

Satellite-based detection of harvest trends on federal lands preceding and following the start of the Northwest Forest Plan.

Sean Healey and Warren Cohen

U.S. Forest Service

PNW Research Station, Corvallis OR



Preview:

- Plot-based vs. satellite-based estimation of disturbance rates
- Disturbance trends
 - Federal forests
 - Non-federal forests
- Developments in satellite-based disturbance mapping that may be relevant to future NWFP monitoring efforts

	Size class	at Time 2			Total, Time 1
		Non-stocked	< 20 "	≥ 20"	
at Time 1	Non-stocked	16.2	1.0	0.1	17.4
	< 20 "	0.6	41.5	4.9	47.0
	≥ 20"	0.1	1.7	33.9	35.7
Total, Time 2		16.9	44.3	38.8	100

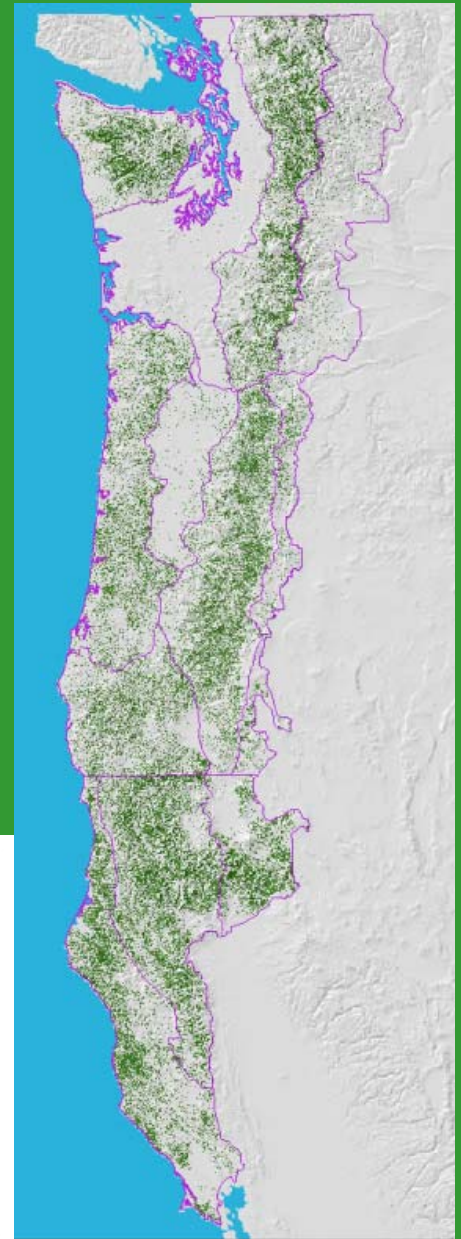
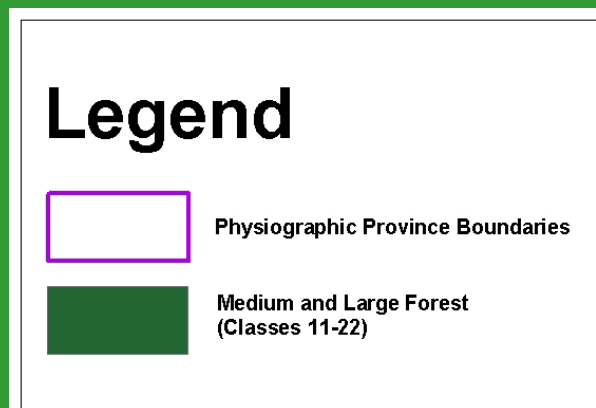
Re-measured plot data can provide unbiased estimates of specific changes of interest. However, this approach does not tie changes to the landscape in a way that is useful for updating and analyzing maps.

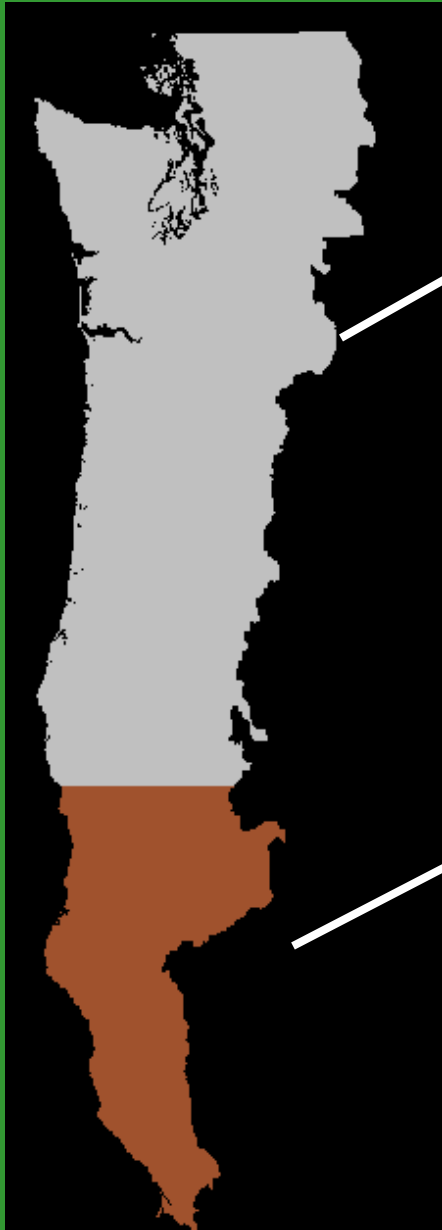
Source: Moeur et al., 2005

Net change estimated over 10 years in ≥ 20-inch class		
Province	Percent	Acres
California		
Cascades	12.7	49,500
Coast Range	5.1	9,300
Klamath	9.7	193,700
Total		252,500
Oregon		
Coast Range	5.6	32,200
Eastern Cascades	1.9	4,700
Klamath	9.7	76,100
Western Cascades	3.6	74,900
Willamette Valley	na	na
Total		187,900
Washington		
Eastern Cascades	2.7	4,900
Olympic Peninsula	-4.6	-30,600
Western Cascades	12.9	191,000
Western Lowlands	na	na
Total		165,300
Northwest Forest Plan	7.7	605,700

In applications where spatial relationships are important (e.g. connectivity analysis), spatially explicit change information is required. The only realistic source of such information is remote sensing.

