



Wildfire and Operational Silviculture Research on Forested State Trust Lands of Washington

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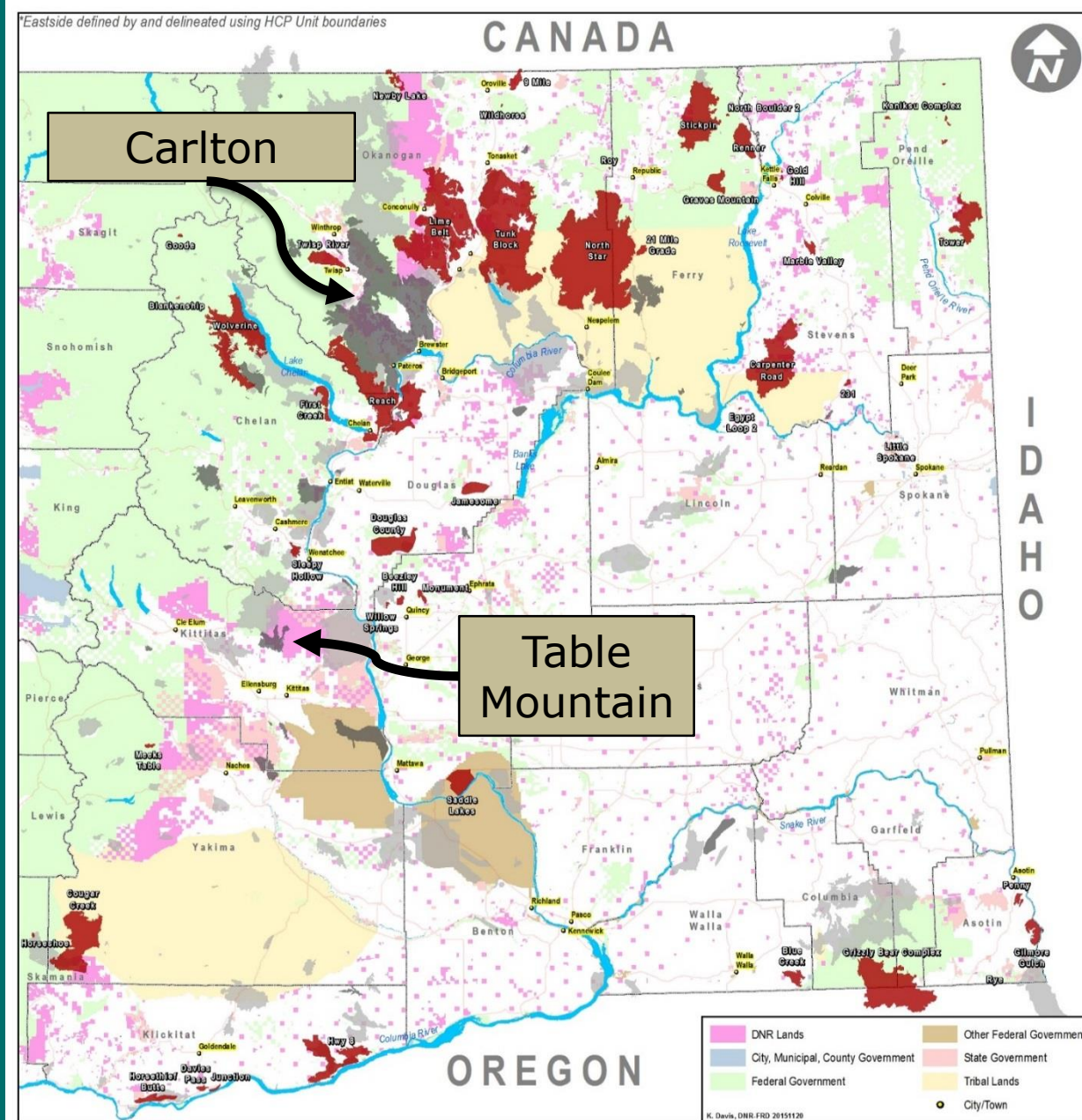
Department of Natural Resources

- Trust land management – agency charged with making money
- Statewide timber revenue around \$200,000,000 annually
- One sixth of the western Washington annual harvest
 - Over a \$6 billion dollar economic impact
- Manage about 747,000 acres in eastern Washington
- Harvest around 60 MMbf annually



Recent Fires

- Burnt in 2014-15
 - 10% of all DNR eastside lands
 - 20% of NE Region
- Grasslands, shrublands, Dry ponderosa pine to moist grand fir and hemlock types
- Burnt timber amounts to over five years of harvest



Washington Eastside Fire Statistics

Acres Burned - All Owners:

- 2003 - 2013 = 1,671,316 ac.
- 2014 = 434,229 ac.
- 2015 = 1,074,732 ac.

DNR State Land Totals

Land Base: 1,556,669 ac.

Forested Acres: 747,018 ac.

DNR Land Base Burned:

- 2014 = 65,336 ac.
- 2015 = 76,430 ac.

DNR Forested Acres Burned:

- 2014 = 25,060 ac.
- 2015 = 50,140 ac.

