

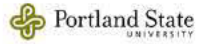
# Mid Scale Data

Data to Model Ecosystem  
Service Outputs for Agency  
Planning

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Oregon



Biodiversity  
Information Center

## Presentation Goals & Outline

1. What is Mid-Scale Data and how does it compare to National and Local scale info?
2. How is it generated?
3. What does it get you and why is it needed for ecosystem service outputs?
4. How is it used in agency planning?

## What is Mid-Scale Data?

- Defined by
  - Spatial Extent
  - Spatial Resolution
  - Attribute Resolution

## Spatial Extent

- Local (e.g., map of birds at PDX)
- Regional (e.g., GNN maps of the PNW)
- Nationwide (e.g., LANDFIRE EVT, USGS GAP vegetation)

## Spatial Resolution

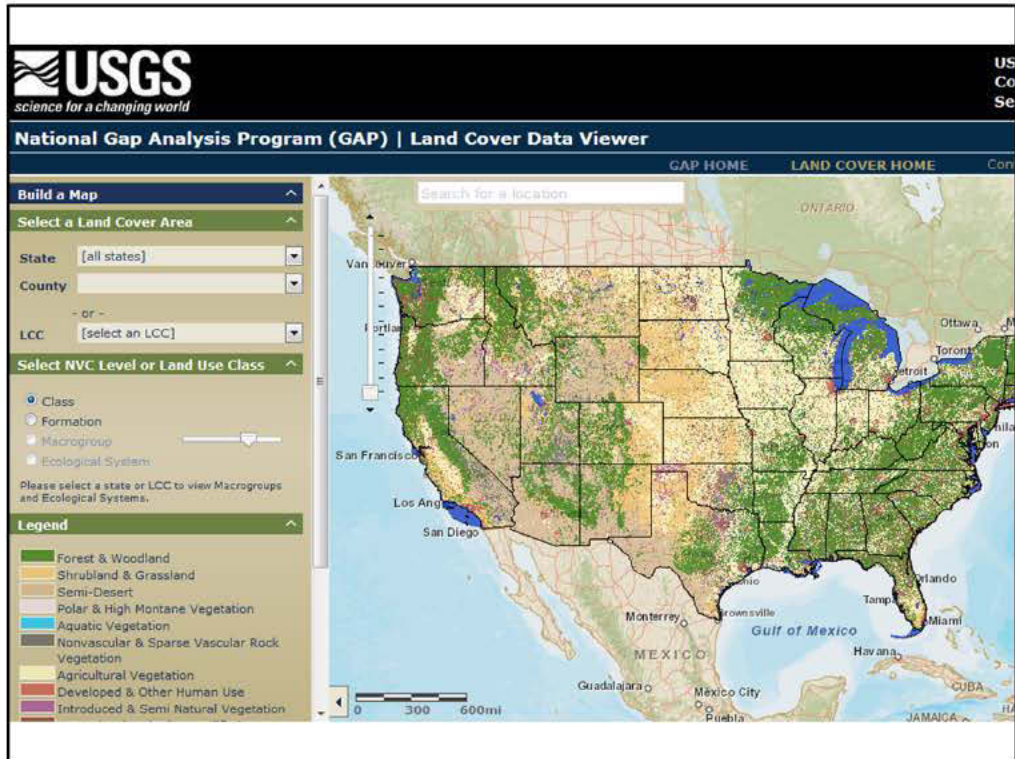
- Fine-scale data = 1m or finer spatial resolution (NAIP or LIDAR)
- Mid-scale resolution = 30m spatial resolution (Landsat)
- Broad-scale resolution  $\geq$  250m spatial resolution (Modis)

## Attribute resolution

- Single-species maps
- Community types (e.g., Ecological Systems)
- Multivariate information on vegetation community composition and structure
  - NN Imputation = a multivariate prediction
  - Maintenance of covariance structure (Henderson et al. 2009)
- Confidence of predictions

