Approaches for Integrating Transitioning Ecosystem Conditions into the Conservation Reserve System for the Lower Columbia River

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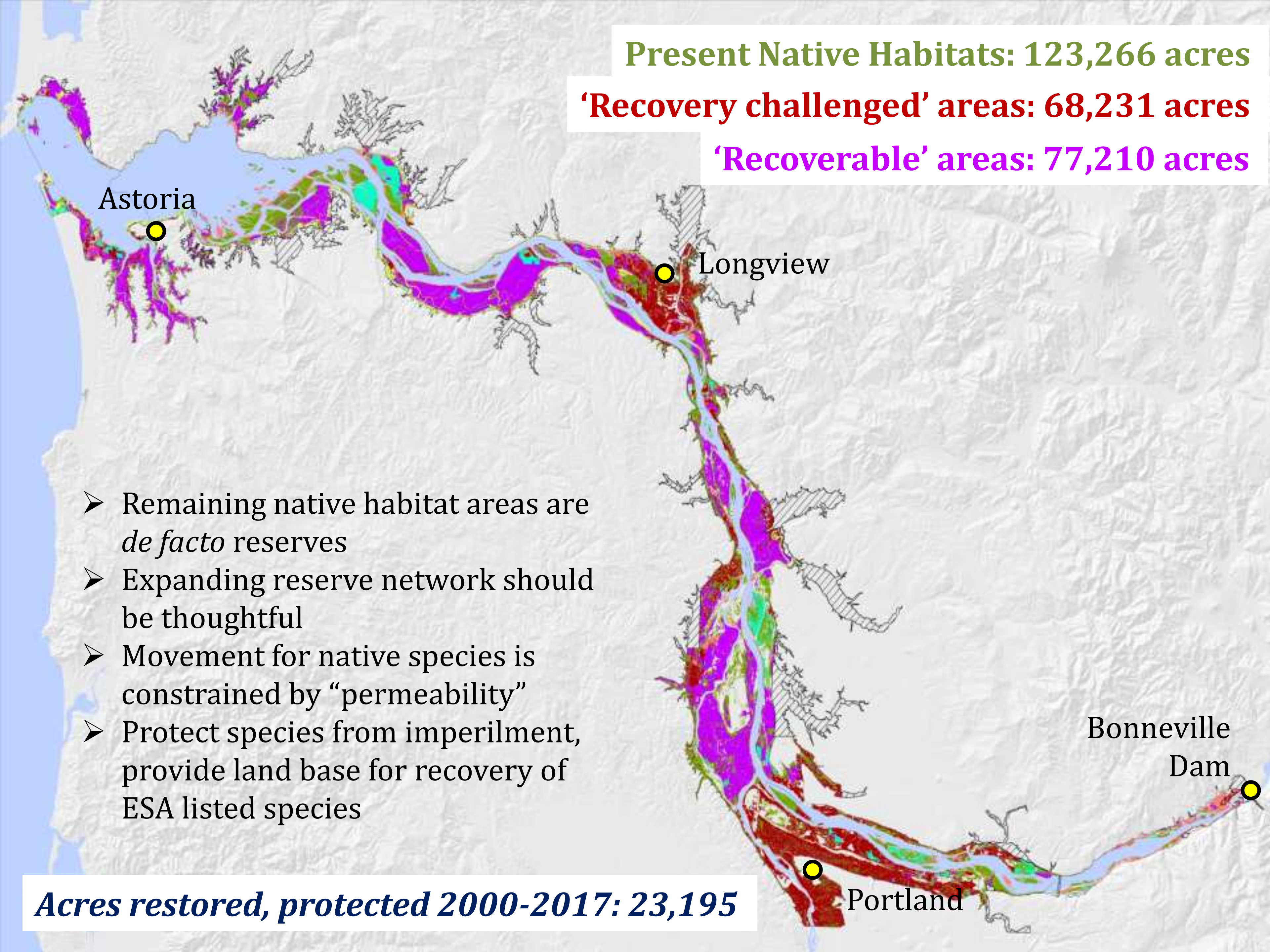
Present Native Habitats: 123,266 acres

