

Framing Landscape Restoration: Core Principles & Management Implications

John Marshall Photo



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Historical Fire Regimes (ca. 1800)

Regime 5:

>200 yrs btw fires, HSF

Regime 4:

35-200 yrs btw fires, HSF

Regime 3:

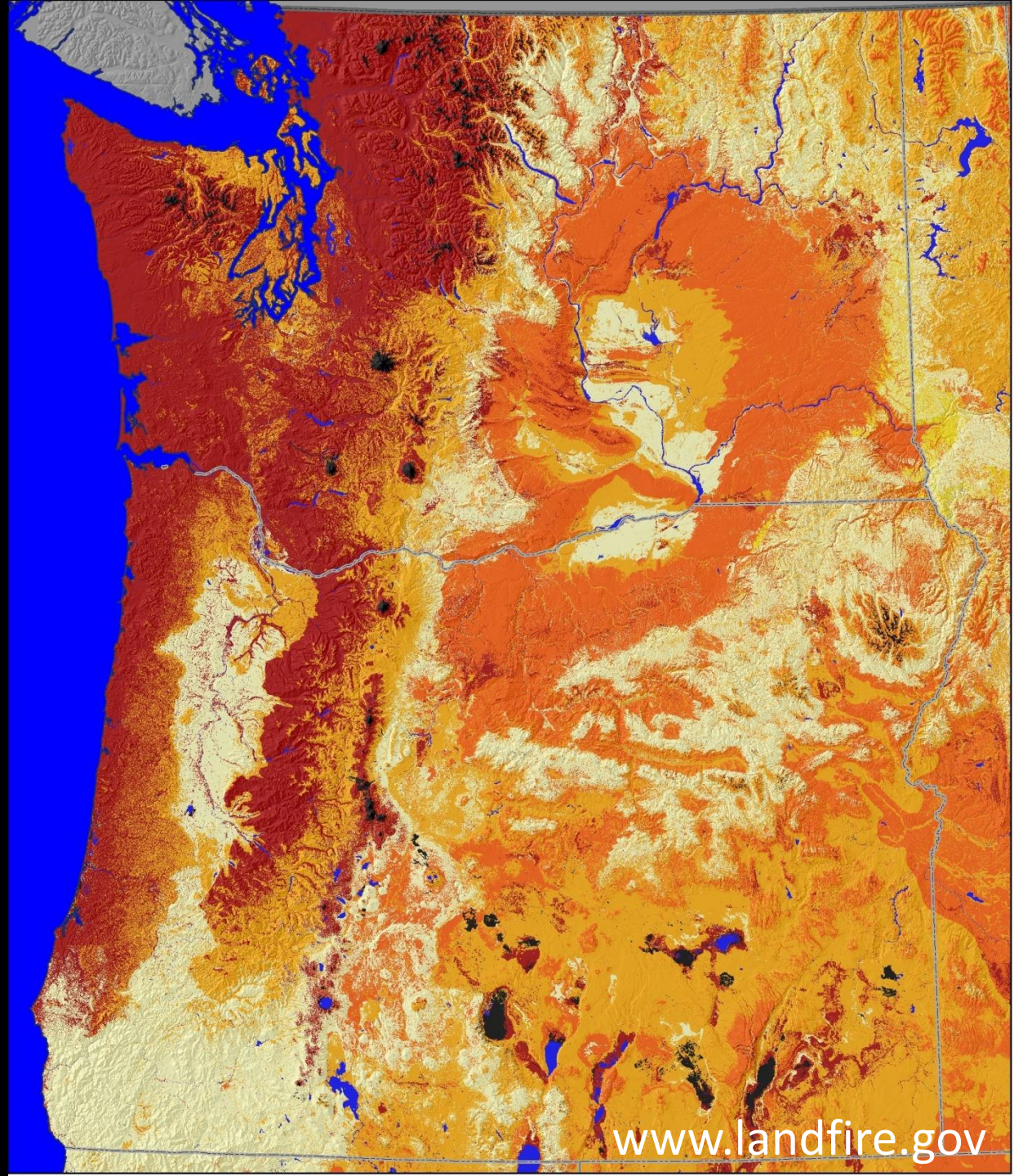
35-200 yrs btw fires, L-MSF

Regime 2:

1-35 yrs btw fires, HSF

Regime 1:

1-35 yrs btw fires, L-MSF

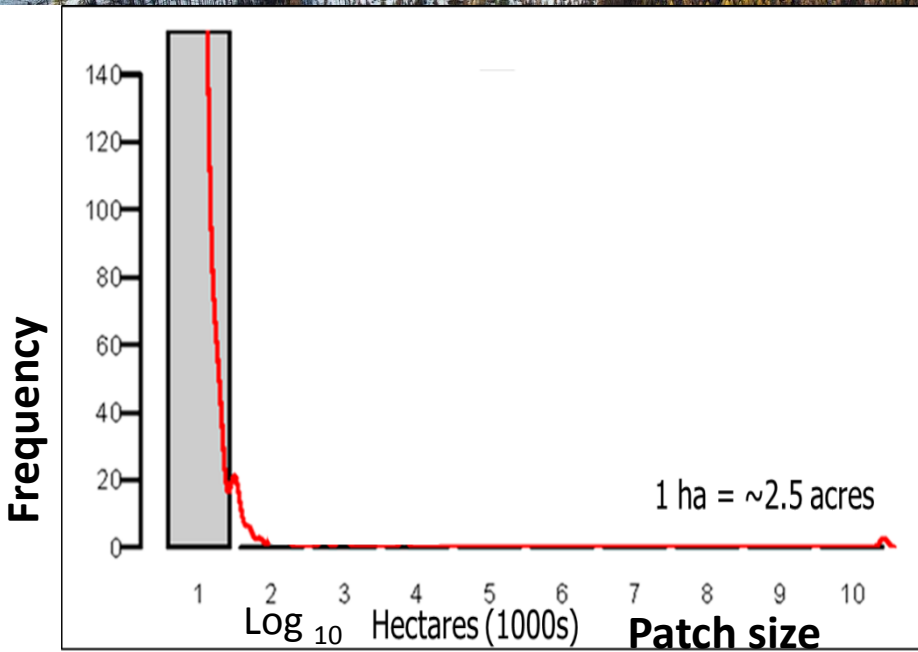


Wildfire



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Mtn pine beetle



Wind event



www.crh.noaa.gov

Disturbance Patterns Provided Critical Landscape Feedbacks

e.g., L, M, H severity fires...