## Uses for estimating ecosystem services

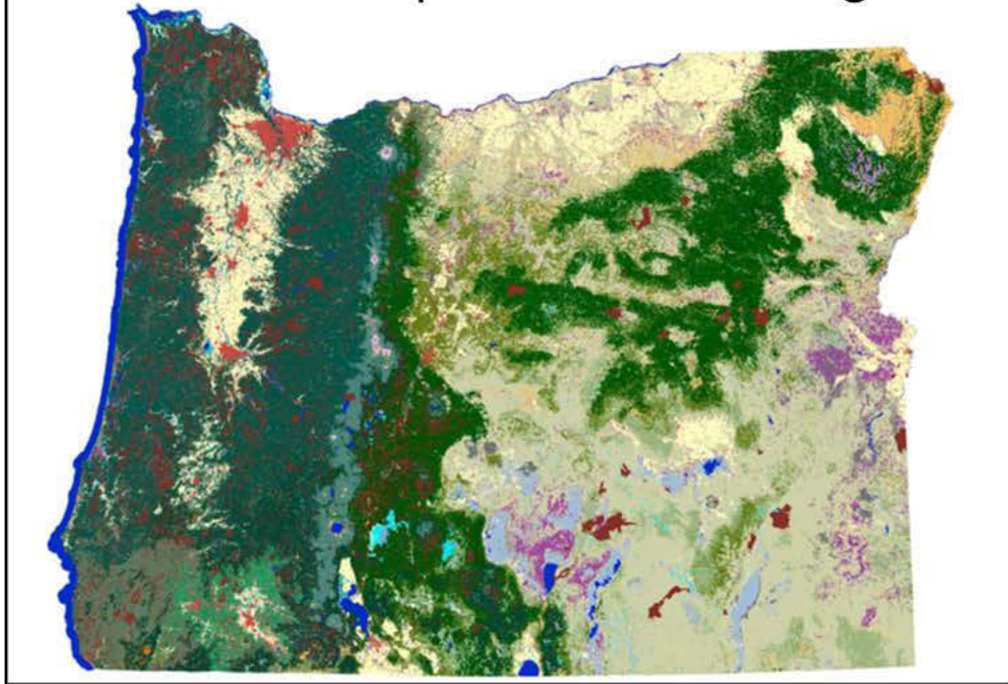
- When data depth is needed
- Flexible vegetation summaries.
- When accurate areal representation over large areas is of primary importance. (e.g., 'how much of watershed 'x' is covered with closed-canopy forests?')



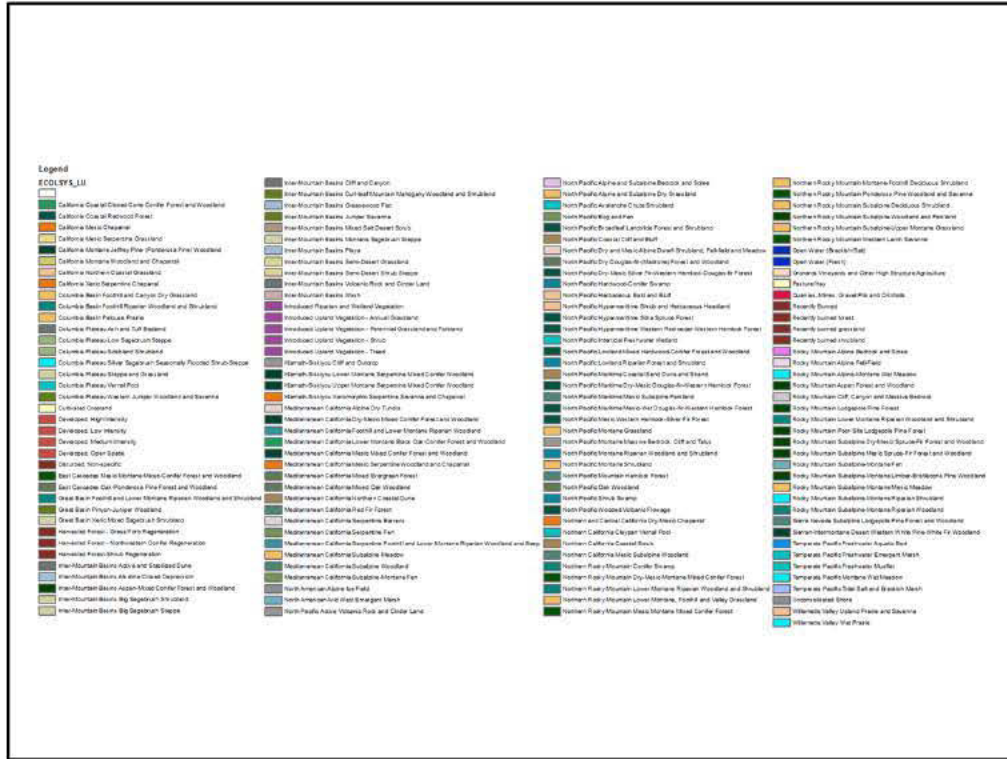
USGS Gap map is a good example of a nationwide data source that carries a fair amount of ecological information. It serves as a useful contrast with mid-scale data when observed at a state-wide spatial extent.