Map of Medium and Large Forests (mean diameter > 20")





Laboratory for Application of Remote Sensing in Ecology

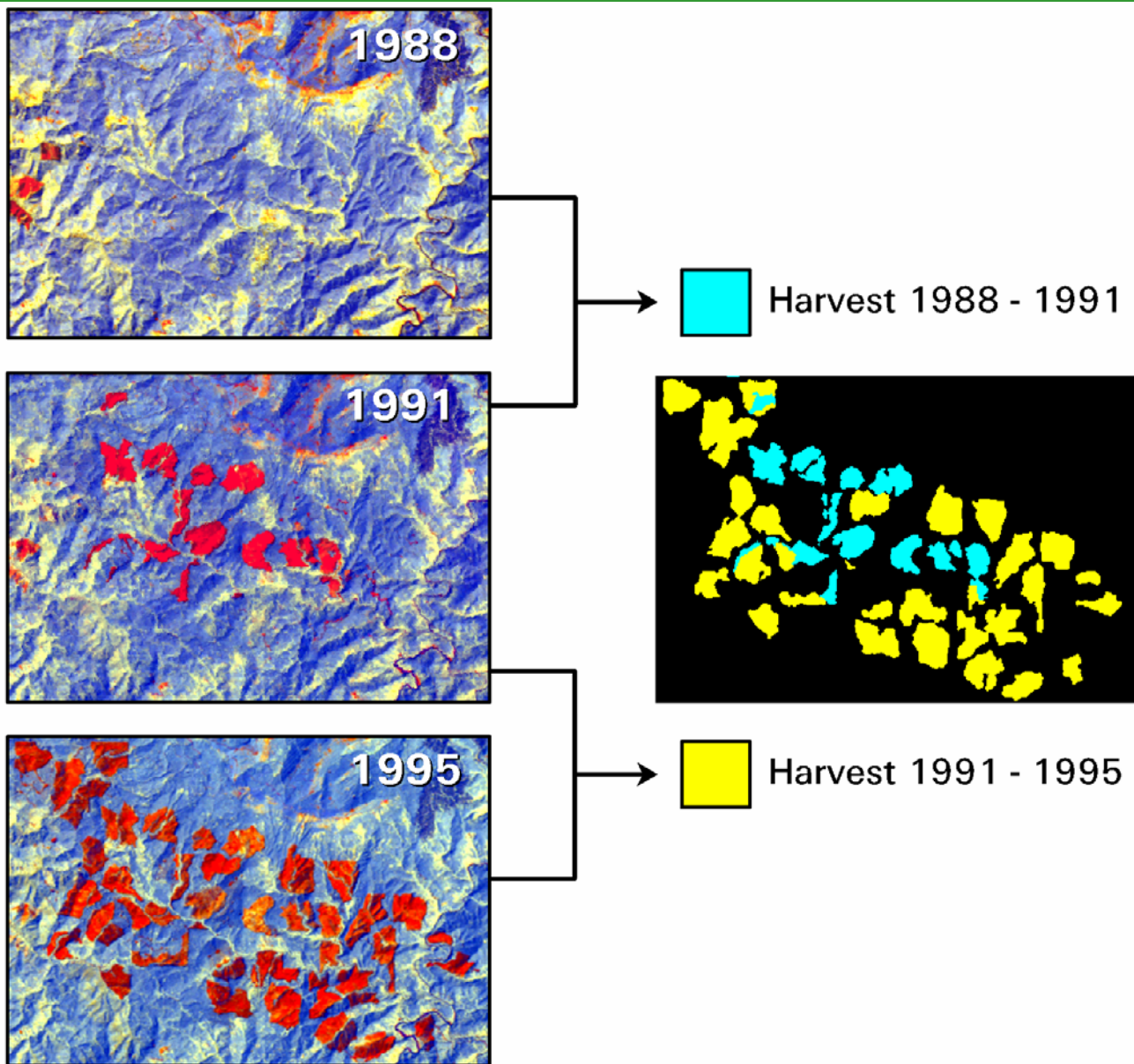
(<http://www.fsl.orst.edu/larse/>)

- Stand replacement harvests and fires that removed the majority of the canopy were mapped
- Used approximately 4-year intervals from 1972-2002

California Land Cover Mapping and Monitoring Program

(http://frap.cdf.ca.gov/projects/land_cover/index.html)

- Vegetation changes from 1994 to 2003 mapped into categories of intensity of loss or gain
- The class “Greater than 70% loss” was deemed compatible with “stand-replacing disturbance.”



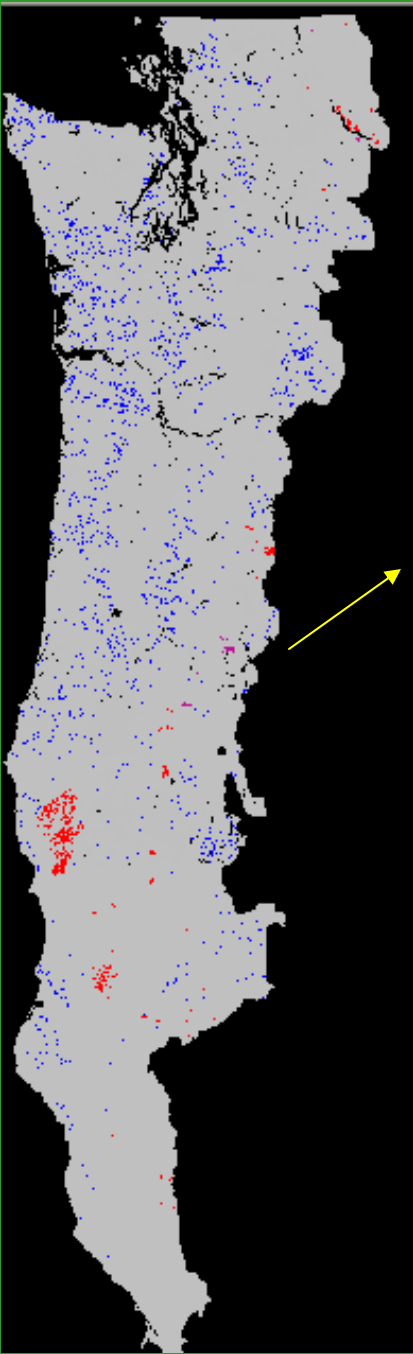
Stand-replacing disturbances create distinctive spatial and spectral patterns, allowing them to be mapped in a relatively straightforward manner.