Maintained patchworks of burned & recovering vegetation, in a variety of successional stages, patch sizes, and patterns

- Other disturbances added to this complexity
- **Patterns spatially interrupted conditions supporting large fires**
- Influenced the frequency, size, & severity of future events
- **Extreme climate & weather events trumped these spatial controls**
- This is essentially how landscape resilience worked
- **Additional work is needed to quantify ecoregion & forest type variation in patch size distributions & the strength of feedbacks**

Important Patch-scale Feedbacks Too:

HSFs restarted succession w/ lots of dead wood, but L & MSFs...

- ✓ **Reduced surface fuels**
 - shorter FLs, lower FLI, less tree torching
- ✓ **Increased the height to live crowns**
 - less tree torching, reduced crownfire potential
- ✓ **Decreased crown density**
 - reduced crownfire initiation and spread potential
- ✓ **Favored early seral tree species**
 - increased tree survival during wildfires
- ✓ **Favored medium and large sized trees**
 - increased tree survival during wildfires
- ✓ **Favored patchy tree and surface fuel cover**
 - favored fire tolerant early seral species, L & MSFs

Change Agents:

Roads and railroads
Subdividing by ownership
Timber harvest – selection
and clearcutting
Domestic livestock grazing
Fire prevention/suppression
Urban/rural development
Agriculture

Key Changes:

Fragmented forest – fewer large patches,
Simpler structure – fewer large trees,
intermediate aged forest dominates
Altered composition – less PP, WL, WWP;
more DF, GF, WF, SAF, ES
Increased vulnerability to fires, insects, &
pathogens
Fewer grasslands & shrublands, in forest
Fragmented fish networks, fewer fish

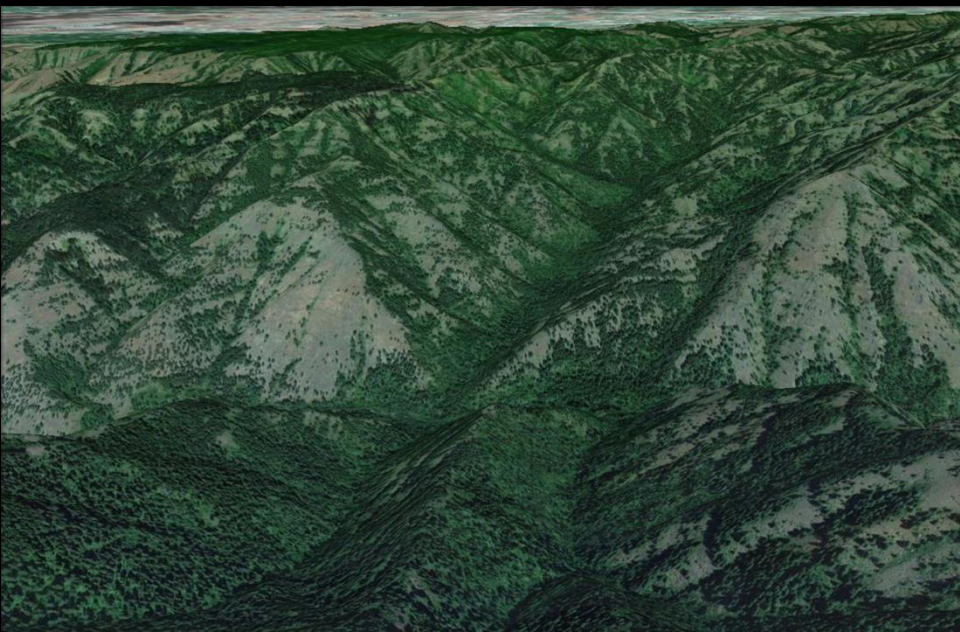
East-side Forest Ecosystem Health Assessment,
Interior Columbia Basin (ICBEMP) Assessment,

Everett et al. 1994
Hann et al. 1997, Quigley et al. 1996,
Hessburg et al. 1999, 2000, Lee et al. 1997,
Bisson et al. 2003, Rieman et al. 2000, 2010

Framing Landscape Restoration: Core principles

1) High functioning provincial landscapes are the conceptual foundation of high functioning local landscapes

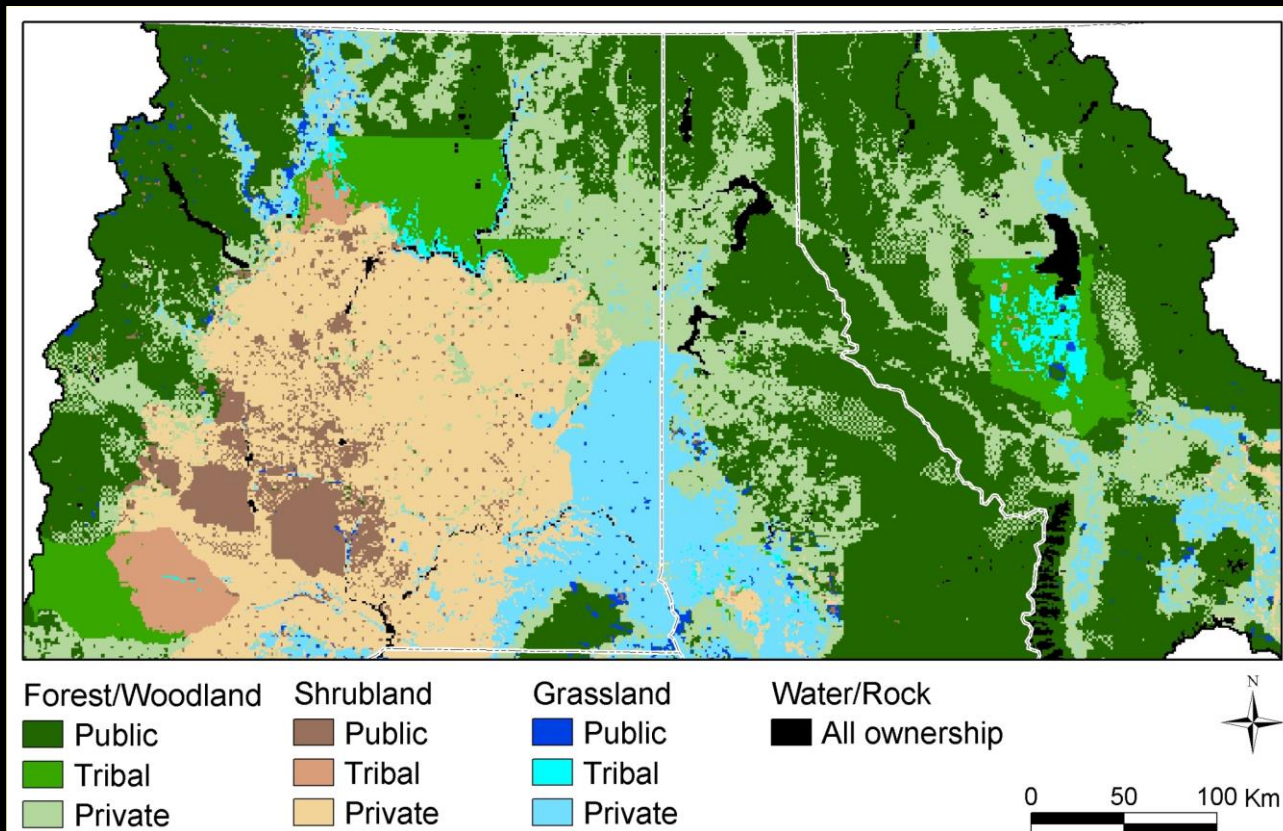
- Additive stand management fragmented the regional landscape
- This accounts for most listed & focal terrestrial & aquatic species
- Local landscape restoration w/o provincial-scale evaluation and prioritization will not likely restore provincial landscapes
- Provinces vary in their management history, outcomes, needs