## 2008 USGS Gap Landcover in Oregon



The USGS Gap map, showing approximately 110 ecological systems, at 30 meter pixel scale. The only information is the ecological system present.



The legend for the GAP map.

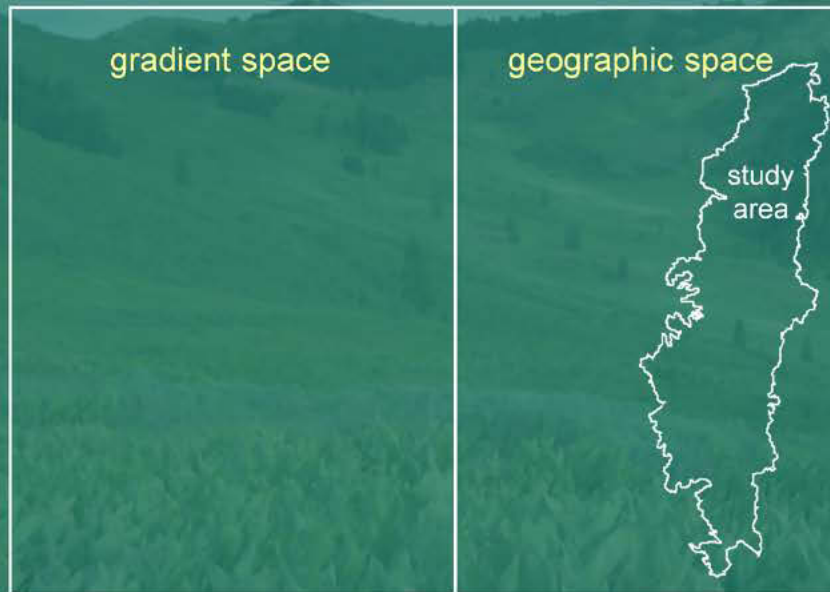
Looking at the number of categories for just Oregon, GAP looks extremely detailed, and it is indeed a useful source of information about the types of habitats around the state in general.

Zooming in a little closer, we begin to see its limitations for conveying ecological complexity.

## What's missing in GAP?

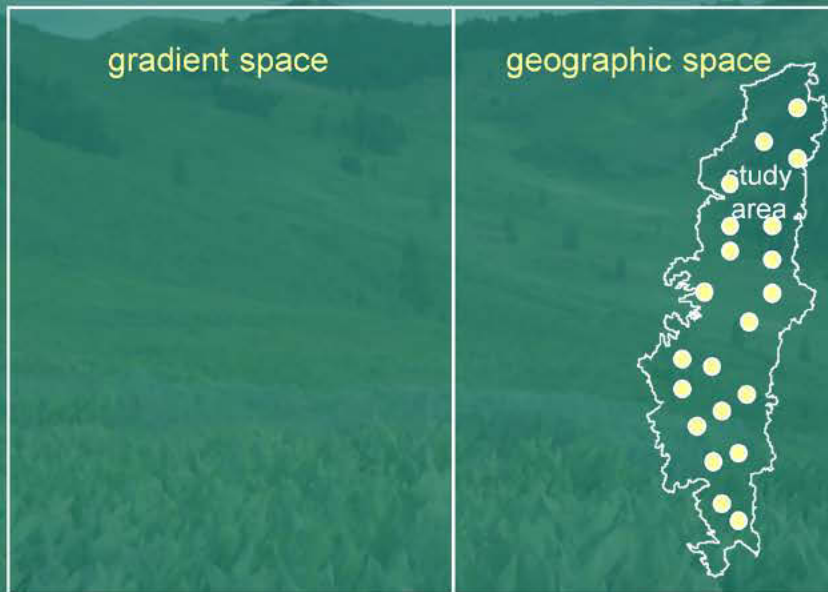
- Vegetation Structure
  - useful for estimating habitat value for wildlife or carbon or wood product availability
- Site attributes (down wood, snags, litter)
  - Useful for evaluating fire risk, wildlife habitat or biomass
- Species Composition of the Vegetation (system)
  - Useful for summarizing ecological condition
    - (e.g., invasive species)