Error Assessment


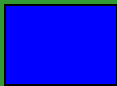

- Accuracy was assessed in over 2500 randomly selected locations.
- Overall accuracy was approximately 90%
- Errors were higher in more open forests and in earlier dates

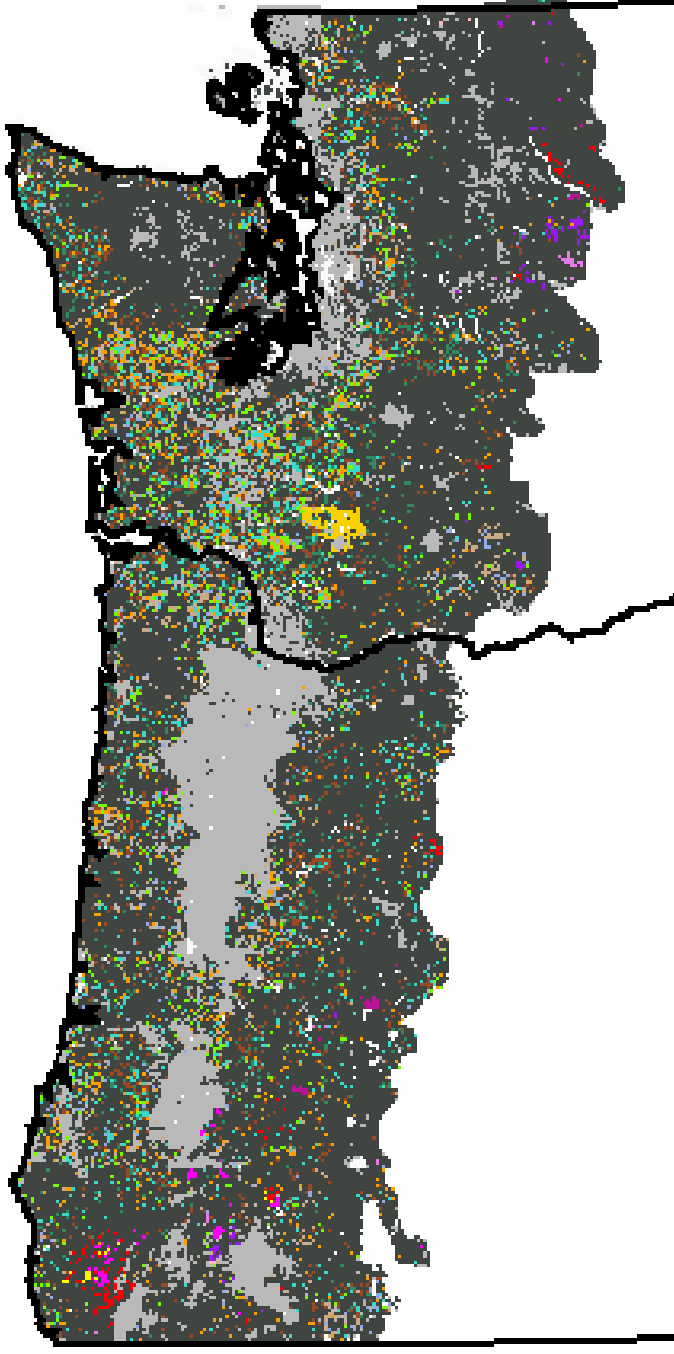
Mapped disturbances were used to update 1996 baseline conditions for old growth forests and spotted owl habitat

Moeur, M. et al., 2005. Northwest Forest Plan – The First Ten Years (1994-2003): Status and Trends of Late-Successional and Old-Growth Forests

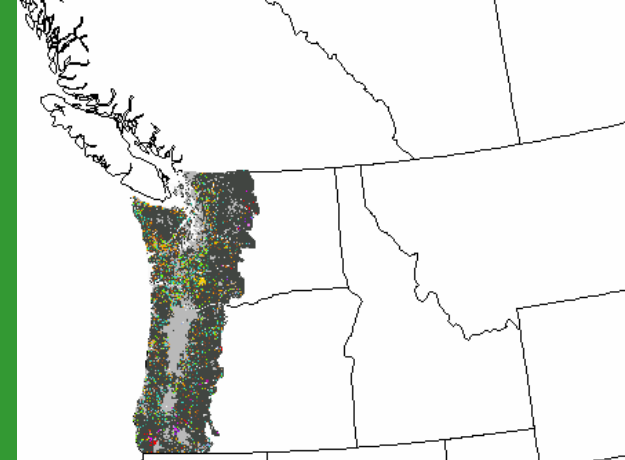
















Lint, Joseph B. (technical coordinator). 2005. Northwest Forest Plan – The First Ten Years (1994-2003): Status and trends of northern spotted owl populations and habitat.

-  No stand-replacing disturbance
-  Stand-replacing harvest, 1996-2002
-  Stand-replacing fire, 1996-2002