'Recovery challenged' areas: 68,231 acres

'Recoverable' areas: 77,210 acres



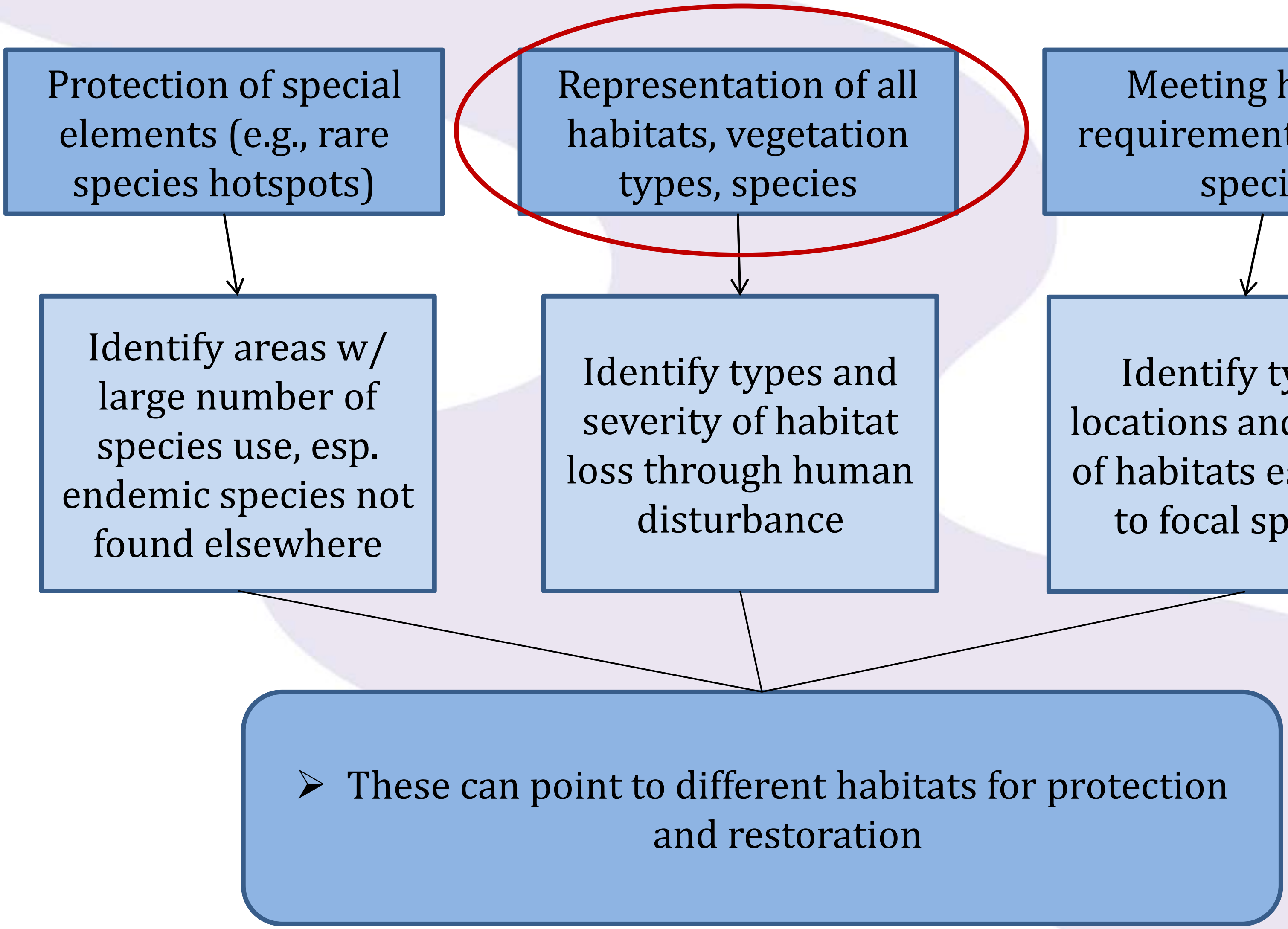
- Remaining native habitat areas are *de facto* reserves
- Expanding reserve network should be thoughtful
- Movement for native species is constrained by "permeability"
- Protect species from imperilment, provide land base for recovery of ESA listed species