## Methods: GNN



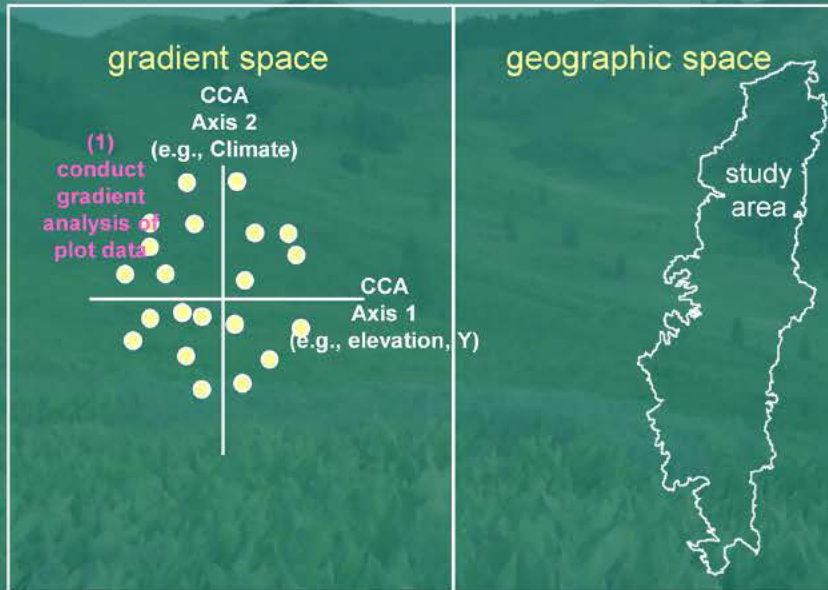
Using nationally available FIA & AIM data to generate midscale data

## Methods: GNN



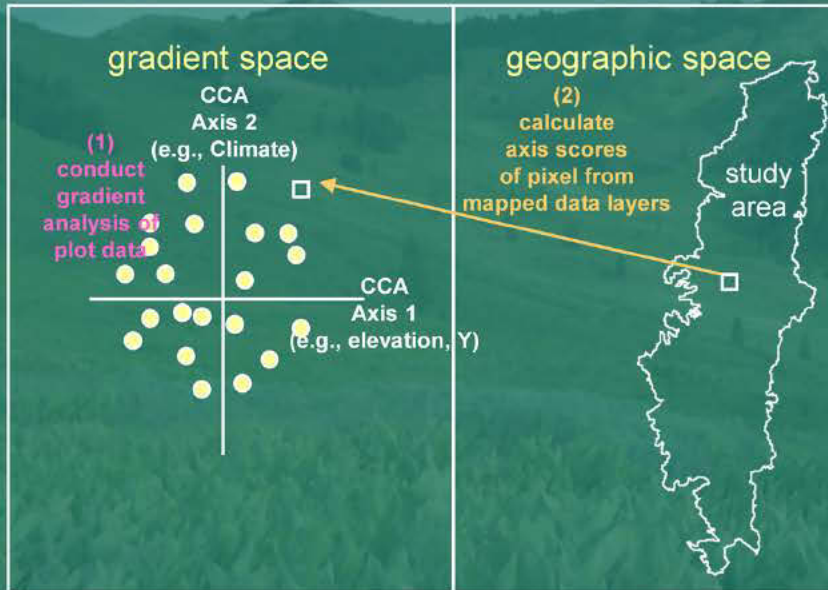
Using nationally available FIA & AIM data to generate midscale data

# Methods: GNN



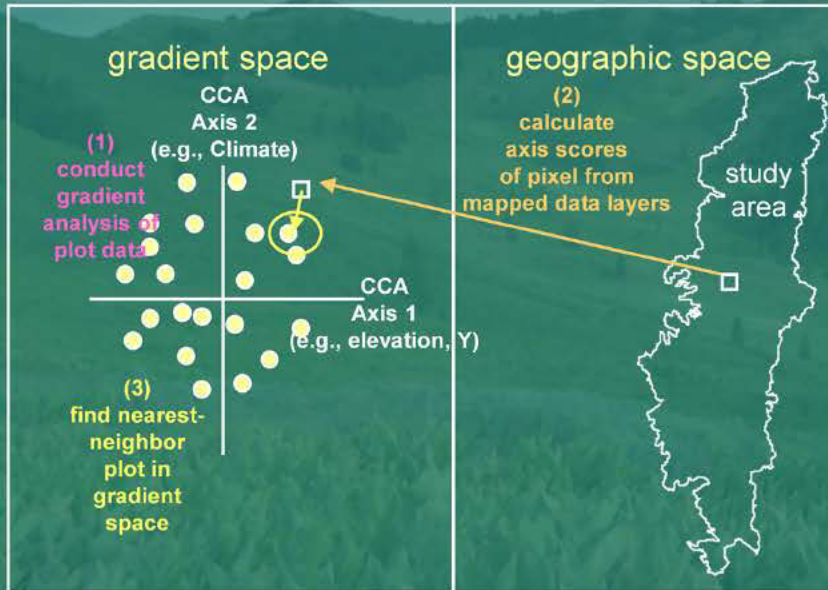
Using nationally available FIA & AIM data to generate midscale data