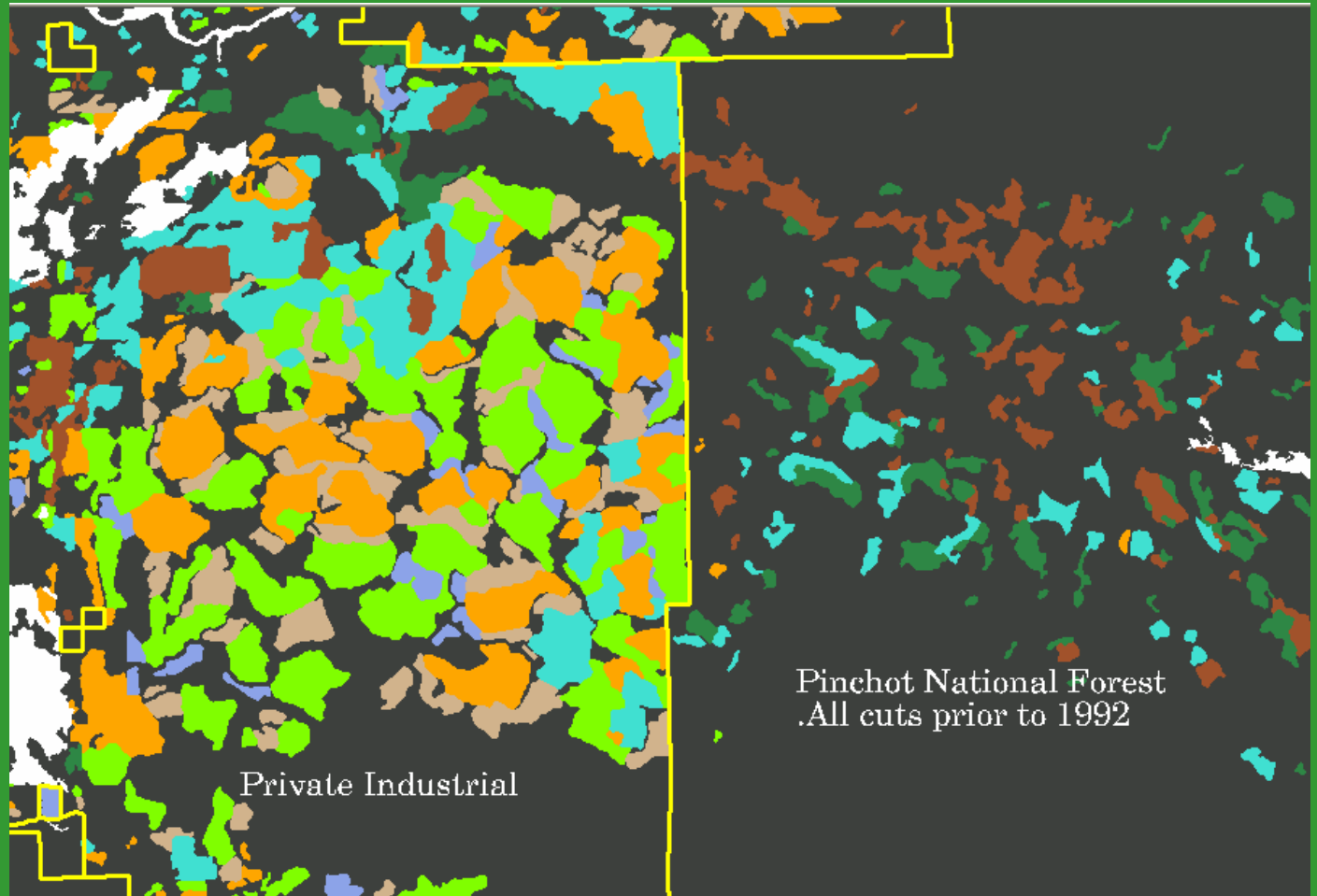


Map of stand-replacing harvests and fires in Oregon and Washington, 1972-2002



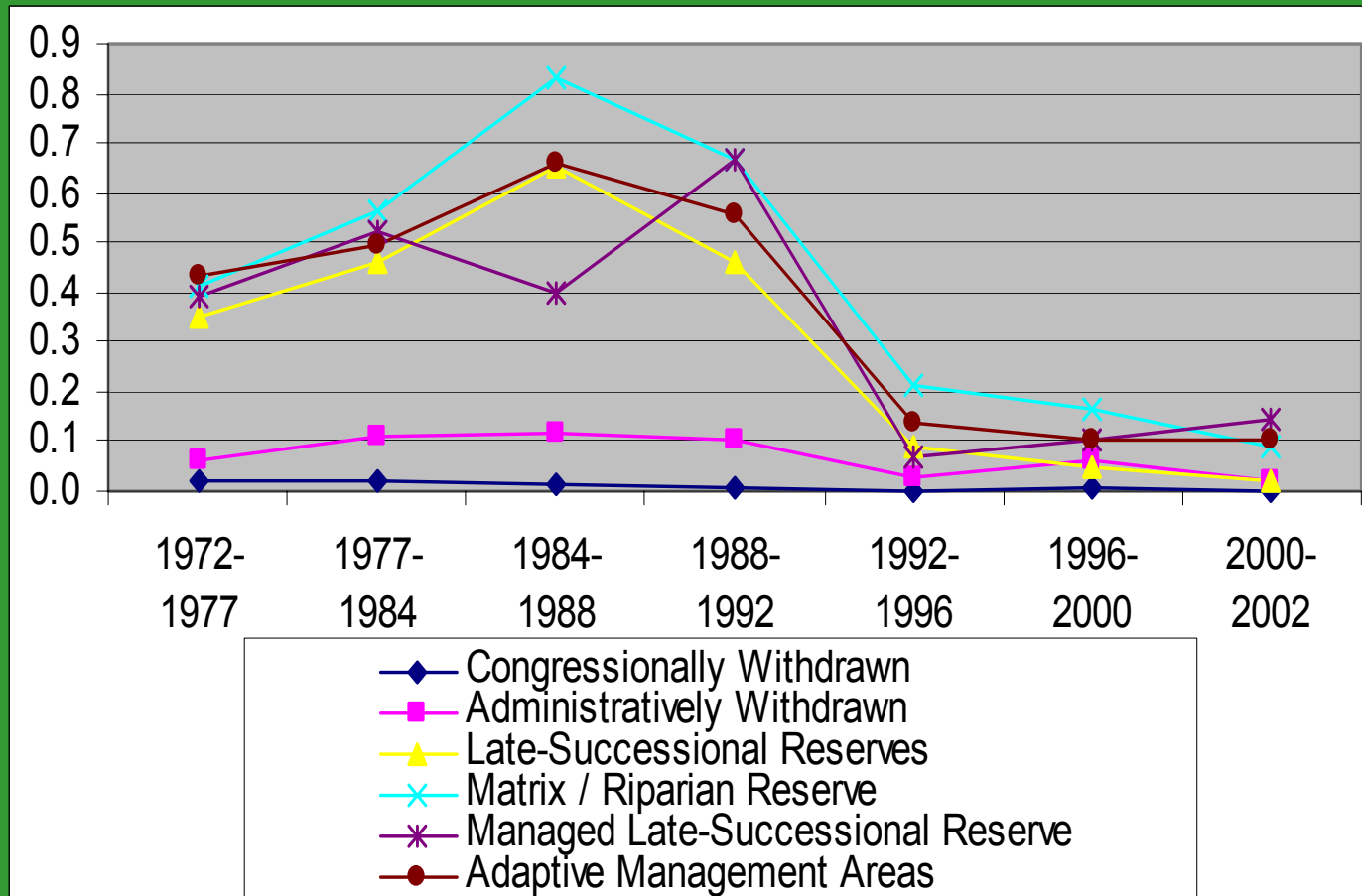
Harvests		Fires	
	1972-1977		
	1977-1984		
	1984-1988		
	1988-1992		
	1992-1996		
	1996-2000		
	2000-2002		

Disturbance maps communicate spatial and temporal harvest trends in a straightforward manner