2003 - 2013 Fires

2014 Fires

2015 Fires



Post-fire Questions and Information Needs

- Policy and Operations
 - Budgets,
 - Personnel
- Policy and Biological
 - Long-term expectations
 - Climate change effects
- Salvage and post salvage
 - Prioritization
 - Where to go
 - Constraints
 - Reforestation issues
 - Rehab issues



Fire Salvage Approach

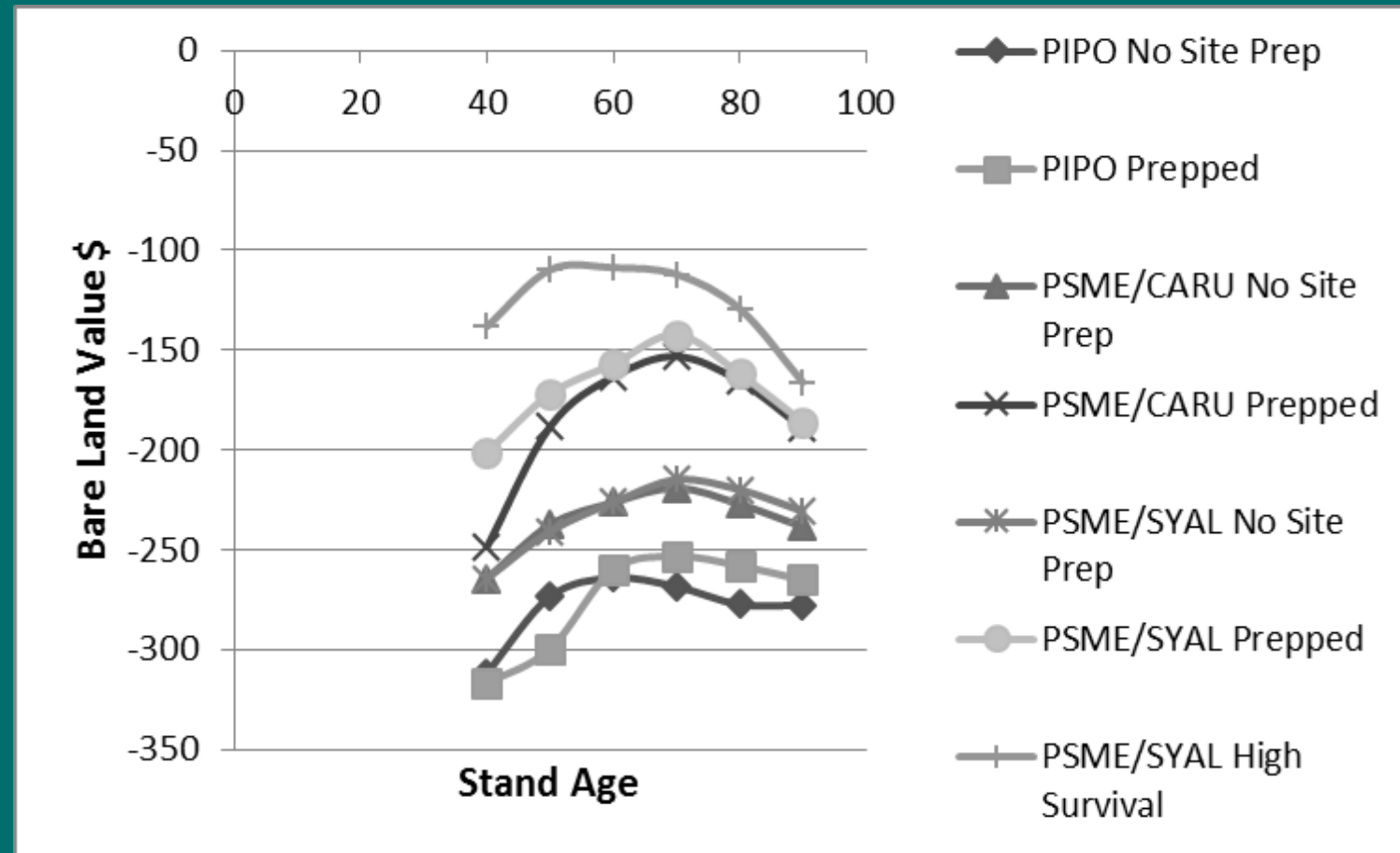
“Triage” concept – Salvage the lowest risk, highest return stands

- Determine how resources affected
 - continued ability to meet objectives or not?
 - extent and level of damage
- Determine where it makes sense to act, given:
 - existing policies & ecological considerations
 - financial outcomes
 - logistical constraints



Salvage Requires Reforestation – Prioritize by Productivity

- DNR manages lots of low productivity stands
- Unless leaving 21 live tpa, or
 - An approved natural regeneration plan
- Need to pay for
 - Harvest and
 - Reforestation costs



Salvage and Post-Salvage Questions

- **Productivity**
 - Regen on dry PP sites
 - Role of natural regeneration
 - Delayed reforestation
 - Site prep needs
 - Does salvage delay recovery
- **Ecological**
 - Reversion to grass or shrubs
 - Native vegetation recovery rates
 - Rehab
- **Habitat**
 - Potential productivity
 - Location



