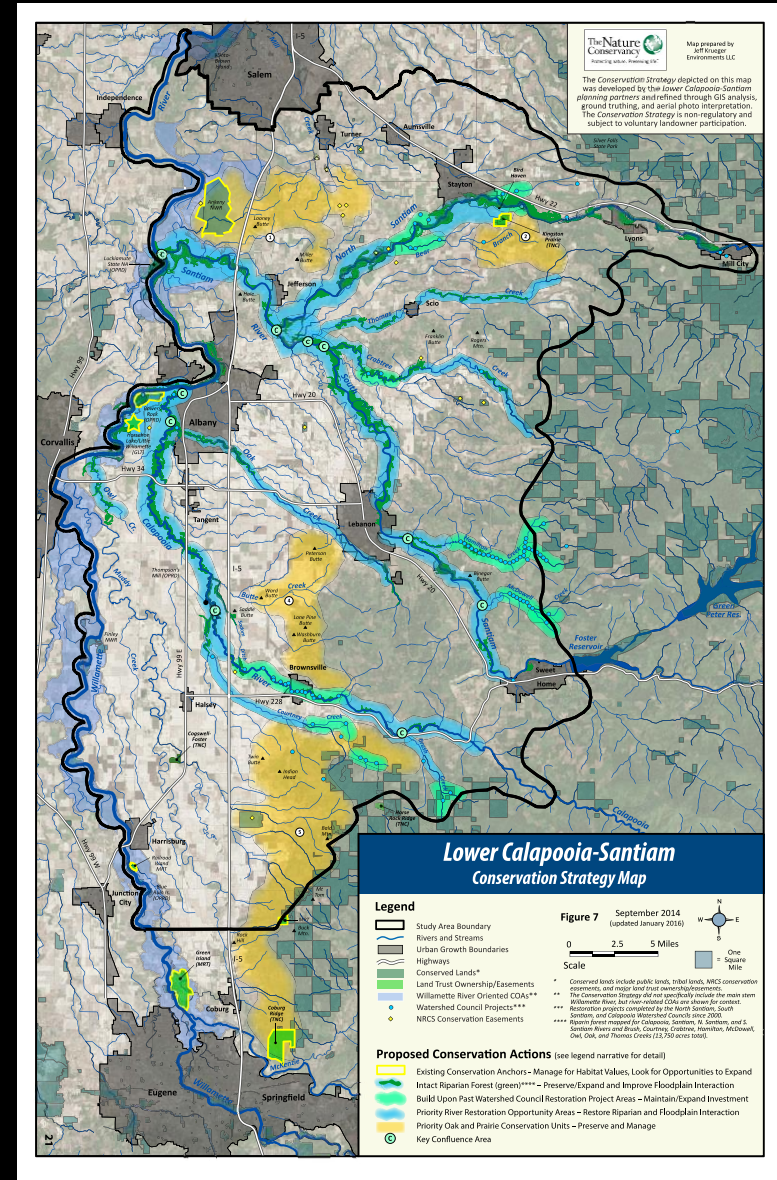
Table 10. *Income potential estimates from logs and wood chips. Estimates have subtracted transportation costs and include both 2005 and 2010 log prices for comparative purposes*. Low: <\$550 per acre; medium: \$550-\$900 per acre; high: \$900-1250 per acre, very high: >\$1250 per acre.*

Restoration Scenario	Average Income Potential Estimate From Logs--Fall 2010 Log Values (Range)	Average Income Potential Estimate From Chips --Fall 2010 Chip Values (Range)	Total Income Potential Estimate--2010 Values	Average Income Potential Estimate From Logs--Winter 2005 Log Values (Range)	Generic Ranking Total Income Potential 2010
Savanna Existing Conditions					
Savanna DFCs	\$0 (\$0-50)	\$0 (\$0-50)	\$0	\$50 (\$0-250)	NO INCOME
Woodland DFCs	\$0 (\$0-0)	\$0 (\$0-50)	\$0	\$0 (\$0-50)	NO INCOME
Fire Hazard Reduction DFC	\$0 (\$0-50)	\$0 (\$0-0)	\$0	\$0 (\$0-0)	NO INCOME
Woodland Existing Conditions					
Savanna DFCs	\$100 (\$0-350)	\$400 (\$50-750)	\$500	\$550 (\$0-1,800)	LOW
Woodland DFCs	\$100 (\$0-300)	\$250 (\$50-550)	\$350	\$450 (\$0-1,500)	LOW
Fire Hazard Reduction DFC	\$50 (\$0-100)	\$250 (\$0-450)	\$300	\$200 (\$0-650)	LOW
Broadleaf Forest Existing Conditions					
Savanna DFCs	\$50 (\$0-150)	\$900 (\$750-1,100)	\$950	\$250 (\$0-700)	HIGH
Woodland DFCs	\$50 (\$0-100)	\$750 (\$550-950)	\$800	\$150 (\$0-500)	MEDIUM
Fire Hazard Reduction DFC	\$50 (\$0-100)	\$650 (\$400-850)	\$700	\$250 (\$100-600)	MEDIUM
Mixed Forest Existing Conditions					
Savanna DFCs	\$600 (\$300-800)	\$700 (\$500-850)	\$1,300	\$3,000 (\$1,550-4,050)	VERY HIGH
Woodland DFCs	\$500 (\$300-650)	\$600 (\$350-800)	\$1,000	\$2,400 (\$1,450-3,250)	HIGH
Fire Hazard Reduction DFC	\$250 (\$150-400)	\$450 (\$50-650)	\$700	\$1,350 (\$700-2,100)	MEDIUM
Conifer Forest Existing Conditions					
Savanna DFCs	\$1,500 (\$700-2,200)	\$300 (\$100-500)	\$1,850	\$7,600 (\$3,550-11,000)	VERY HIGH
Woodland DFCs	\$1,400 (\$650-2,200)	\$250 (\$100-500)	\$1,700	\$7,100 (\$3,350-10,900)	VERY HIGH
Fire Hazard Reduction DFC	\$600 (\$150-1,150)	\$250 (\$100-400)	\$850	\$3,000 (\$800-5,700)	MEDIUM