Framing Landscape Restoration: Core principles

2) Ownership boundaries frame restoration needs/solutions poorly

- Terrestrial & aquatic spp. habitat /metapopulation concerns won't likely be resolved by any landowner working in isolation
- Cross-boundary collaboration & problem solving are needed



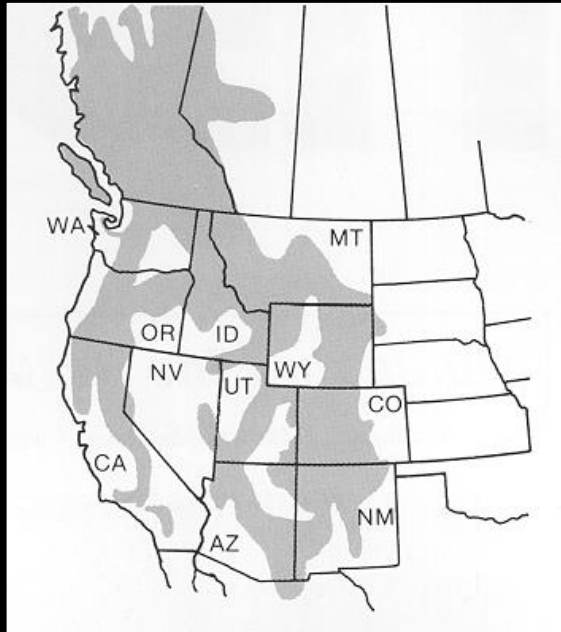
Framing Landscape Restoration: Core principles

3) The disturbance regime--the *engine* that drives the system

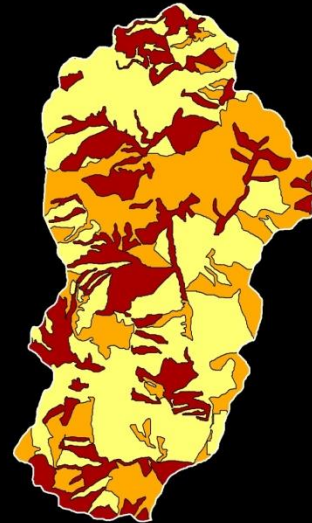
- Fire, I&D, weather regimes naturally varied by forest type
- Regime attributes: freq, sev, extent, seasonality, variability
- Process follows pattern; restoring patterns might restore processes
- Uncertainty about the extent to which regimes may be restored



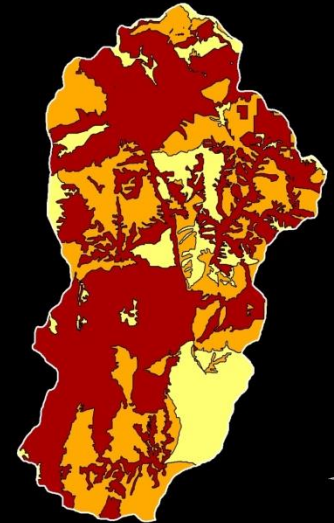
Mountain pine beetle



Historical



Current



Low Moderate High

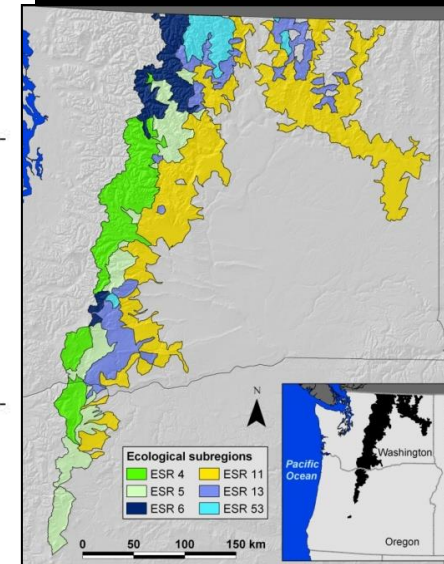
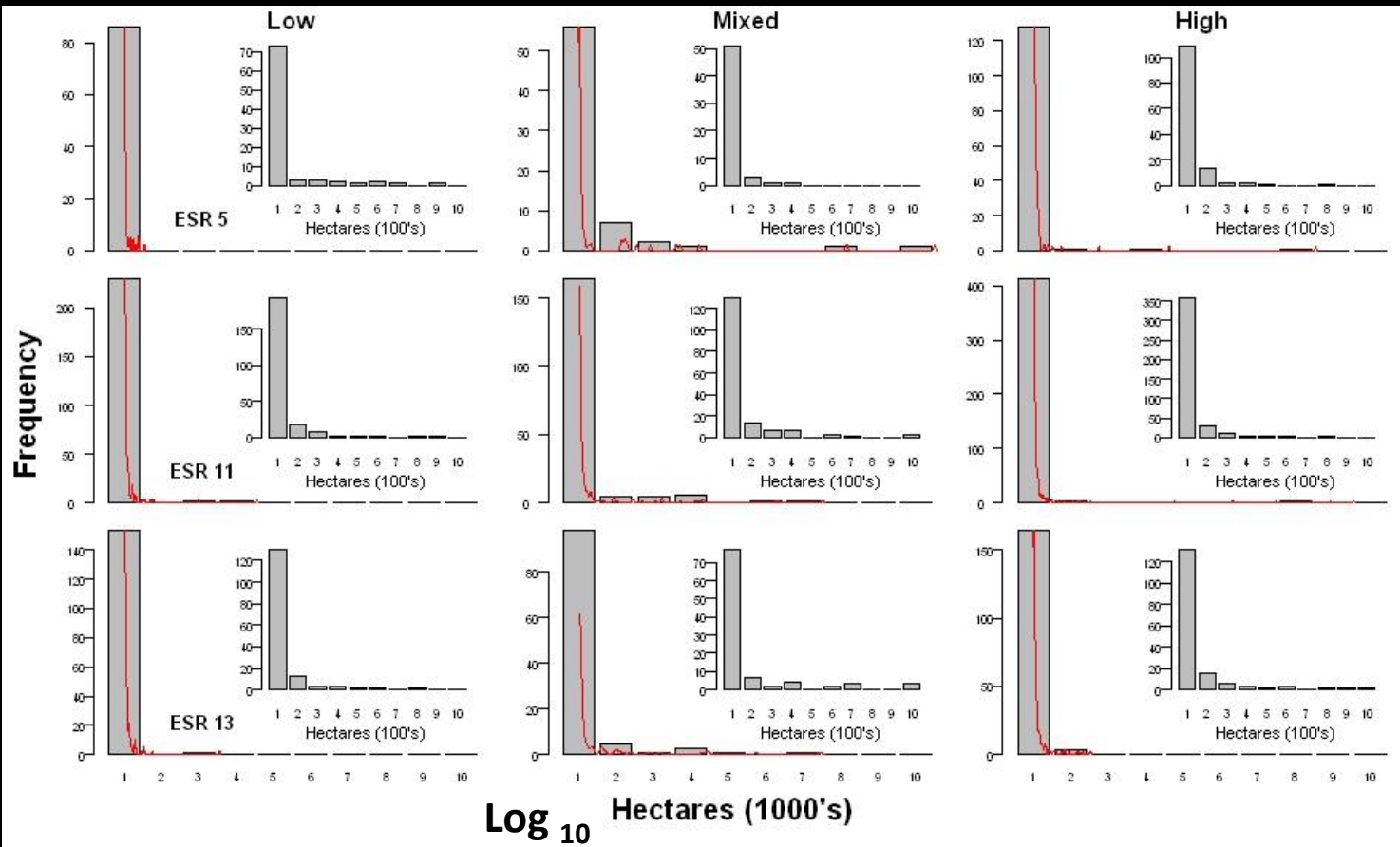
0 1 2 3 4 5 Km