Board of Natural Resources and DNR Executive Management – Landscape Level Assessment of Management Potential

- Inventory data on about 490,000 acres
- Assigned all sites to broad ecological groups based on:
 - SDI_{max}, fire regime, typical stand structure
 - PP, PP/DF, dry Mixed Conifer, moist MC, Subalpine
- Management scenarios developed for Ecological Groups
 - Plant Association x Site Index
 - Appropriateness of even or uneven aged management
 - Silvicultural activities
- Financial Capability Index
 - What level of investment is needed to manage a site
 - What levels of silvicultural investment can the site support



Four Levels of Management Potential

1. Disturbance and reversion to shrub or grassland
 2. Site cannot support silvicultural investment,
 - Uneven-aged w/natural regen,
 - PCT only with harvesting
 3. Can support limited investment,
 - Uneven-aged, natural regen and a stand alone PCT
 4. Site can support full range of *likely* investments
 - Even-aged with site prep, planting, and PCT
- As productivity declines the following all increase:
 - future climate sensitivities (to, e.g., temperature and precipitation),
 - wildfire disturbance frequencies, and
 - likelihood of transitioning to a different ecological group.

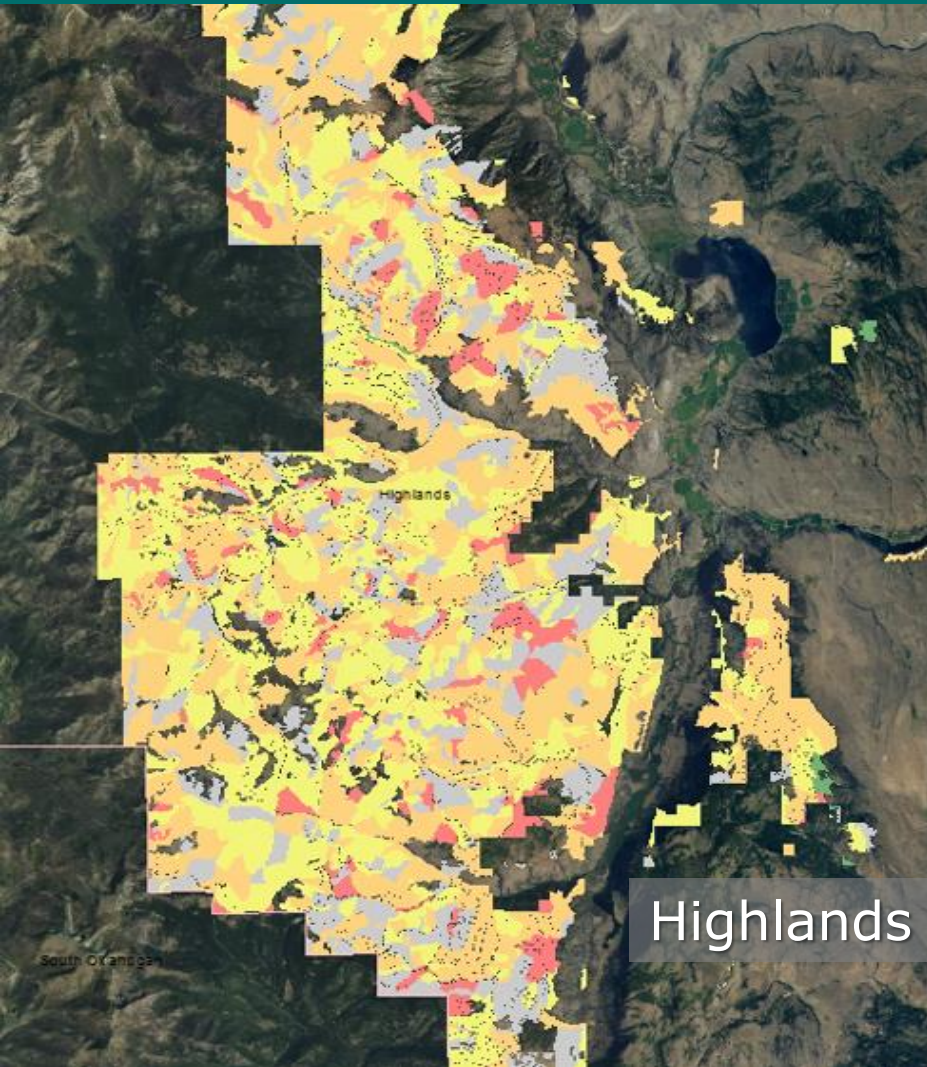
Acres and Percent Distribution of Management Potential across DNR Lands

Ecological Group	Site Index Class				
	SIC-V	SIC-IV	SIC-III	SIC-II	SIC-I
PP	1%	2%	2%	0%	0%
PP/DF	2%	11%	10%	1%	0%
MC-D	2%	7%	16%	11%	6%
MC-M	0%	1%	4%	4%	4%
SAF	4%	6%	2%	0%	0%