Acres restored, protected 2000-2017: 23,195

Considerations for Our Reserve Network

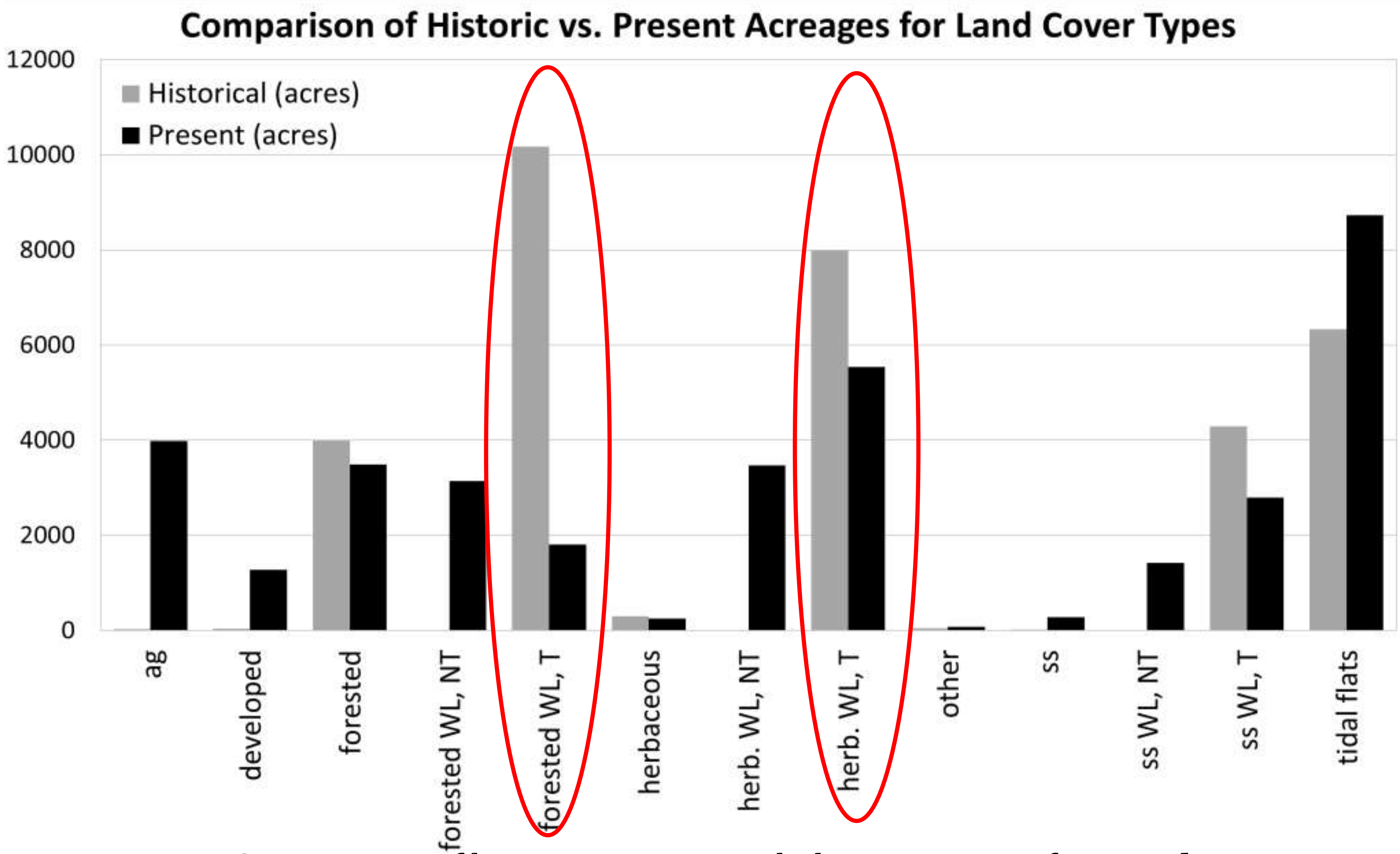
- Maintaining viable, intact ecosystems more efficient, economical and effective than species-by-species, site-by-site or threat-by-threat conservation approach (see Noss 2000)
  - If ecosystem degraded significantly, ecosystem restoration required
  - Understanding of impacts needed to stop trajectory of degradation (e.g., habitat change analysis from Marcoe and Pilson 2017)
- Habitat protection and restoration efforts are creating de facto reserve network
  - Requires well thought-out, comprehensive and long-term approach:
    - Native species are limited in ability to relocate when site conditions change or become unfavorable
    - Native species do not have homogeneous habitat requirements; habitat diversity is critical for biodiversity
  - Despite 23,195 acres restored OR protected between 2000 to 2017, still increasing number of imperiled species
    - 24 species in 2004, 32 species in 2010, 40 species in 2015 (from EP State of the Estuary Report 2015)