Framing Landscape Restoration: Core principles

4) Predictable disturbance severity patch size distributions emerged from the native disturbance regimes

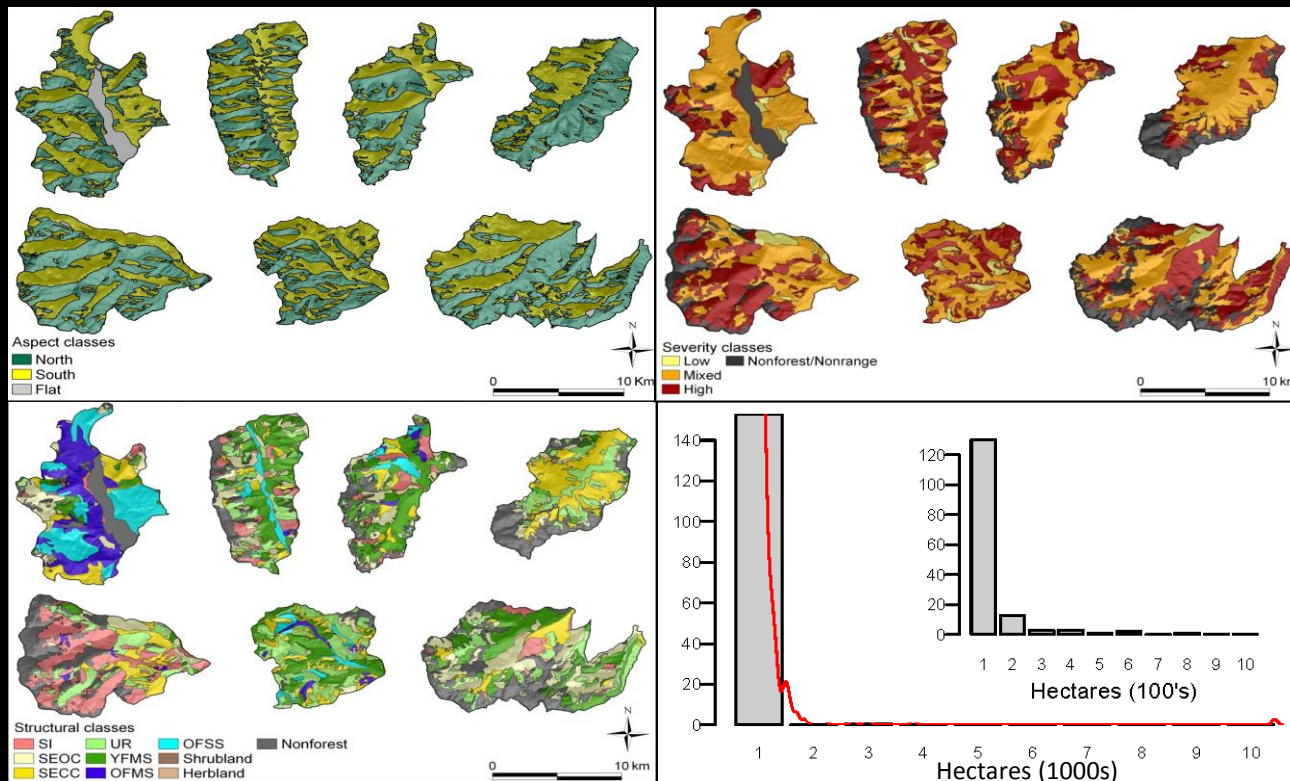
- Relatively self-maintaining, landscape resisted abrupt changes
- Yielded predictable patch size distributions of successional states
- This is an important ingredient to landscape resilience



Framing Landscape Restoration: Core principles

5) The NRV emerged from the disturbance patch size distributions

- It's *how* pattern influenced disturbance regimes
- Current successional patterns are not in synch w/current regimes
- This is driving new disturbance regimes w/ uncertain outcomes
- NRV is non-stationary, evolves w/ the climate, becomes FRV