Ecological Group	Site Index Class				
	SIC-V	SIC-IV	SIC-III	SIC-II	SIC-I
PP	4,153	8,423	11,578	1,895	192
PP/DF	12,194	54,942	50,037	6,841	743
MC-D	10,574	36,433	80,131	55,896	27,782
MC-M	1,642	5,910	19,167	19,942	18,138
SAF	21,624	31,335	9,012	1,022	376

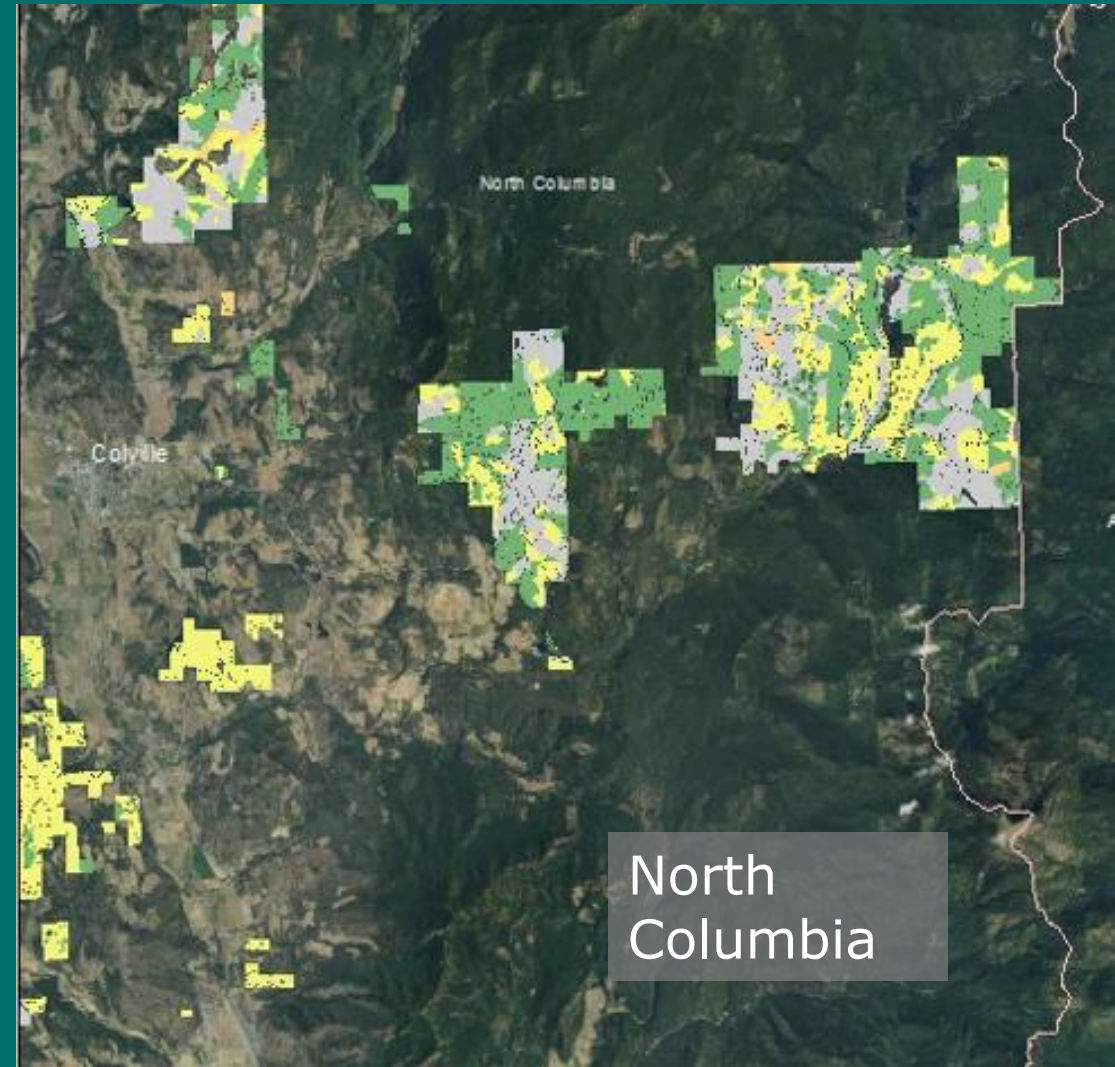


Management Potential on Two DNR Districts



Highlands

Green highest NPVs
Yellow and Orange
Intermediate
Red lowest NPVs



North
Columbia

Fires and ESA Commitments: Northern Spotted Owl Habitat Potential

- DNR has an HCP covering NSO in eastern Cascades
- Fires near Klickitat and Ellensburg burnt NSO habitat
 - How fast can habitat re-grow?
 - Can it even grow where it is designated?
- Commitments without quantifying biologic potential
- Similar issues concerning biological capabilities with lynx plan



Table Mountain Fire - 2012

- Lightning ignition on Saturday, September 8, 2012
- Total burned acres: 42,634 acres
 - 10,587 acres of State land
- Mostly stand replacement severity
- Habitat type series PP, DF and some GF
- Elevations 3,900 to 4,500 ft.
- SI 45 to 60 at age 50



Table Mountain - Salvage and Reforestation

- DNR Harvested about 11 MMbf from 1,800 acres
- Forest Practices Rules state reforestation if leaving fewer than 21 tpa
- Planting of about 2,000 acres began fall 2013 and spring 2014
 - Styro-10 seedlings, 35% WL, 35% PP, 28% DF, 2% ES
- 200 non-salvaged acres planted to help with development of habitat for Northern Spotted Owls.