Three Basic Approaches for Identifying Critical Areas for Inclusion in Reserve Network:



Adapted from R. Noss 2000

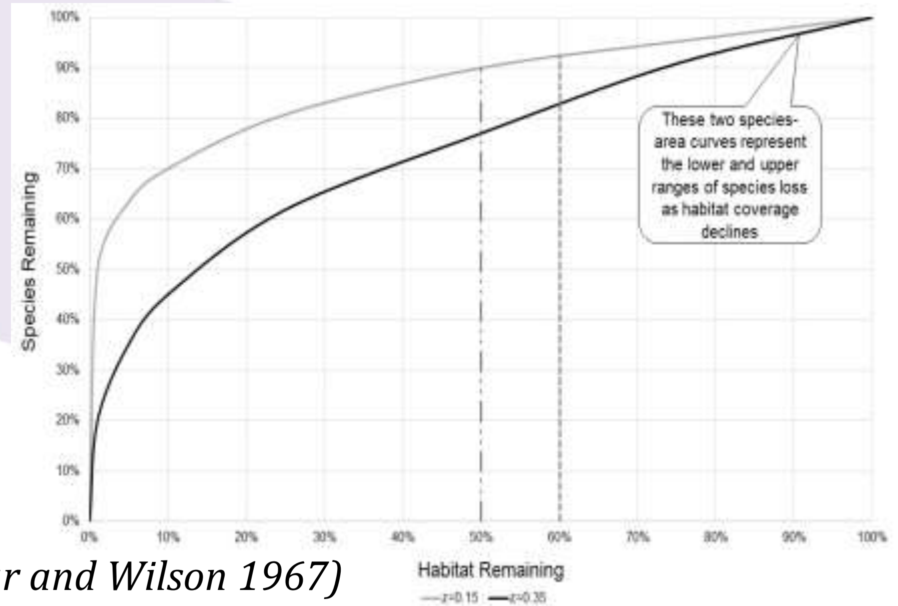
Prioritized Habitats by Severity of Loss by Reach, Region and Entire Lower River