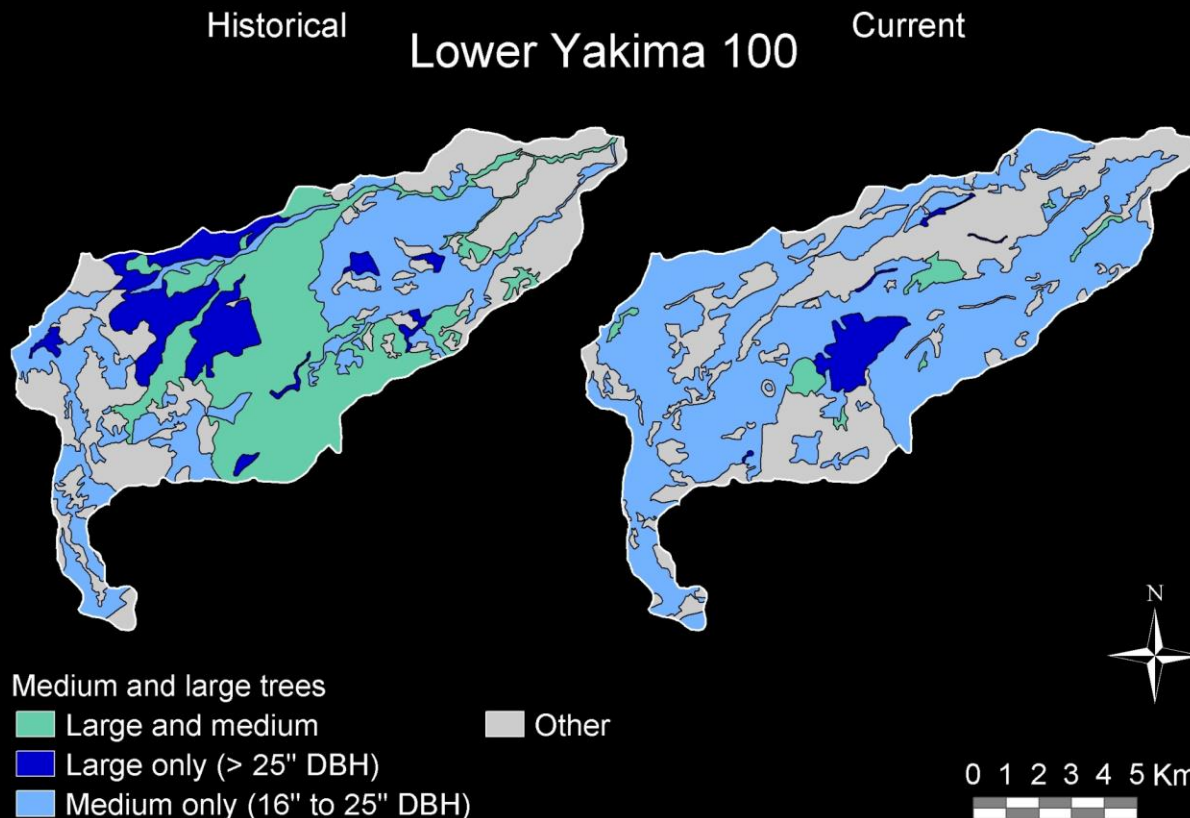


Keane et al. 2009
Weins et al. 2012
Moritz et al. 2011
Perry et al. 2011

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6) Medium & large old trees are a critical backbone of MC landscapes

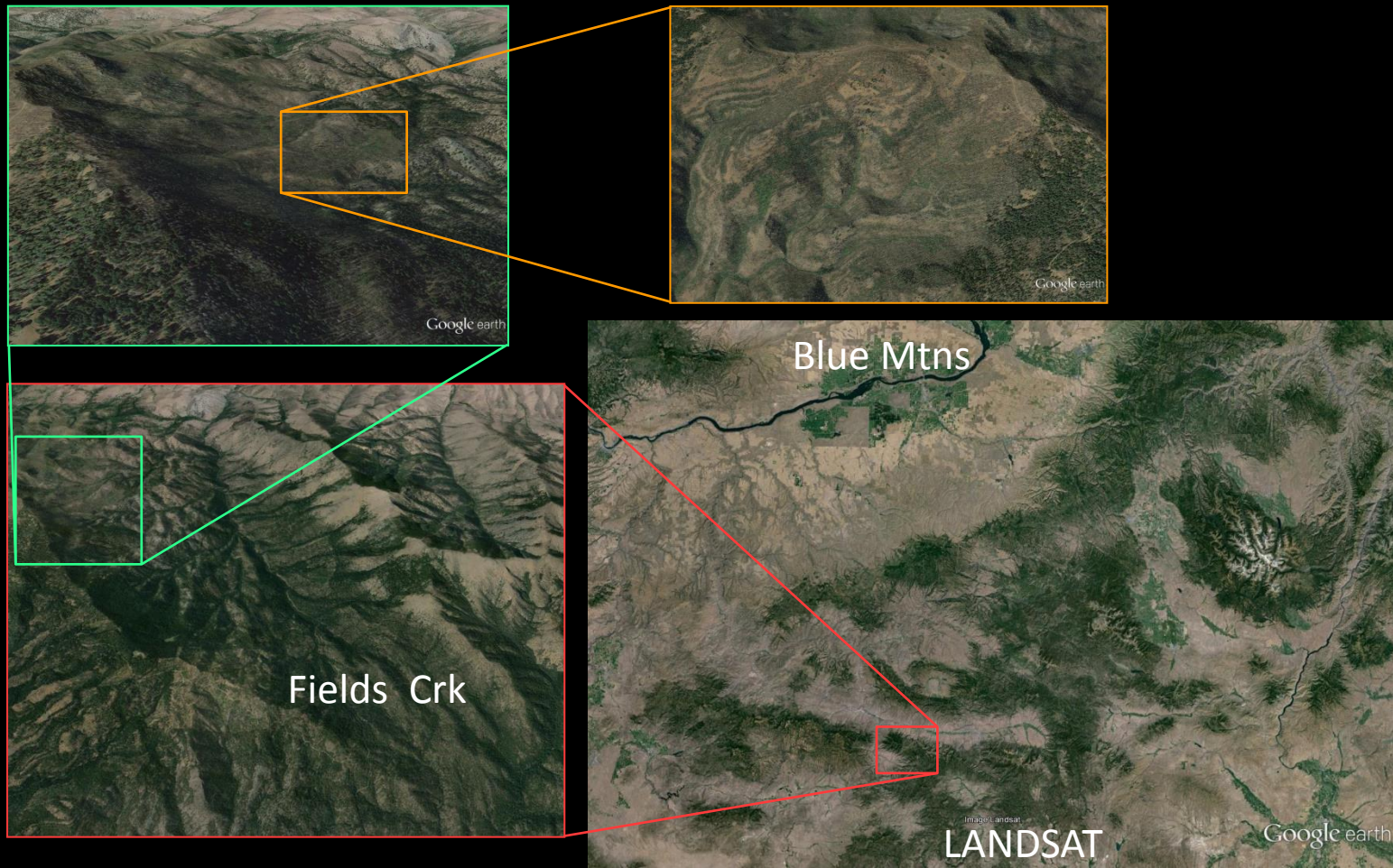
- Widely distributed, living & dead, dominated by early seral spp.
- Increase landscape resilience to wildfires, droughts
- Vital to many wildlife/fish habitats, current supply is reduced
- Because of long period of landscape service, key building blocks