* Readers accessing this document after 2010 can obtain regionally specific, current income estimates of log values online from the Oregon Department of Forestry (www.oregon.gov/ODF/STATE_FORESTS/TIMBER_SALES/logpage.shtml).

A landscape-scale portfolio of oak ecosystems across:

- Range of Variability of Environmental Conditions
- Conservation Anchors and Connectors
- Landscape Scale Ecological Function and Ecosystem Services



Courtesy Jeff Krueger

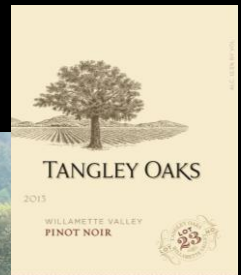
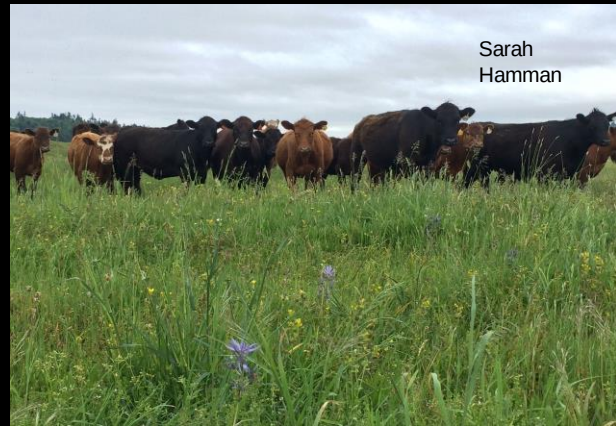
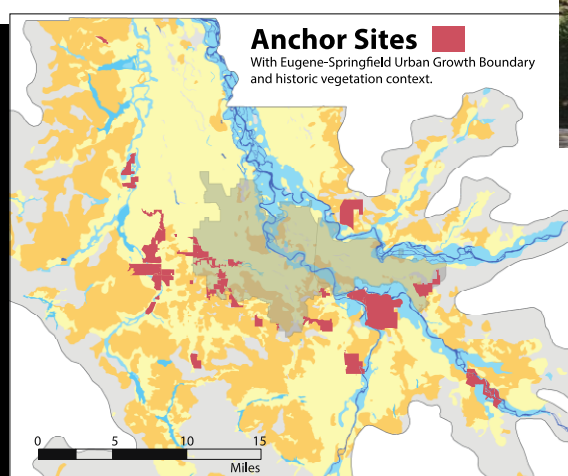
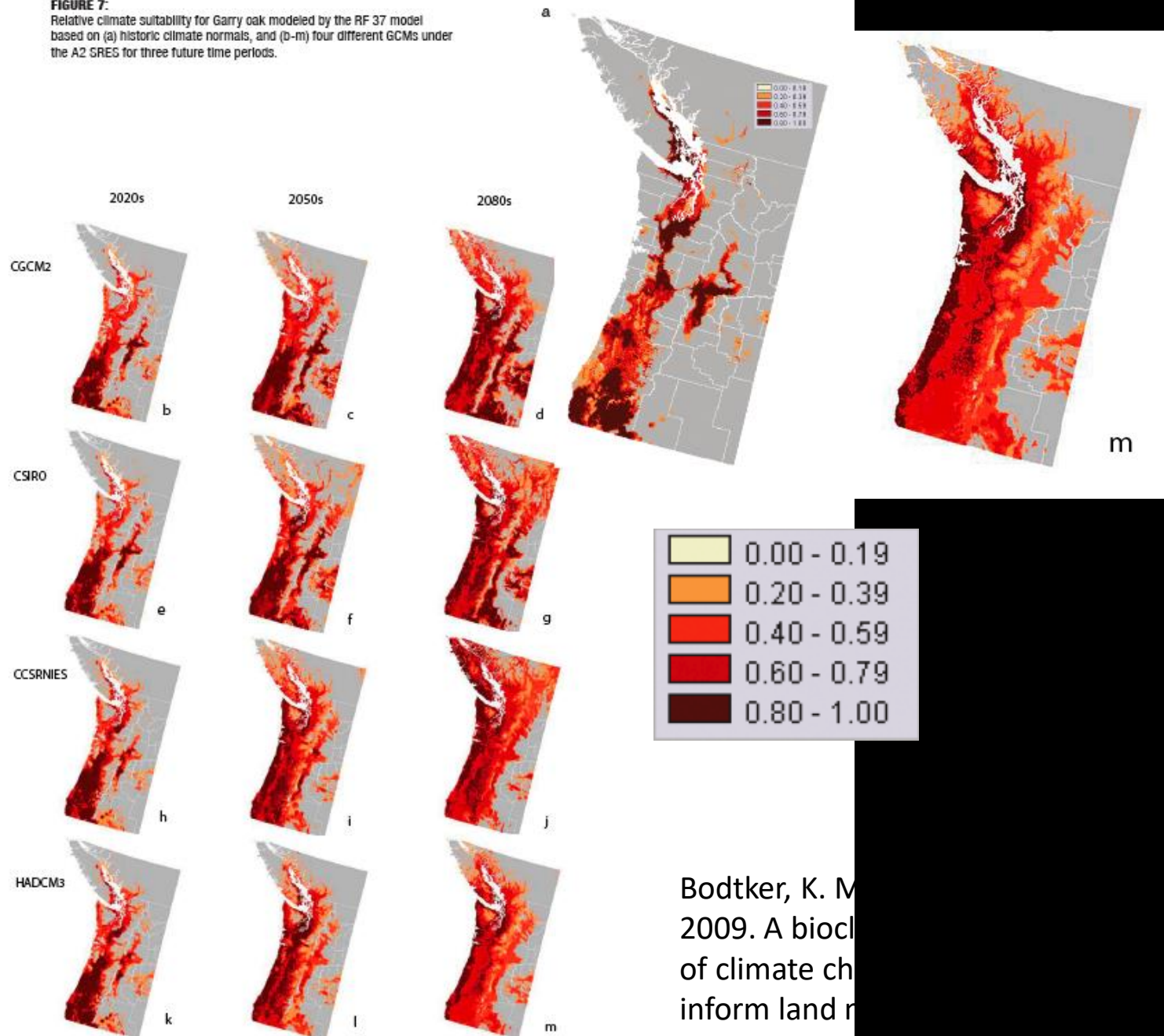