Comparison of historic vs. current habitat coverage for **Reach B**

Habitat Coverage Targets

- **No net loss of native habitats (2009 baseline; 114,050 acres lost since 1870)**
- **Recover 30%* of historic extent <u>for priority habitats</u> by 2030; 40%* of historic extent by 2050**
  - Recover ***representation*** of habitats, many occurrences of habitats for ***redundancy,*** and quality habitats for ***resiliency***
  - Focus on multiple large "reserves" with interspersed patches to provide migratory corridors, permeability
  - Focused on protecting species from becoming imperiled; targets focused on recovery of imperiled species a separate task
- Focused on restoring historic, preserving current conditions
- If targets are reached, equals 46% - 88% native habitat coverage per reach; and a total basin-wide 60% native habitat coverage (up from 50% coverage in 2009)



**Based on species-area curve (MacArthur and Wilson 1967)*

Three Basic Approaches for Identifying Critical Areas for Inclusion in Reserve Network:

Protection of special elements (e.g., rare species hotspots)

Representation of all habitats, vegetation types, species

Meeting habitat requirements of focal species

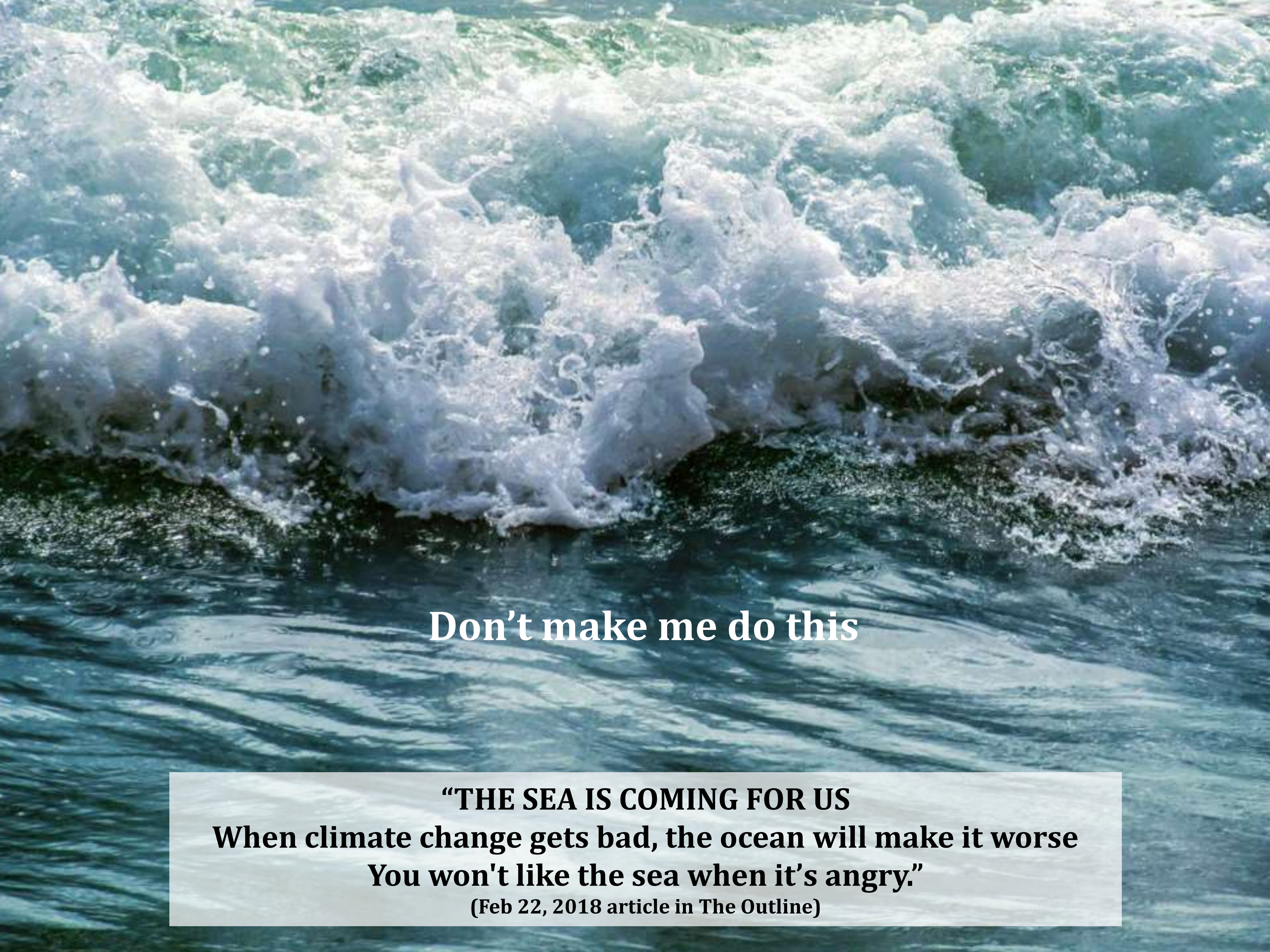
Identify areas w/ large number of species use, esp. endemic species not found elsewhere