Carlton Complex Fires - 2014

- Began on July 14, 2014 as four separate lightning-caused fires in the Methow Valley which merged into one by July 20
 - Burned over 250,000 acres (1,011.7 km²).
 - Destroyed approximately 300 houses in and around the towns of Pateros and Malott, as well as rural Okanogan County.
- 48,150 acres of DNR Trust Lands burned
 - 17,109 acres forested



Carlton Complex 2014

- Mostly low productivity pine sites
- Many acres with reforestation issues
- Many acres with low volume
- Most sites negative NPV if planted
- Triage Stand Selection:
 - Stand replacement burns
 - Site Index ≥ 60
 - Minimum 6 Mbf/acre harvestable
 - Sites with lower reforestation risks
 - Sites with roads and access
 - Less than 40% slope



Operations Research Specifically to Address

- Rates of Vegetative recovery
- Rates of natural regeneration
- Season of planting
- Species
- Herbicides
- Delayed reforestation



480 BCE, Xerxes Burns the Acropolis and the Sacred Olive Tree of Athena

Herodotus wrote that when the Athenians returned they found the sacred olive tree 'sprouted the same day to a height of two cubits'.

Athenians thought it was a miracle.

Interior NW is a fire-adapted ecosystem designed for rapid recovery



Table Mountain Sampling

- 12 stands were harvested and planted
 - One to six lines per stand depending on size and variability
- 22 stakelines of 20 seedlings each, total of 440 seedlings
 - Species, height, vigor, damage
- Distance, direction and slope to seed source
- Slope, aspect, elevation
- Plant association
- Site index

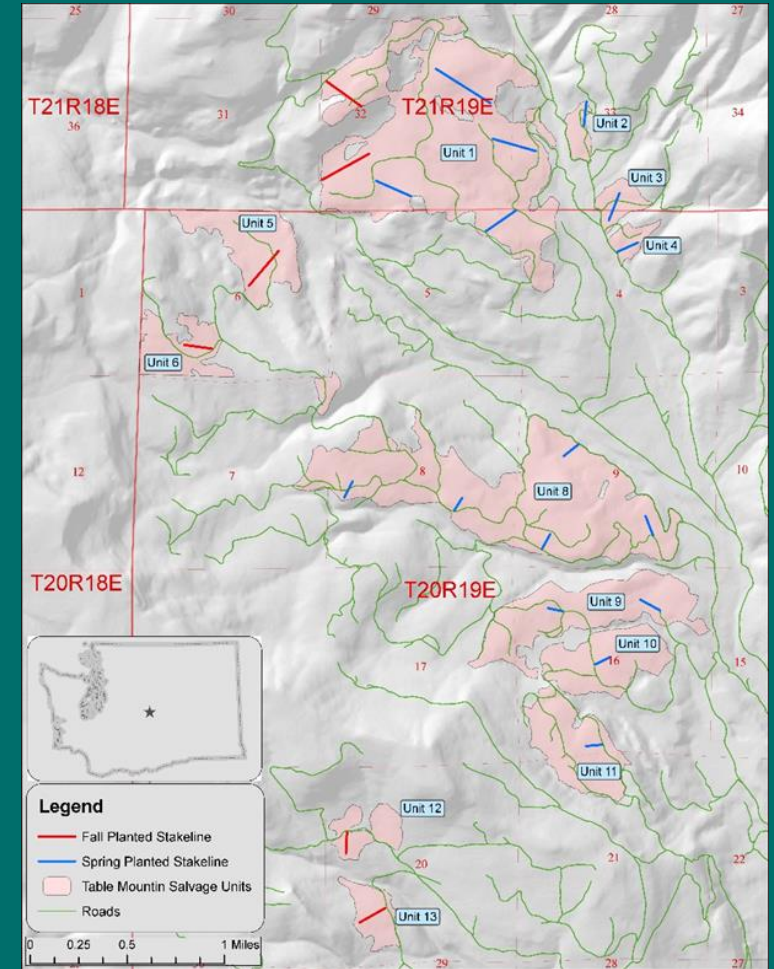


Table Mountain Vegetation Sampling

- Seedling centered plot – 1 meter radius
- Every 5th seedling
 - Total 120 vegetation plots
- Recorded % cover and height by life form
 - Grass, forb, short shrub, tall shrub, HW and conifer
- Recorded germinants
- Measured established naturals



Table Mountain Vegetation Recovery

- Vegetation Assessed in Fall
- 1 m radius Tree centered plots
- 2013 = <1%
- 2014 = 27%
- 2015 = 29%
 - Grass = 18%
 - Forbs = 9%
 - Shrubs, HW = 2%