# Methods: GNN



Using nationally available FIA & AIM data to generate midscale data

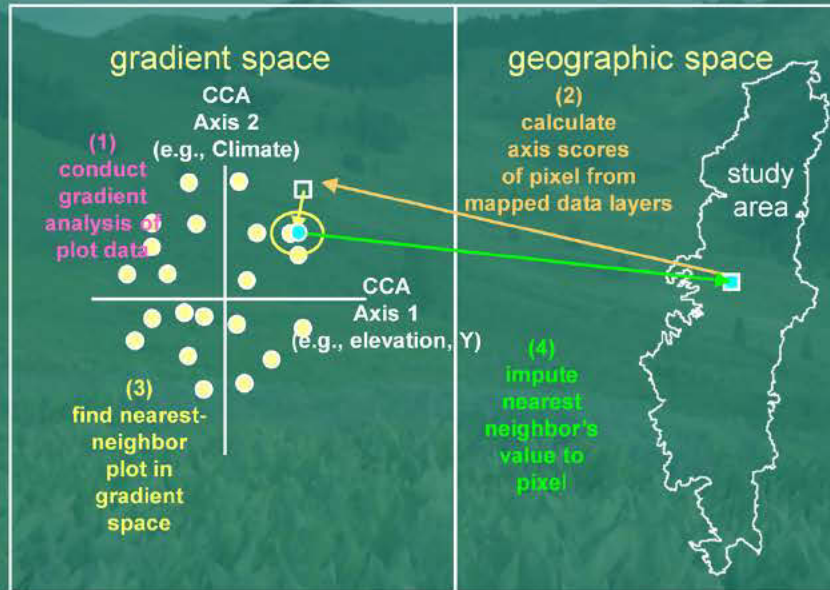
# Methods: GNN



Using nationally available FIA & AIM data to generate midscale data



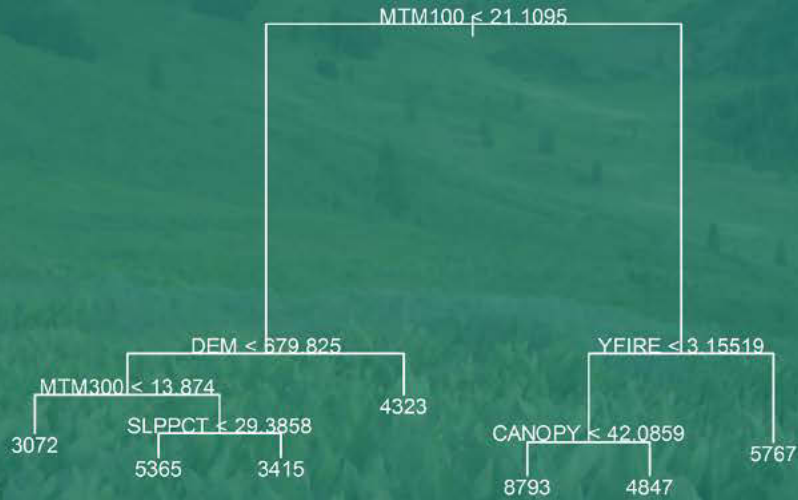
# Methods: GNN



Using nationally available FIA & AIM data to generate midscale data

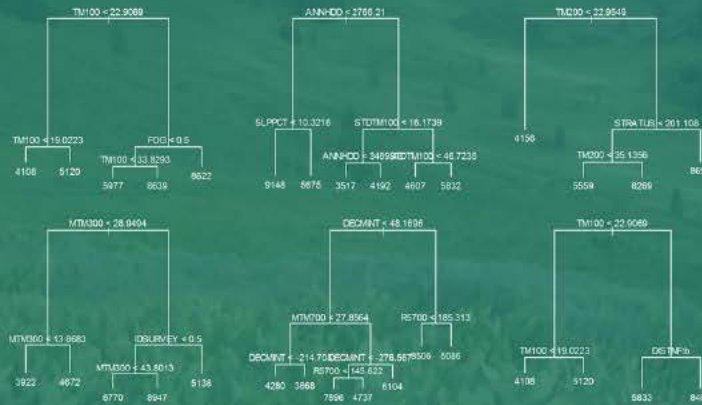
# Methods: Random Forest (RFNN)

- One Classification Tree:



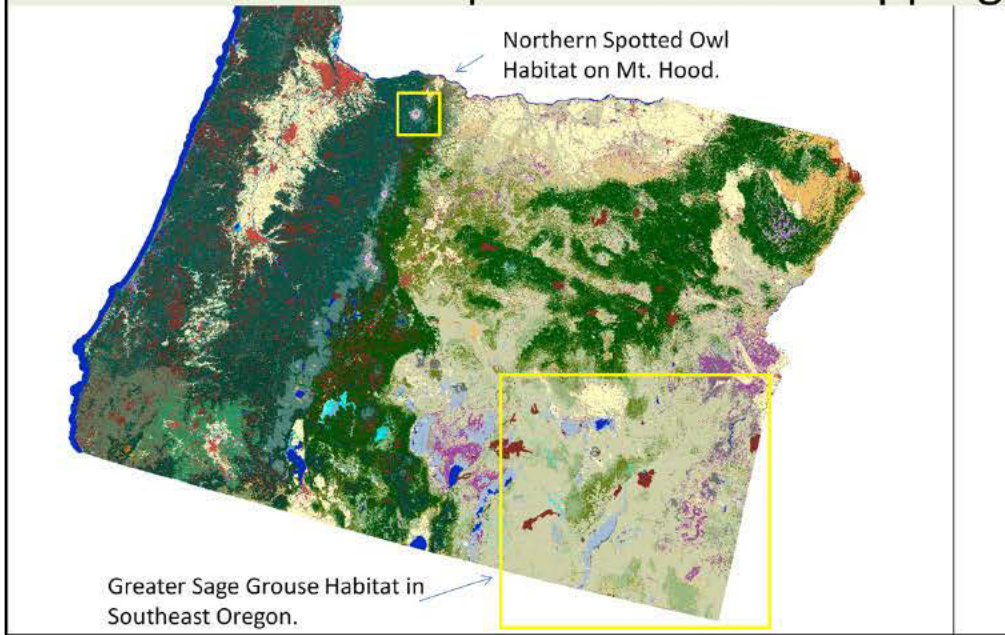
# Methods: Random Forest (RFNN)

- A whole forest of classification trees!

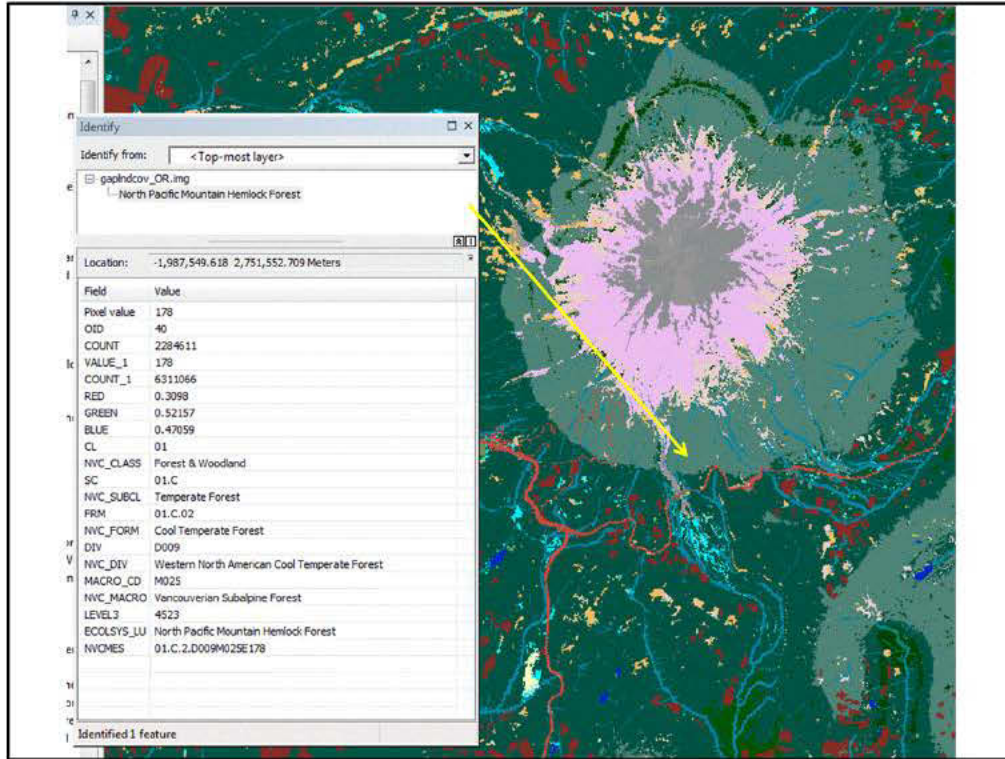


- Each tree model is built from a random subset of explanatory variables and input data.
- When the model is applied to mapped data, each tree 'votes' on which Plot best represents a pixel should be.