Framing Landscape Restoration: Core principles

7) Landscapes exist w/in landscapes and there is cross-talk btw levels

- Eco-regional > local landscapes > patch neighborhoods > patches
- All levels exhibit patchiness (i.e., pattern heterogeneity), cross scale spp. movements, habitat connections, disturbance flows



Framing Landscape Restoration: Core principles

8) Topography & physiography provide an intuitive natural template for lifeform, successional, & patch size patterns



Framing Landscape Restoration: Management Implications

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1) Provincial & Local Landscape Evaluations Reveal Key Insights

- Provincial evaluations needed to identify broad habitat connectivity needs, disturbance regime departures, priority local landscapes to restore
- Local landscape evaluations prioritize patch-level treatments that restore and reconnect the regional landscape
- Engaging stakeholders in both, early/often, likely increases success
- Explicitly link terrestrial, aquatic, road system restoration opportunities

Framing Landscape Restoration: Management Implications

2) A Central Role for Restoring the Inherent Disturbance Regimes

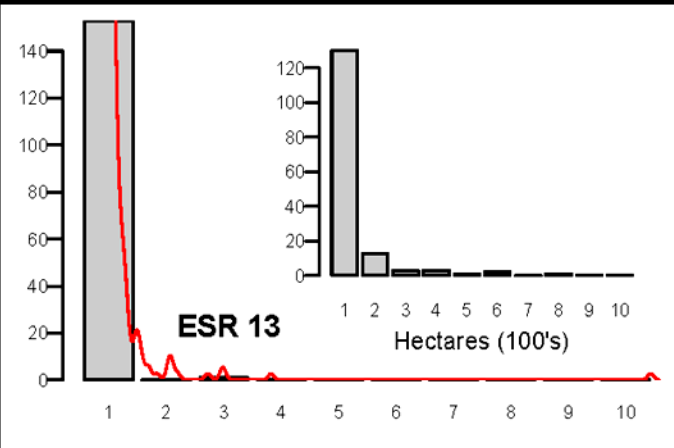
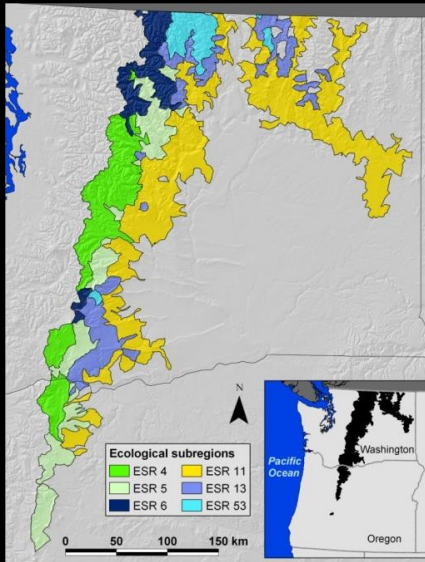
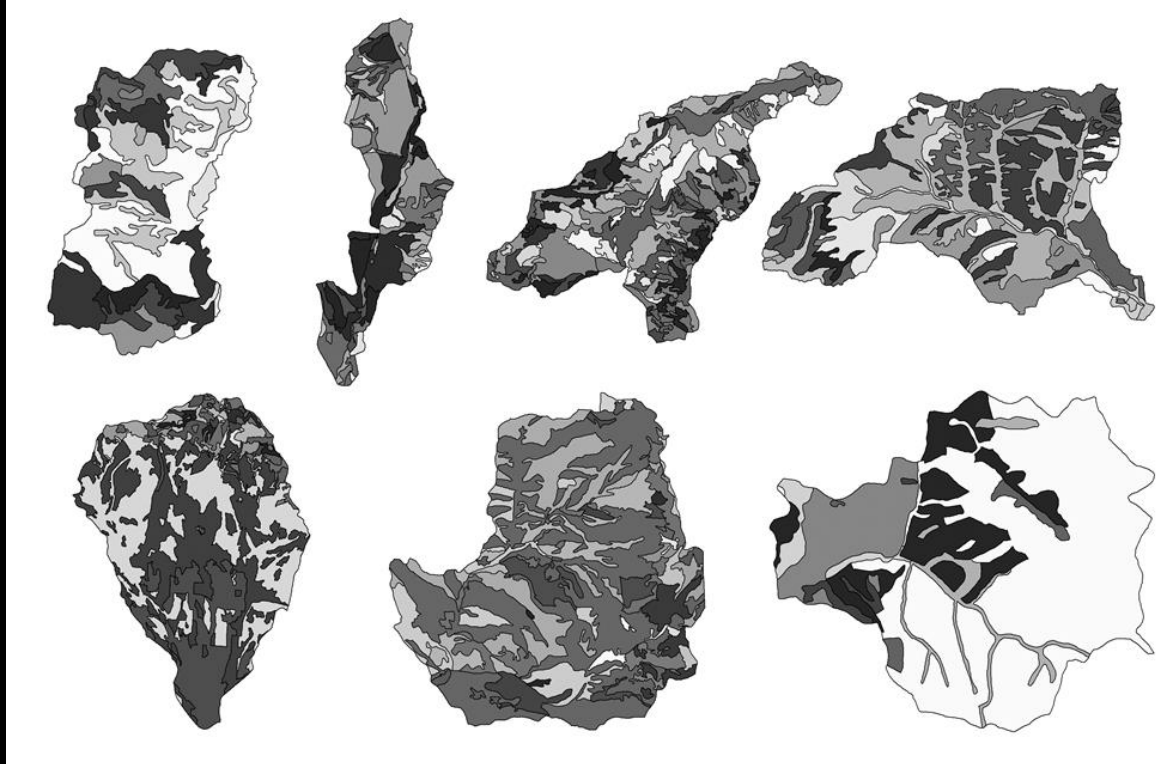
- The heartbeat of terrestrial & aquatic landscapes
- Disturbances worked in synchrony with the climate
- Processes derive from this synchrony at all scales



Framing Landscape Restoration: Management Implications

3) Representative Patch Size Distributions (PSDs), HRV, & FRV Conditions are Key References

- To understand needed amounts/patterns of forest succession/habitat patches, best summarized by province or ecoregion
- HRV and FRV conditions correlate with disturbance PSDs
- Needed to diagnose key landscape pattern departures



Framing Landscape Restoration: Management Implications

4) Consider a Central Role for Old Trees and Old Forests

- In regional and local landscape planning
- For wildfire, wildlife, & climate resilient landscapes
- Live and dead, are critical habitat components



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Framing Landscape Restoration: Management Implications