Stand-Replacing Harvest in Oregon and Washington by NWFP Land Use Allocation

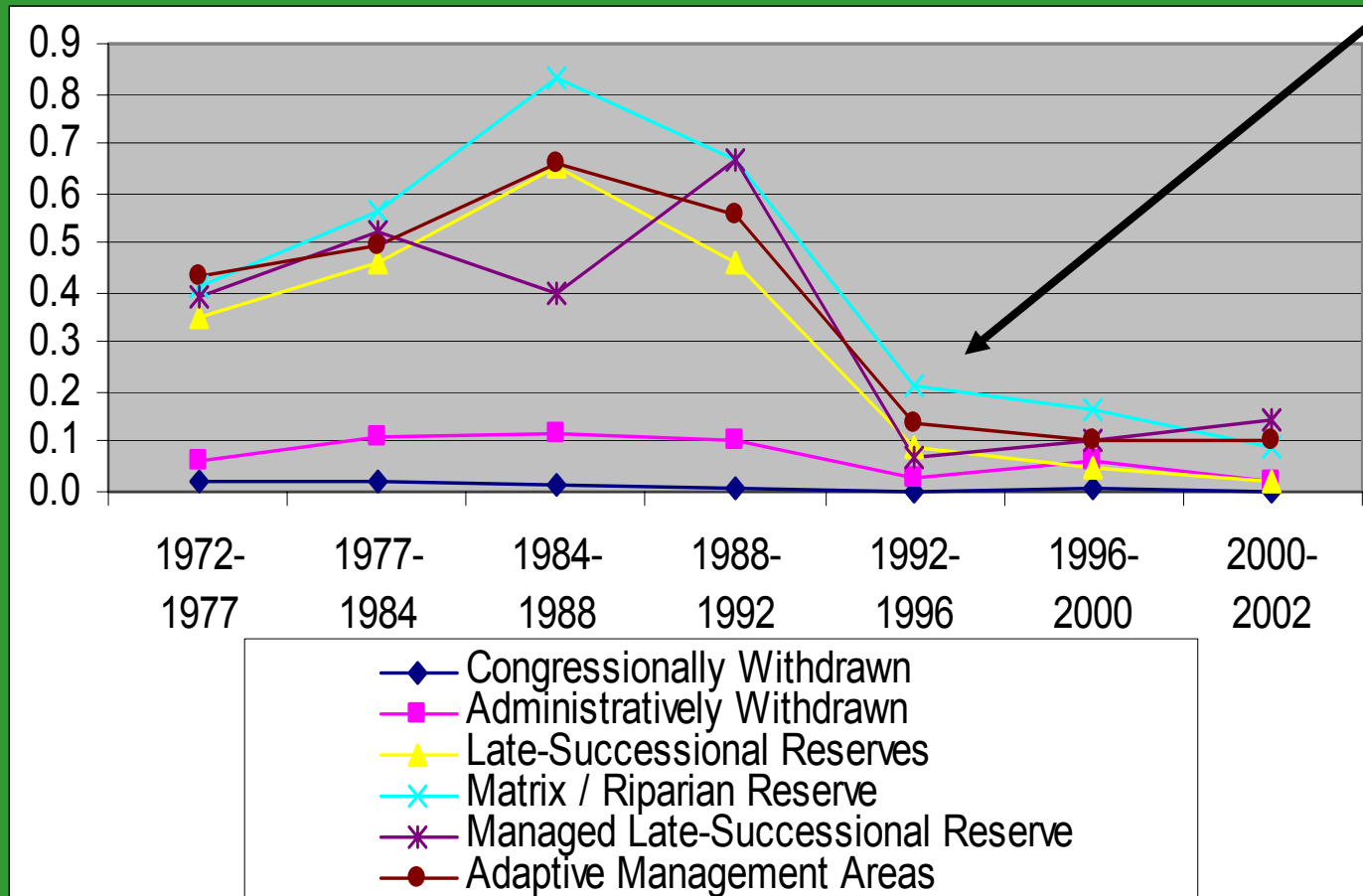
% Harvested / Year



Stand-Replacing Harvest in Oregon and Washington by NWFP Land Use Allocation

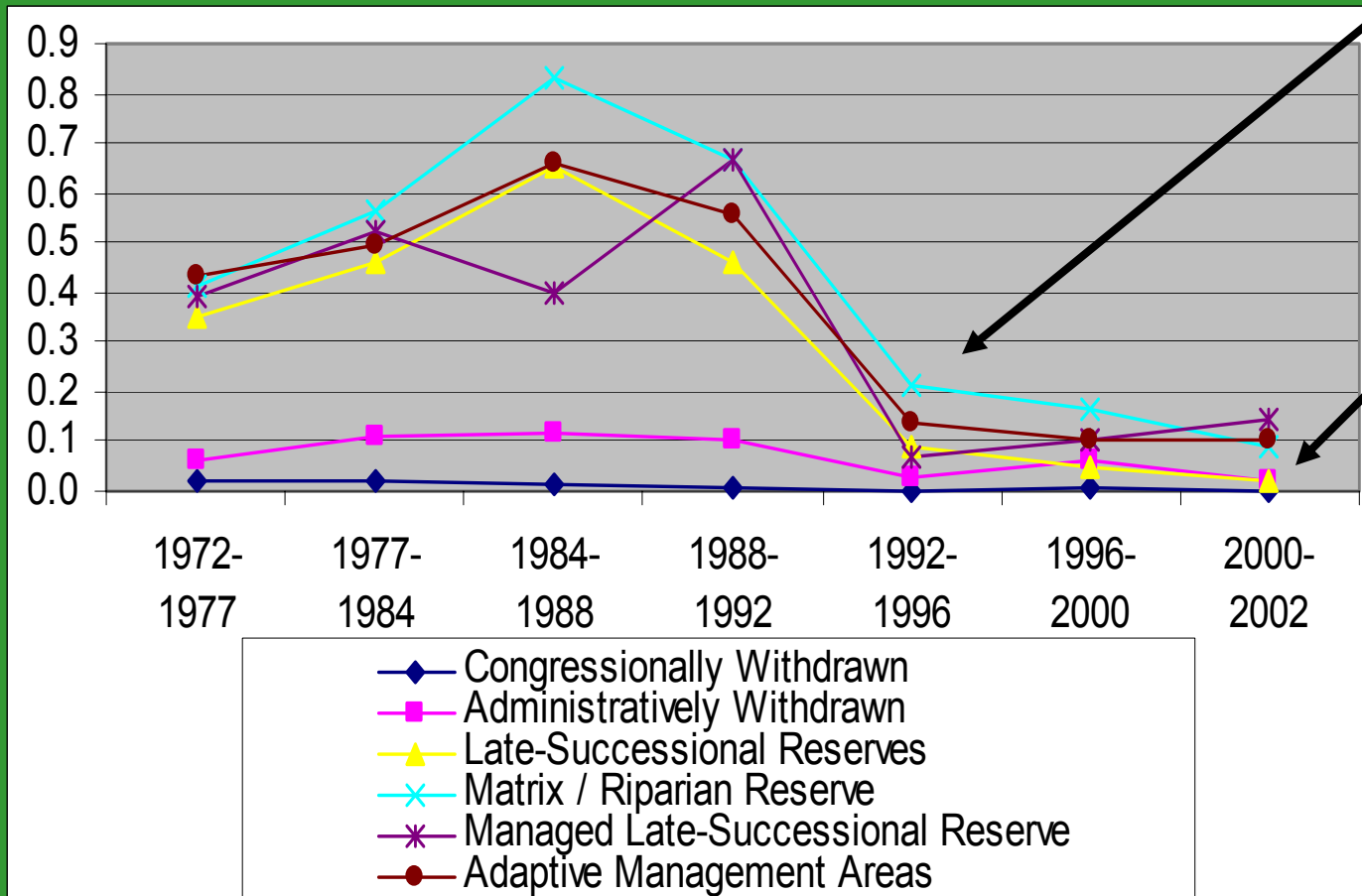
Overall decline in harvest levels

% Harvested / Year