# Mid-Scale Data vs National Data for Species Habitat Mapping

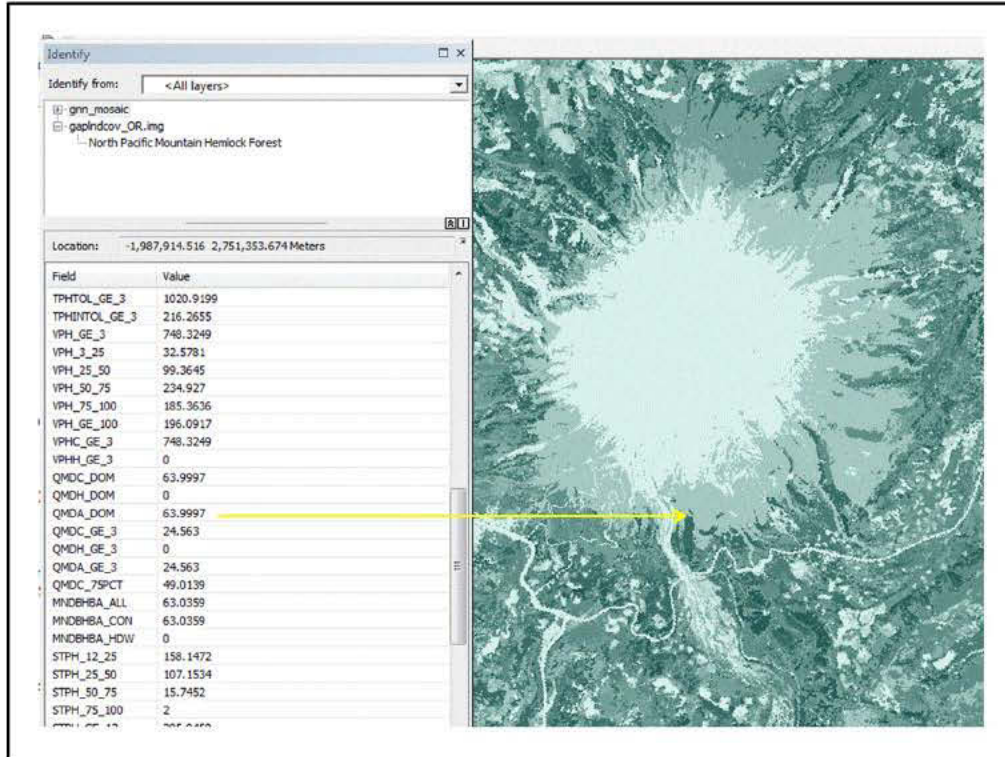


The USGS Gap map



### GAP Map at Mt. Hood.

There are multiple levels of vegetation classification available in the GAP map. The GAP map tells us that there is a band of North Pacific Mountain Hemlock Forest. Around Mt. Hood, at the higher elevations.



There is much more complexity within the single vegetation type, however.

This is a mid-scale data source:

GNN (showing Quadratic Mean Diameter (e.g., size) of the Dominant tree species (QMDA\_DOM))