Reforestation Study and Sampling at Carlton

- 4 stands – two salvaged and two not
- All ponderosa pine
- Five planting seasons
 - Fall 2014, Spring and Fall 2015, and 2016 Spring 2017
- Three blocks per stand
 - 25 seedlings per block, per planting date
 - Ultimately 1,200 seedlings
- Every other seedling received a spring Velpar treatment
- Snag longevity and fall rates



Vegetation Sampling at Carlton

- 30 vegetation plots per stand
 - 1/300 acre circular fixed plot
- 225 plots centered on planted sample trees
 - 1 meter radius
- Vegetation % cover by life form
 - Grasses, forbs, short shrubs, tall shrubs, HW, conifer
- Recorded germinants
- Measure established naturals



Vegetation Recovery at Carlton



Carlton Vegetation Recovery

One-Year
Post-Fire

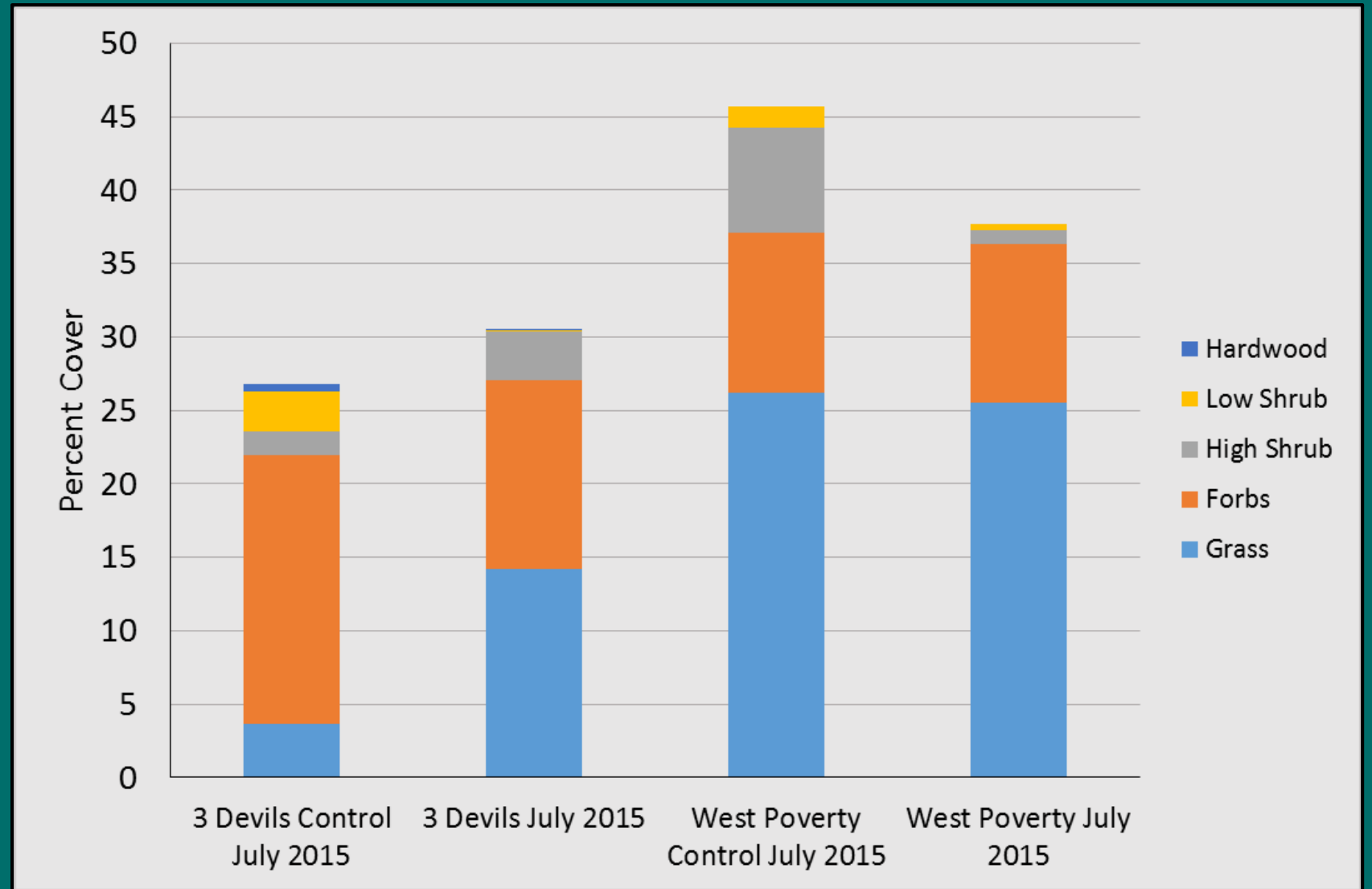
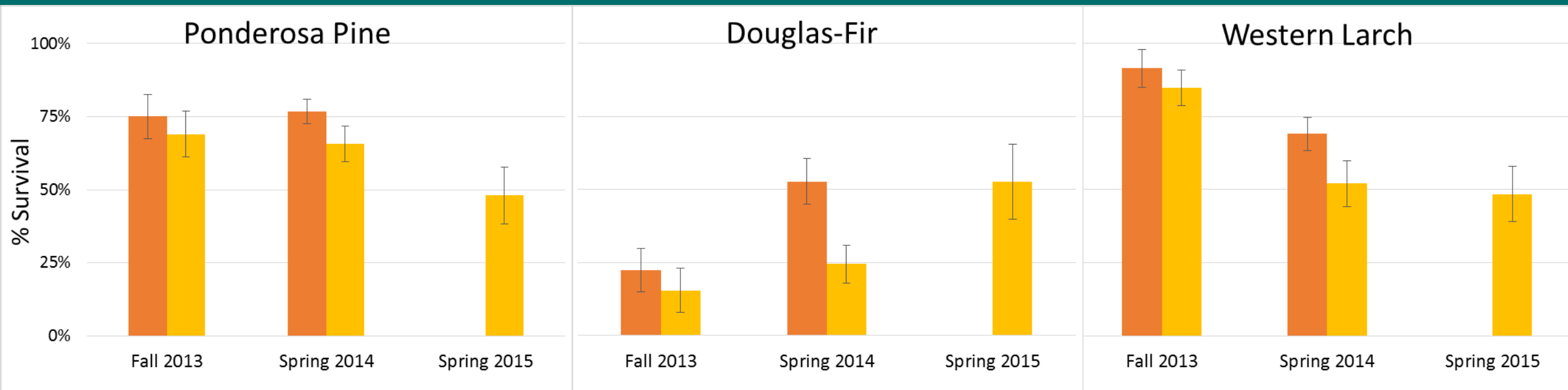
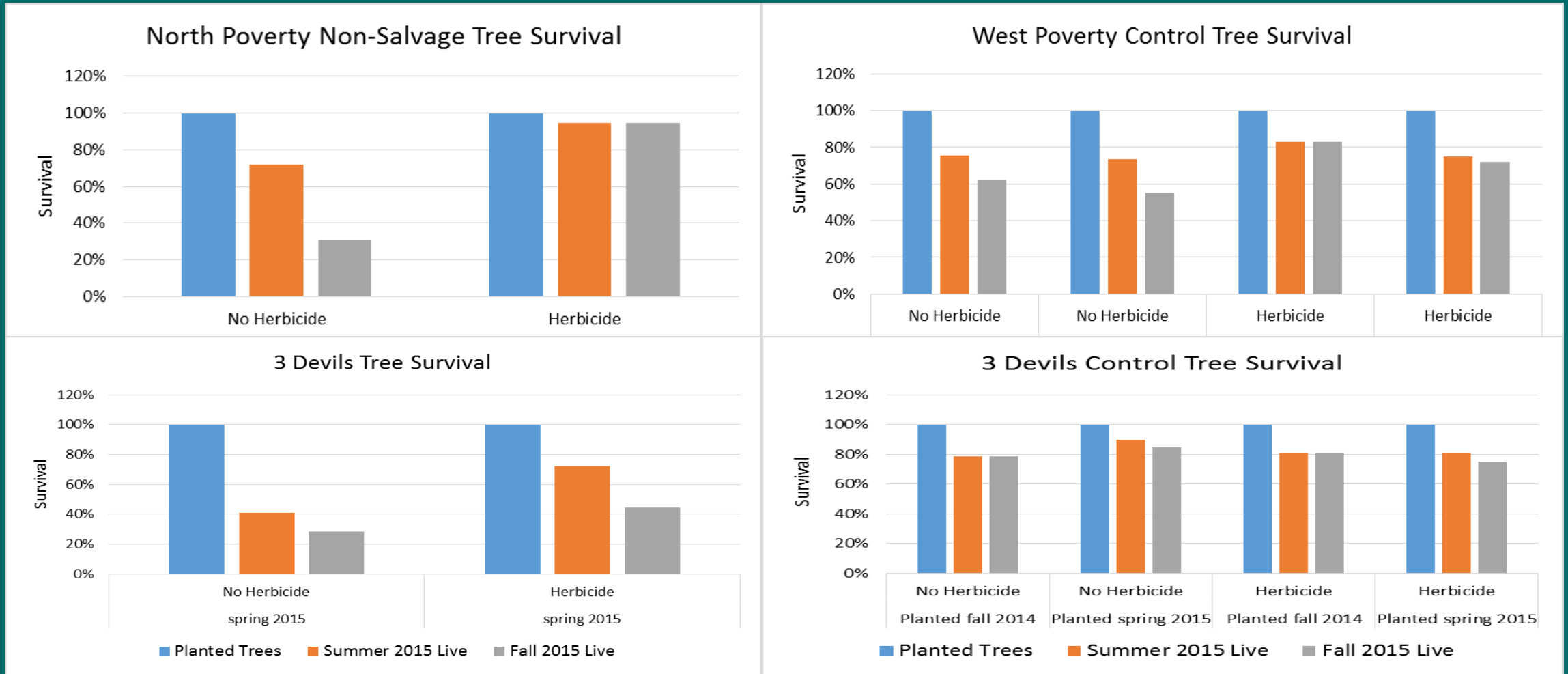