Identify types and severity of habitat loss through human disturbance

Identify types, locations and extent of habitats essential to focal species

- These can point to different habitats for protection and restoration

Adapted from R. Noss 2000


Don’t make me do this
“THE SEA IS COMING FOR US
When climate change gets bad, the ocean will make it worse
You won't like the sea when it’s angry.”
(Feb 22, 2018 article in The Outline)

Shifting Ecosystem Conditions:

- **Sea level rise** and more intense storms, increased wave energy, increased erosion (National Climate Assessment 2014, 2017)
  - **Ecosystem shift** – predictions of saltwater intrusion up to Cathlamet
    - OHSU's Mojgan Rostaminia dissertation
  - **Further loss of floodplain habitats -** Increased flooding, conversion, submersion and erosion of floodplain habitats
    - NWF 2007
    - NOAA Coast SLR website provides generalized info of flooding risk to floodplain areas
- **Ocean acidification and hypoxia** (OAH) – increasing impacts to shellfish, nearshore ocean food web, fish behavior
  - Increased intrusion into estuary, especially w/precipitation changes
    - See Roegner et al. 2011 for hypoxia in lower Columbia
- **Marine heatwaves** will change ocean food web, predation, disease
- Changes to **California Current** and patterns of upwelling, although models vary about effect on intensity (tend towards more intense), timing and duration
  - Thermal stratification, and OAH is expected in to increase

Shifting Ecosystem Conditions:

- **Warmer temperatures, longer warm temperature periods** – (NCA 2014, 2017)
    - Mainstem lower Columbia does not fluctuate horizontally or vertically in water temperature between Beaver Army Terminal and Camas stations; tributaries have little influence on temperature which is largely driven by upstream conditions or marine influence in lowest section of river (Hanson et al. (EMP reports - 2014, '15, '16)
- **Changing precipitation patterns** –(NCA 2014, 2017)
    - More intense events, more variable weather
    - More precipitation falling as rain, lower snow packs in mountains
        - Higher winter flows, lower summer flows
        - Tributaries will have higher winter flows, lower summer
        - More severe droughts
- Increased pest invasions of forests, tree dieoffs, and larger, more severe forest fires

➢ **Widespread ecosystem shifts are likely and may be abrupt (e.g., large disturbances such as wildfires, insect outbreaks, diseases)**

Shifting Ecosystem Conditions:

- Resource management has traditionally focused to reestablish the suite of species that occurred at a site before major human activity altered it

- Historical targets no longer make sense when climate change will profoundly alter which species can survive at that site

- Major shifts in climate will occur over the next century no matter how vigorously greenhouse-gas emissions are reduced (NRC 2010)

➢ Ecosystems have always been dynamic - variability over seasonal, annual, decadal and longer time periods
➢ Idea that ecosystems fluctuate within a defined and constant range of variability (or "stationarity") is DEAD (from Stein et al. 2013)