5) Consider A Central Role for Provincial & Local Landscape Rx's

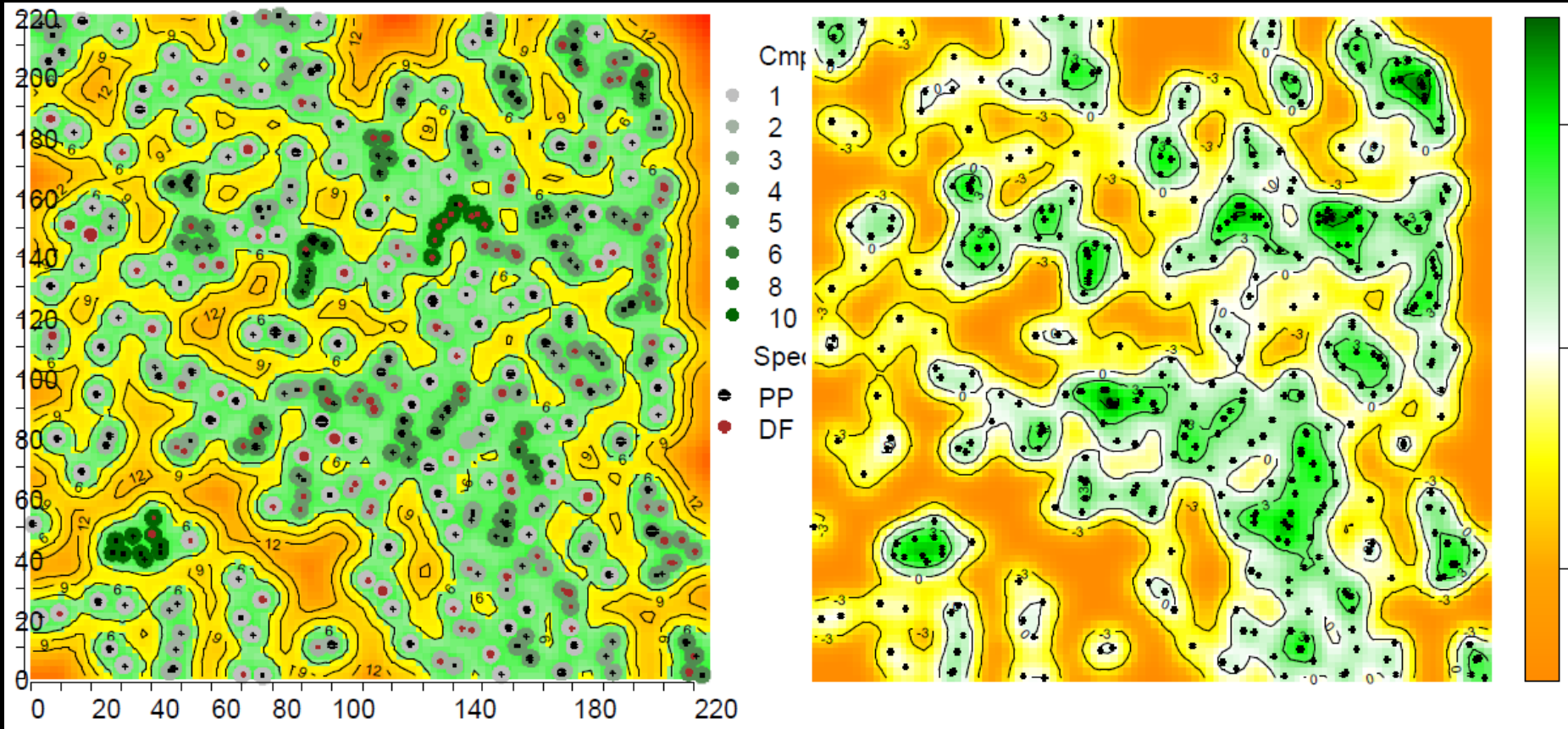
- Provincial landscape Rx's strategically prioritize local landscapes
 - ✓ That resolve WL and fish habitat connectivity concerns
 - ✓ That restore disturbance regimes/reduce vulnerabilities
- Local landscape Rx's identify patch treatment areas to accomplish restoration



Framing Landscape Restoration: Management Implications

6) Consider Restoring Patchiness w/in Patches

- Recreate heterogeneous patterns within patches, clumps and gaps
- Creates fine scale habitats & spatial controls on disturbances within patches



Framing Landscape Restoration: Management Implications

7) Consider using physical geography to inform regional landscape Rx's

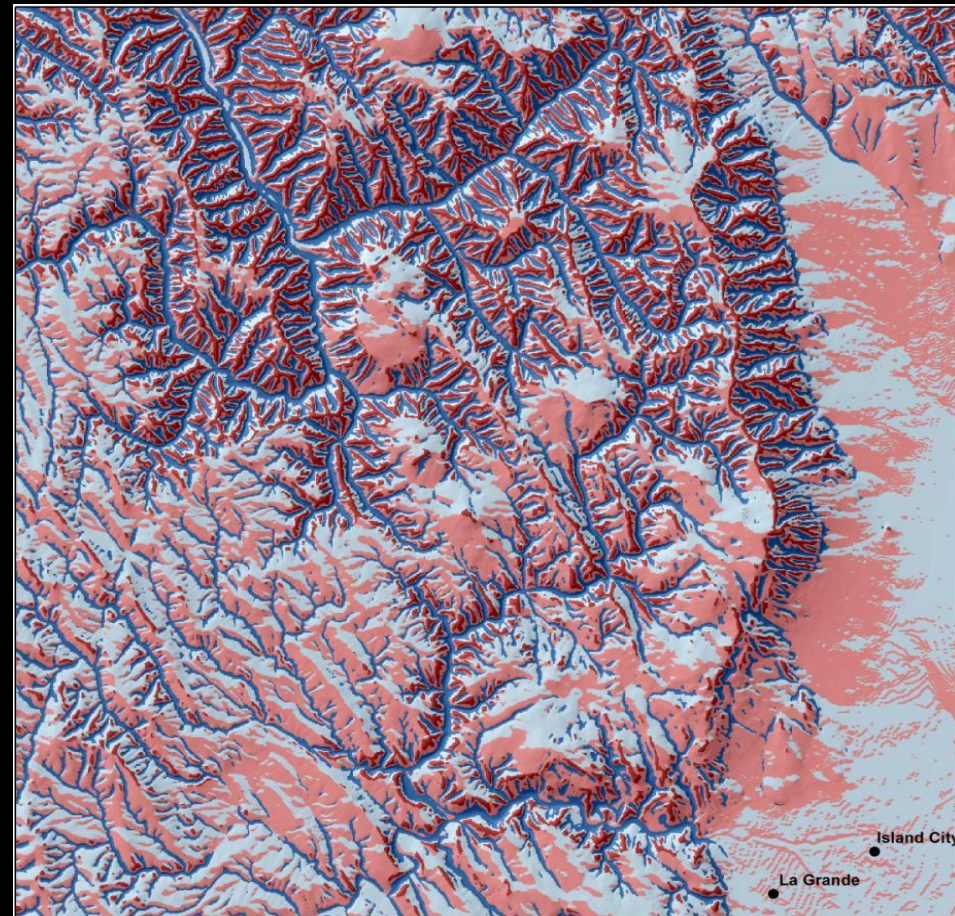
- Tailor physiognomic conditions to the broad-scale topography
- **Downscaled climate data should inform this process**
- Identify ecotones and topographic limitations, where lifeform & land cover type changes are most likely; plan for these changes