Table Mountain Tree survival results

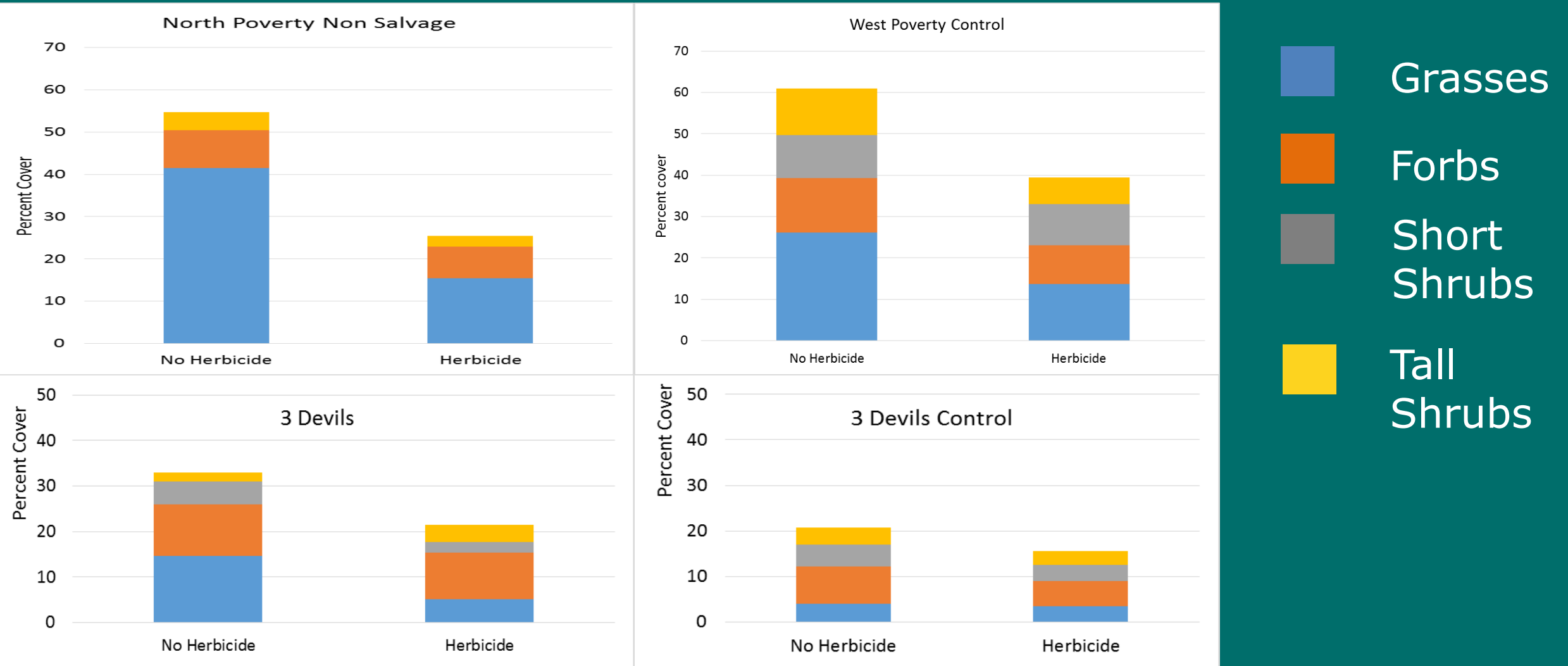
- Fall vs Spring
 - Better for WL
 - Equal for PP
 - Worse for DF
- Delayed Planting
 - Insignificant for WL
 - Worse for PP
 - Better for DF
- FPA min's not met
- Replanting occurring
- Naturals coming in



Carlton Survival by Year and Season of Planting and Herbicide



Herbicide Effects on Vegetation % Cover



Carlton Survival

- High levels of Late summer mortality without herbicides
- Survival improved with Velpar on 3 of 4 sites
 - Up to 85% vs. 25%
- One site showed insignificantly better survival without Velpar
 - Also had lowest veg cover %
- Fall vs Spring inconclusive



Herbicide and Survival Results

- 3 of 4 sites reduced veg cover to about 20% in year one
 - Veg plot size vs spot treatment size
- Grasses most common competitor
- Grasses reduced by about 50%
- Other life forms barely affected



Natural Regeneration

- Table had scattered first year germinants and established seedlings
 - September burn allowed cone ripening and seed maturation
 - Many sites have nearby live trees
- Carlton earlier burn, August
 - No cone ripening or seed maturation expected
 - Long distances to live trees



Future Efforts

- Monitoring of studies will continue
- Expanding into the more productive areas burned in 2015
- Herbicide work
- Natural recovery across environmental gradients
- Additional seedling species
- Refined assessments of
 - Productivity
 - Habitat potential



Conclusions

- Some dry sites likely to revert to grass or shrubland
- Reforestation success not assured
 - Herbicides may be necessary
 - Herbicides may not be enough
- Fall planting can be a viable alternative
 - Weather
- Vegetation recovers rapidly – fire adapted ecosystems
 - Delayed planting may be problematic
- Retain sufficient live trees to avoid planting



Sylvis WL Study Site

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