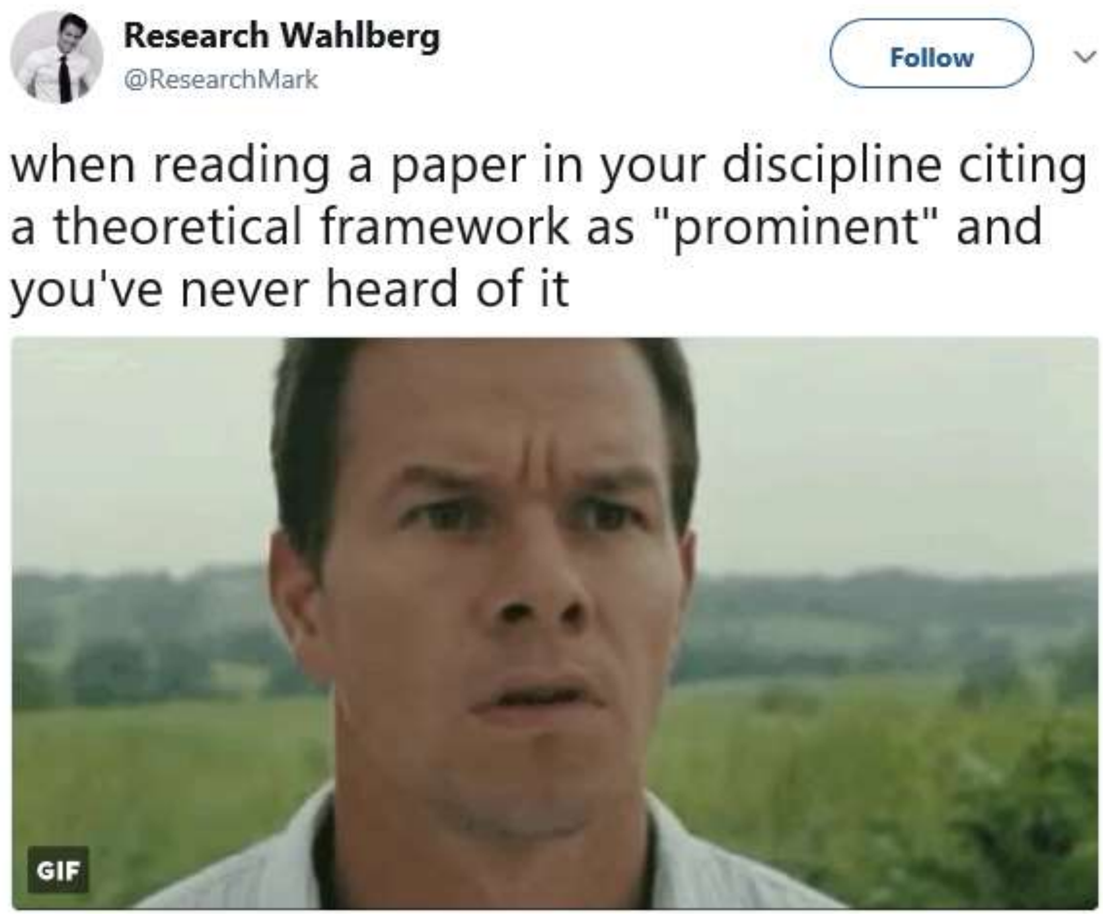
- Protecting biodiversity and species will require a shift from classic "place-based" strategies that maintain integrity of local reserves within fixed boundaries to more dynamic strategies that foster ability of species to move across landscapes so that they can persist (Schmitz et al. 2015)

Shifting Ecosystem Conditions:

- Approaches to adaptation can range from resisting change to protect species to actively facilitating changes

- Commonly used framework is continuum of resistance, resilience, and transformation (Stein et al. 2013)

- Combination of rapid rates of climate change with intense and widespread human impacts on landscape limit adaptive capacity of species and ecosystems



“Conservation planning is always an exercise in decision making in the face of limited and uncertain data, and especially so in the case of planning for climate change.”