Stand-Replacing Harvest in Oregon and Washington by NWFP Land Use Allocation

% Harvested / Year

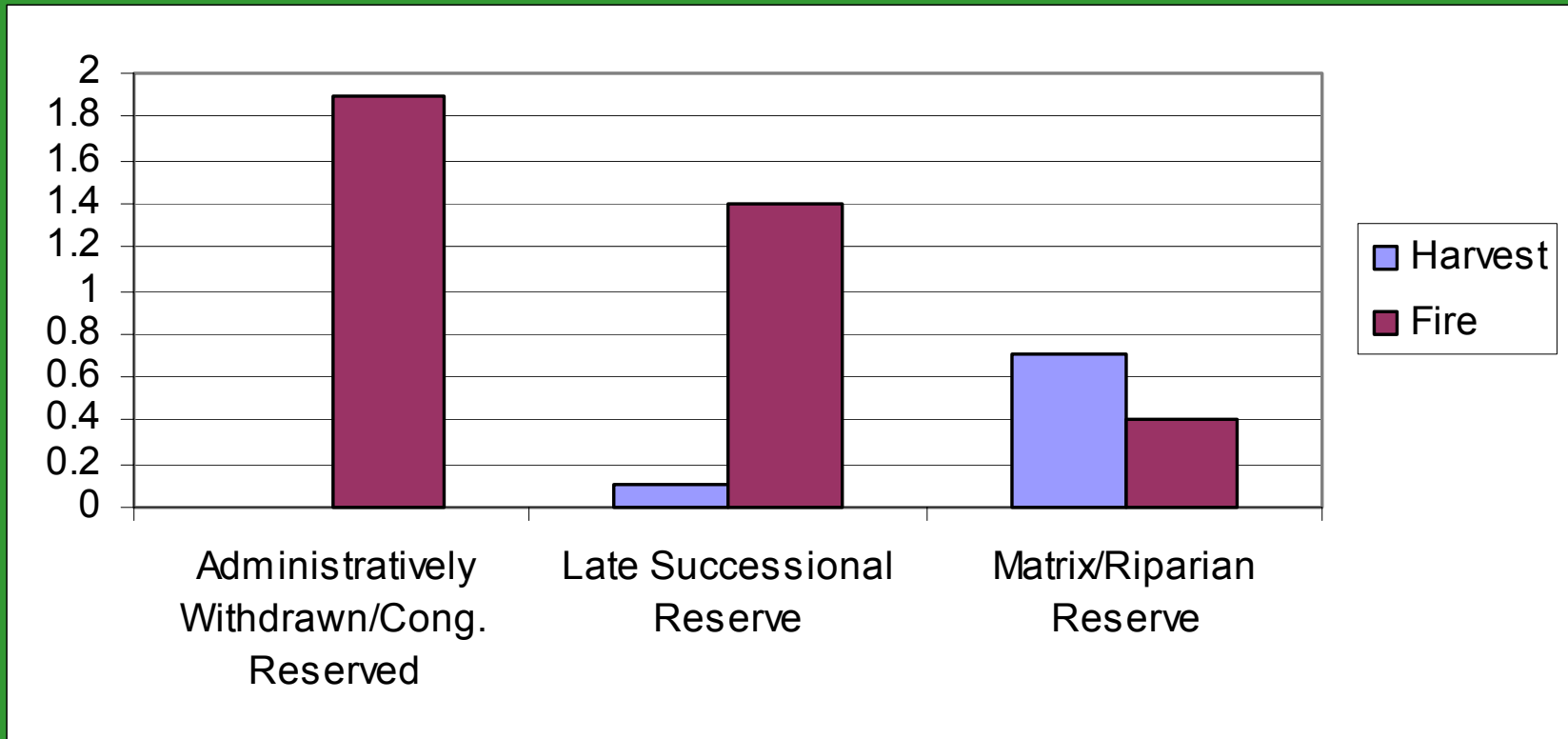


Overall decline in harvest levels

Late-successional reserves moved from the harvested to the reserved group

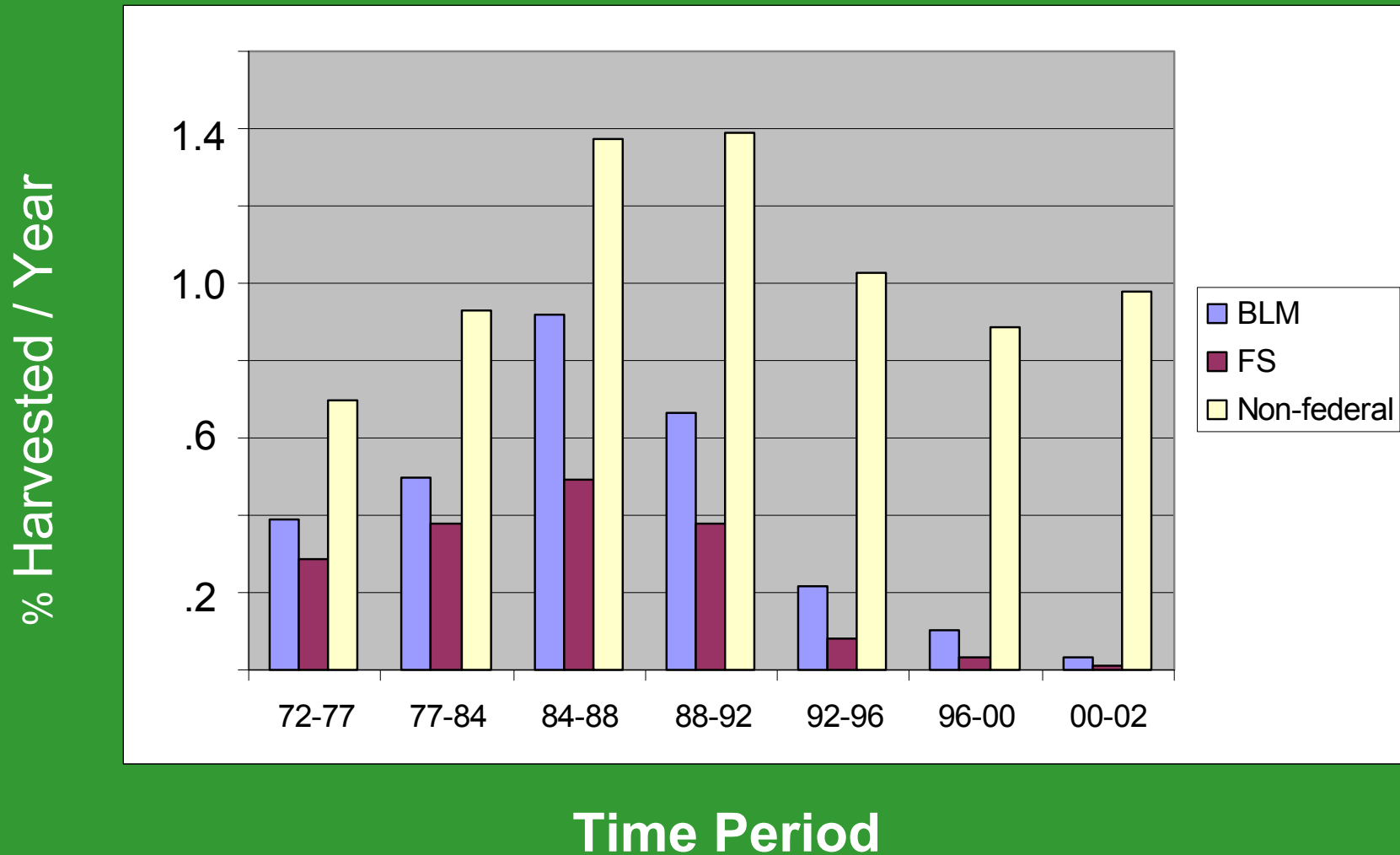
Percentage of NWFP forests (QMD ≥ 20) undergoing stand-replacing disturbance from 1994-6 to 2002