FIGURE 7:
Relative climate suitability for Garry oak modeled by the RF 37 model
based on (a) historic climate normals, and (b-m) four different GCMs under
the A2 SRES for three future time periods.



Bodtker, K. M.
2009. A biocl
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Differential loss and retention of legacy savanna oaks, pines and Douglas-fir due to life history strategies, esp. shade tolerance



Pre-Euro-American Settlement trees

Life Stage	Species				
	QUEGAR	PINPON	PINLAM	PSEMEN	CALDEC
Living	22	15	2	32	5
Log	24	8	0	3	0
Snag	11	3	0	2	1
Total	57	26	2	37	6



Oregon White Oak
(QUEGAR)



Ponderosa Pine
(PINPON)



Sugar Pine
(PINLAM)



Douglas Fir
(PSEMEN)





The Aesthetics of Oaks





Emerging Outcomes

- Many areas with large presettlement savanna trees require protection within the next 10-15 years to prevent the complete loss of these 150-500 year old trees



Emerging Outcomes

- If a key conservation goal is to conserve oak savanna across the range of environmental conditions and community types in which it was formerly found, we must protect and restore sites that no longer have living oaks, especially more mesic and productive sites that are now conifer forest.



Emerging Outcomes

- Counterintuitively, restoration on more mesic sites that have converted to conifer forest may be more effective and feasible in the long run because of faster tree growth, a substantial financial return from timber harvest, and potentially greater ability to establish a groundlayer with relatively high proportions of native species.



Emerging Outcomes

- Private landowners require land management options that help them pay for restoration.
- These may include strategies that provide a continuing supply of income, provide access to public funds to support fire hazard reduction, and/or innovative policy incentives that allow them to restore savanna without losing agricultural or forestry tax benefits.



Emerging Outcomes

- Oak savanna restoration in the Willamette Valley has ecological, social, recreational and aesthetic values in contexts ranging from large wildlands to rural properties to urban parks to residential yards. It can provide an ecological endpoint for different cultural goals. In particular it offers the potential to protect human life and property on the wildland-urban interface by reducing the risk of catastrophic wildfire while simultaneously restoring an imperiled native ecosystem.