(Carroll et al. 2017)

- Uncertainties in CO_2 emission reductions
- Uncertainties with model predictions of climate change
- Uncertainties how ecosystems will respond to aspects of climate change
- Uncertainties how ecosystems will respond to actions we take to sustain those aspects of nature we want to maintain

Climate Adaptation Framework

(from Schmitz et al. 2015)

1. Protect current patterns of biodiversity
   - Need this to protect species now, under current conditions
   - Traditional methods of protecting ecosystems, establishing ecologically representative and connected reserve network, restoring historical processes, species are still critical "no-regrets" strategies
2. Protect large, intact, natural landscapes and ecological processes
   - Or assembling connected portfolio of smaller, undeveloped spaces
   - More "resilient" to disturbances, changes, and protect larger assemblages of species
3. Protect geophysical settings (land facets)
   - Species presence depends on suite of factors, e.g., soil chemistry, topographic positions, aspect, slope, elevation
   - Premise is that as climate changes, these locations are enduring features because geology and soils will not change
   - TNC used soil order, elevation and slope to map in Columbia Plateau

Climate Adaptation Framework

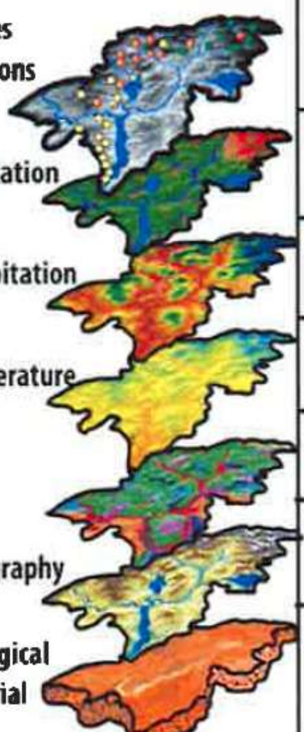
(from Schmitz et al. 2015)

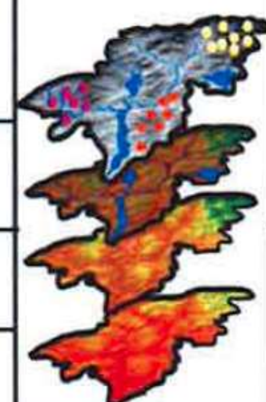
4. Maintain and establish ecological connectivity
   - Species will shift their range as climate changes
   - Connecting areas with corridors, stepping stones, or working lands creates permeability for species movement
   - ➢ Model where species might move to meet climate niche and evaluate current corridors, landscape permeability to identify whether they can move or whether additional lands are needed
5. Identify and protect areas providing future climate space for species expected to be displaced by climate change
   - ➢ Model where species might move to meet climate niche
     - Multiple downscaled climate scenarios to encompass range of possibilities and areas where scenarios/model runs agree
   - ➢ Identify if these areas are managed to ensure these species persistence
   - HOWEVER, biophysical conditions (SLR, topography, land use, changes intensity and frequency of disturbances) may preclude shifts in range

Climate Adaptation Framework

(from Schmitz et al. 2015)

6. Identify and protect climate refugia
   - ➢ Specific places where climate and associated conditions are likely to remain stable OR
   - ➢ Areas that change but will still be suitable to species in surrounding region





Current Conditions — Available Input Layers	Protect current patterns of biodiversity	Protect large, intact & natural landscapes	Protect the geophysical setting	Future Conditions	Maintain & restore ecological connectivity	Identify & manage future climate space for species	Identify & protect climate refugia
Species Locations	✓				✓	✓	✓
Vegetation	✓	✓			✓	✓	
Precipitation	✓					✓	✓
Temperature	✓					✓	✓
Soil			✓				
Topography		✓	✓		✓		
Geological Material		✓	✓		✓		

Questions?

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