% Disturbed 1994-6 to 2002



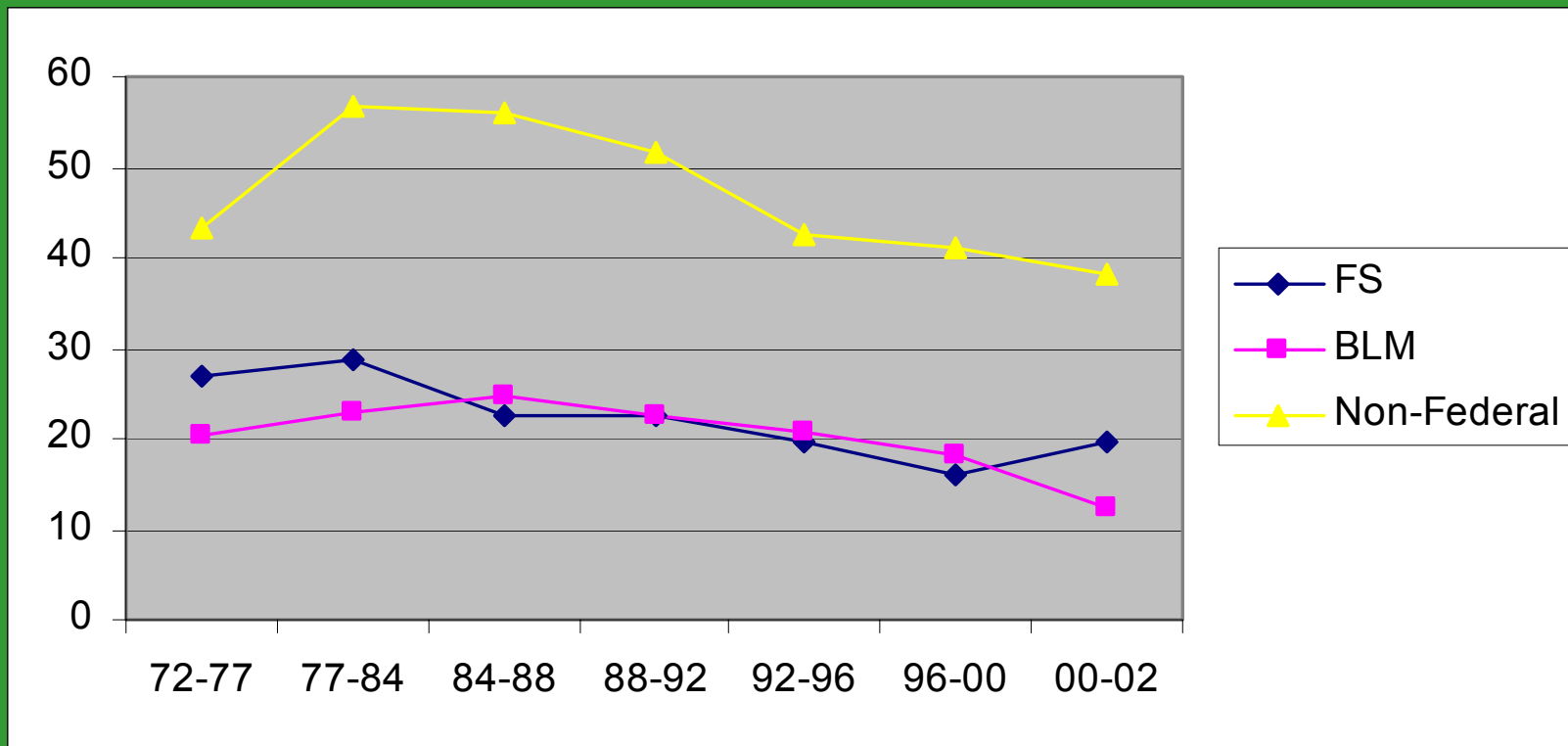
Source: Moeur et al., 2005

Percent of federal and non-federal forestland harvested in the NWFP area of Oregon and Washington, 1972-2002