Framing Landscape Restoration: Management Implications

8) Consider using topography to inform local landscape Rx's

- Map of aspects, ridges, valleys
- Use PVTs to approx. indicate site potential, regime areas
- Tailor open, early seral spp cond to S & ridges; closed, mixed spp and layered cond. to N & valley bottoms
- Consistent PVT definitions & maps are lacking & needed
- Consistent current vegetation maps are lacking & needed



Topographic position

- Valley bottom
- Ridge top

Aspect

- North
- South

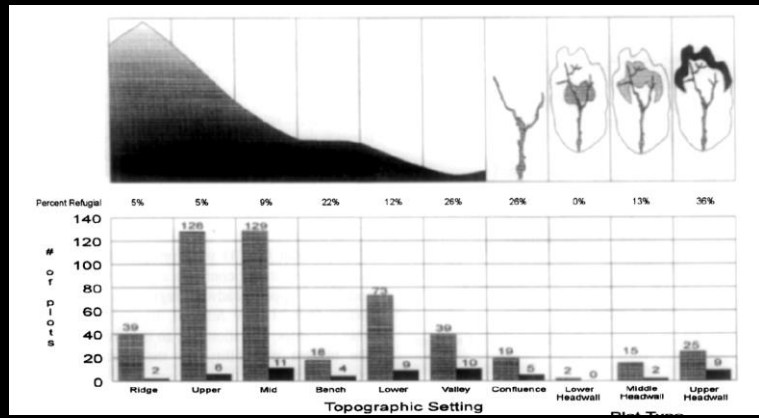
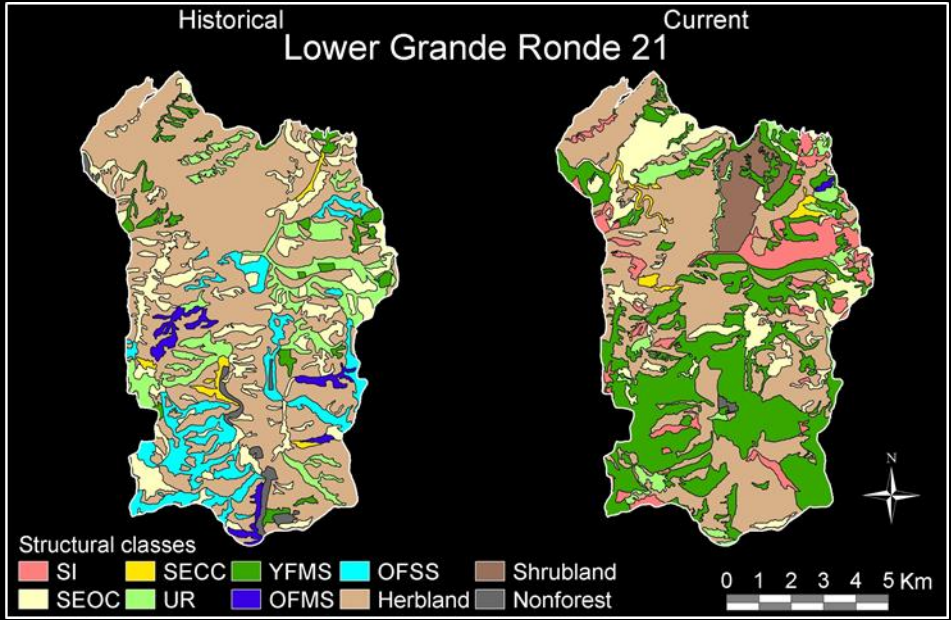
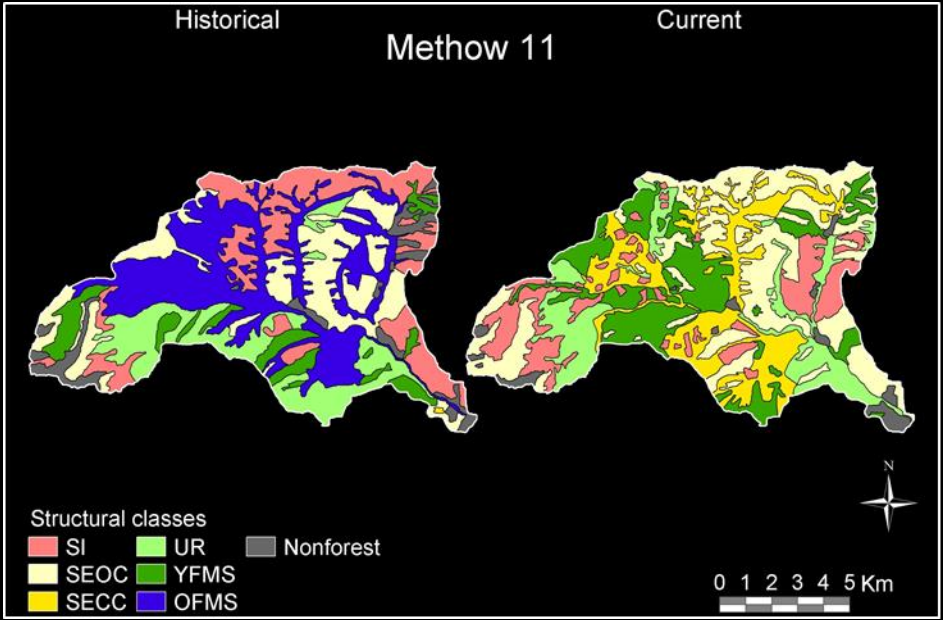
0 5 10 Kilometers

Topographic position is based on a 200 m radius window.
Aspect is displayed where the topographic position is neither valley bottom nor ridge-top.

Framing Landscape Restoration: Management Implications

8) Consider using topography, continued...

- Recruit old forest (OF) patches in refugial settings, create fire tolerant neighborhoods around them



e.g., see Camp et al. 1997

Summary



- Handful of core principles
- **These tie directly to management implications**
- Regional landscape Rx's are foundational, provide the big ticket insights
- **Local landscape Rx's get the job done, sewing up the regional landscape**
- Key opportunity ahead to partner mgt and research in tool development, designing, monitoring, adapting mgt treatments