Federal agencies use smaller harvest units than non-federal land-owners

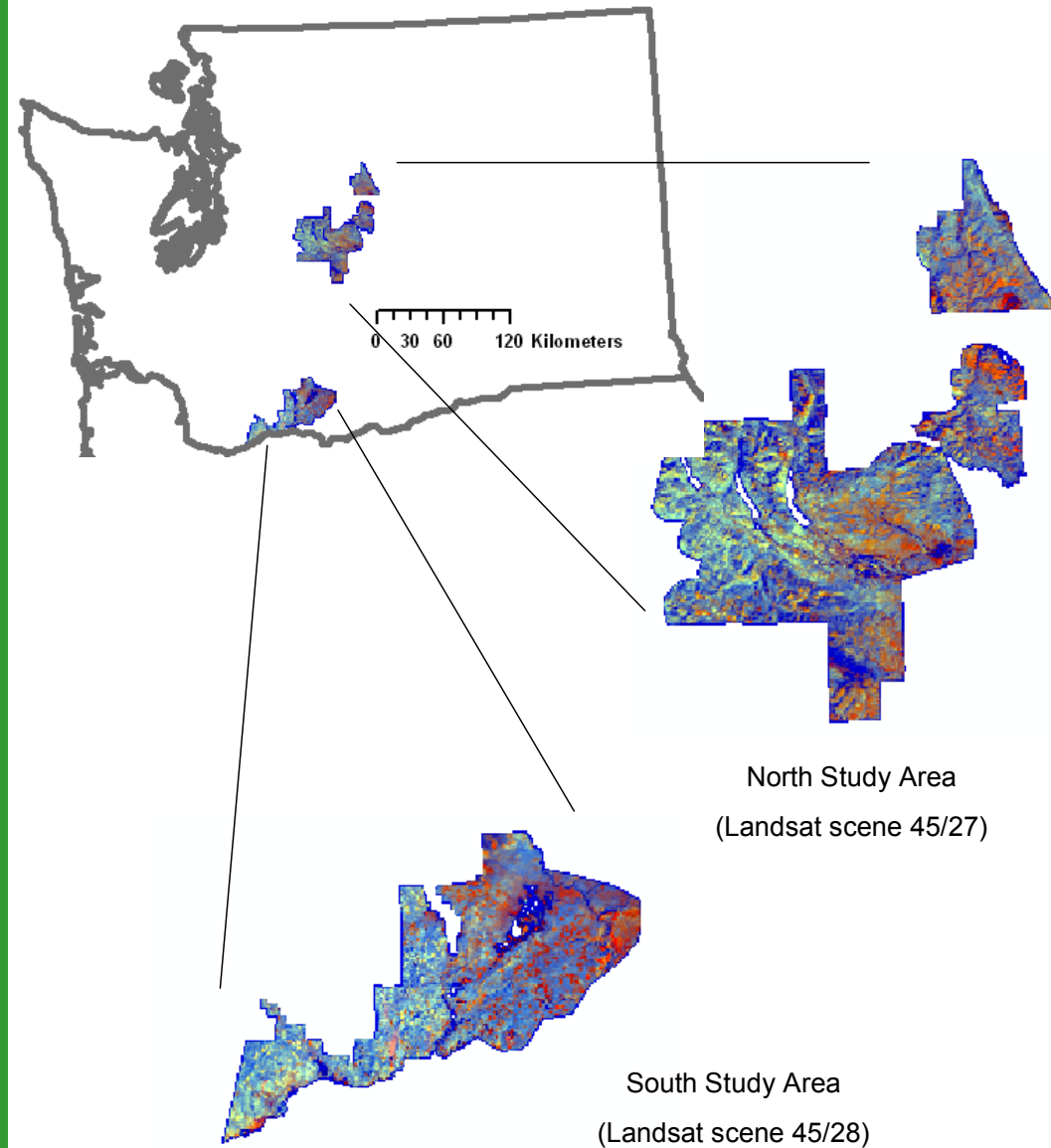
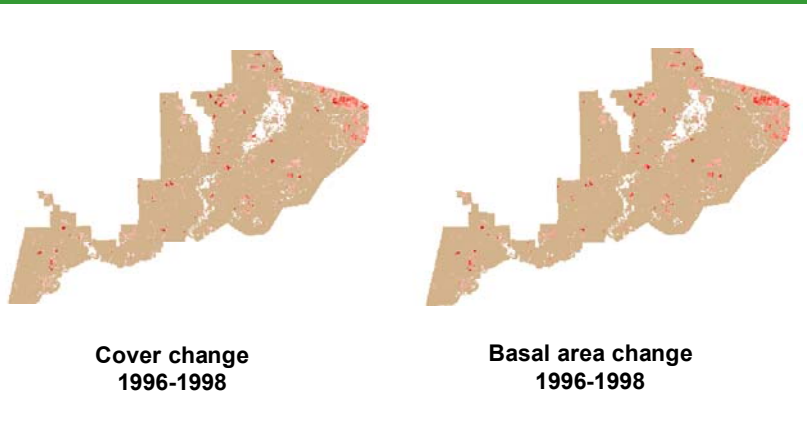
Mean Patch Size (acres)



Time Period

Study Area for Washington Thinning Study

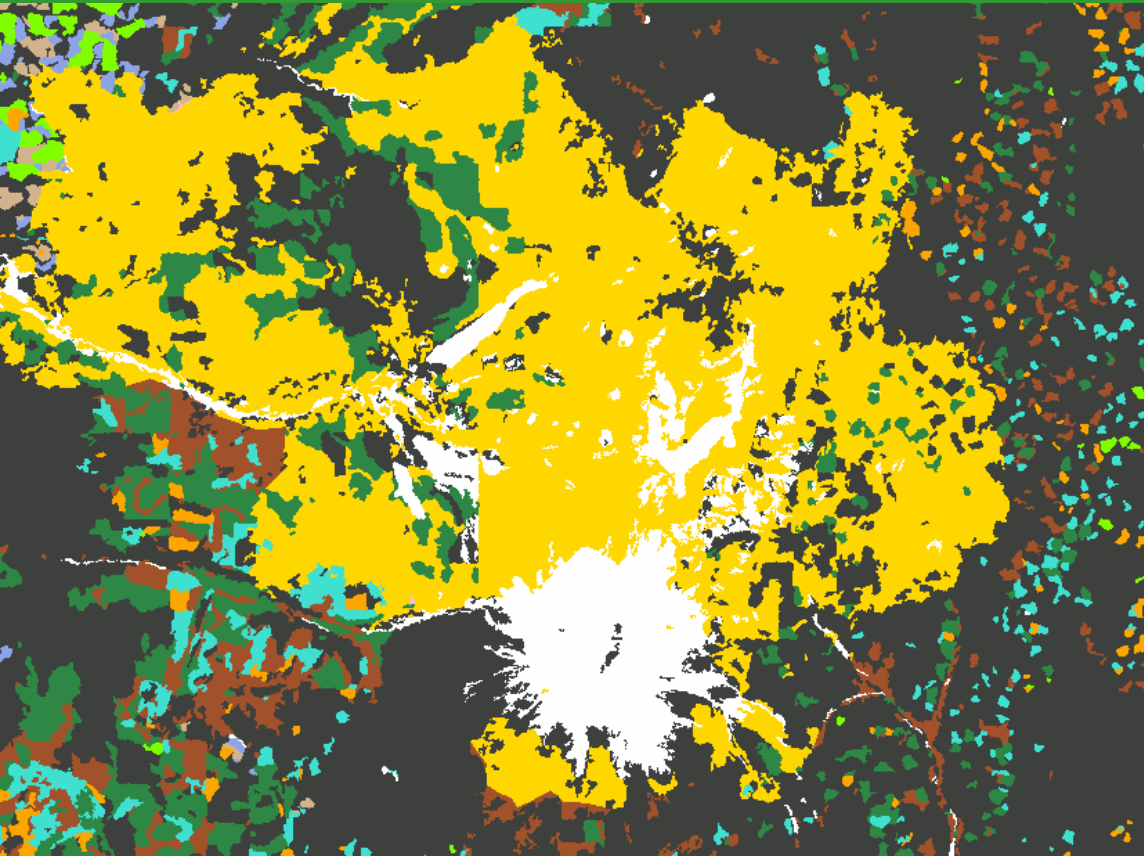
Predicted Removal



Summary

- Harvest rates on federal land have fallen dramatically in the period corresponding the NWFP
- Non-federal forest owners are harvesting at rates that are down from a peak in the 1980's, but about equal to levels in the 1970's
- Fire continues to be a dominant disturbance agent in federal forests
- Partial harvest is a common practice on federal land, and improving remote sensing techniques make it likely that future monitoring efforts will be able to measure these changes

Acknowledgments:



Mount St. Helens

This work was supported by the Interagency Regional Monitoring Program of the Northwest Forest Plan. Oversight was provided by Melinda Moeur, vegetation monitoring lead. Michael Lefsky (Colorado State University) also played a major role in the mapping reported here. Lisa Fischer and Barbara Maurizi led disturbance mapping in California. Partial harvest detection work was largely funded by the Washington Department of Fish and Wildlife.