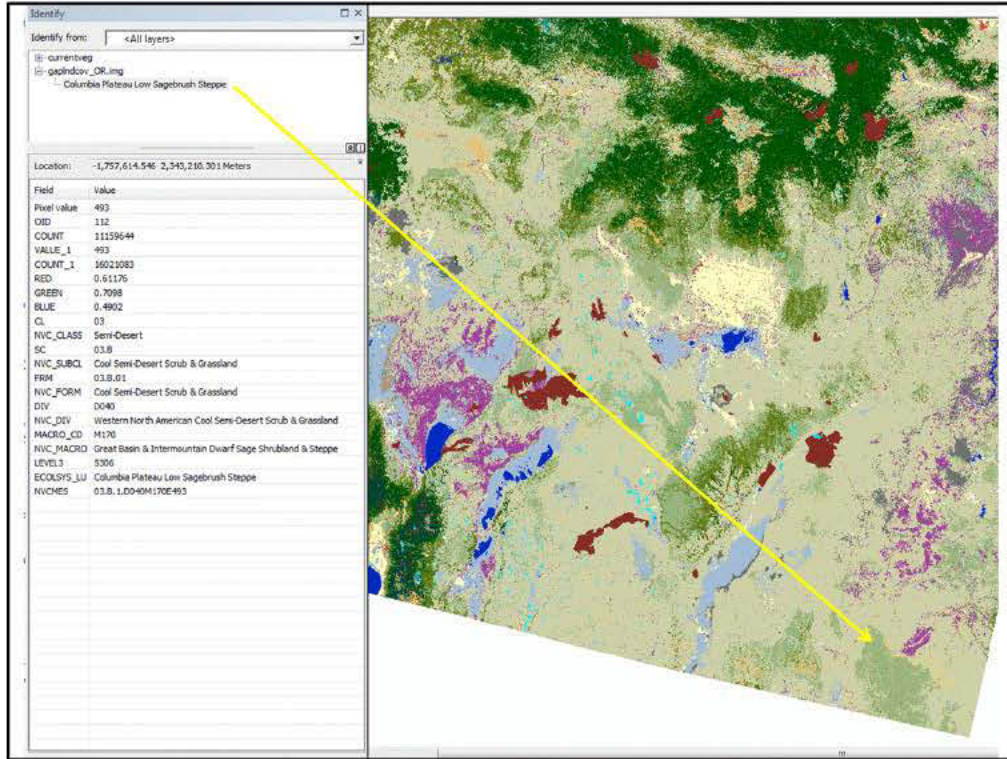
Same spatial resolution as GAP

Available across all forests of Oregon, Washington and California, and a few select areas elsewhere in the Lower 48 States.

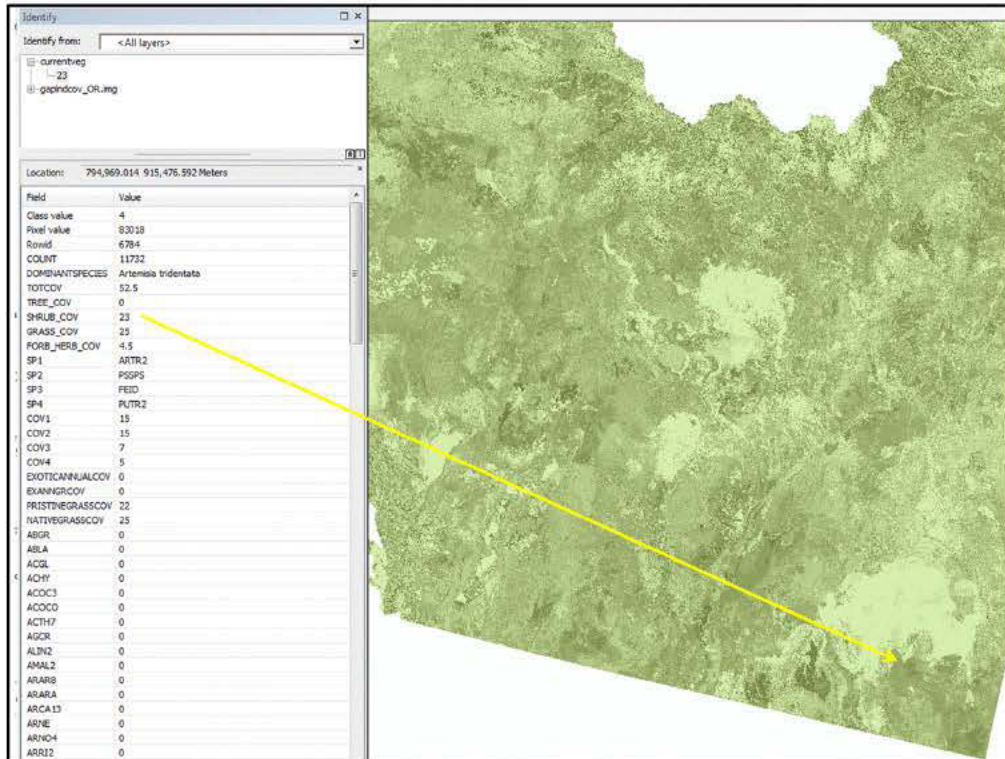
In this version of GNN, there are 162 variables describing forest structure and composition attached to a single grid.

More summary variables are available, including species-specific summaries (e.g., canopy cover of Mountain Hemlock, or Trees per hectare of Subalpine fir, or local forest tree species diversity).

This can be useful if interested in mapping forests which have an old-growth type forest structure, which is useful in estimating areas that might serve as habitat for the Northern Spotted Owl. This has been done for monitoring the effectiveness of the Northwest Forest Plan in maintaining and enhancing NSO habitat across the forests of the Pacific Northwest.



The USGS Gap landcover maps a zone in Southeastern Oregon where many grouse leks have been observed as “Columbia Plateau Low Sagebrush Steppe”



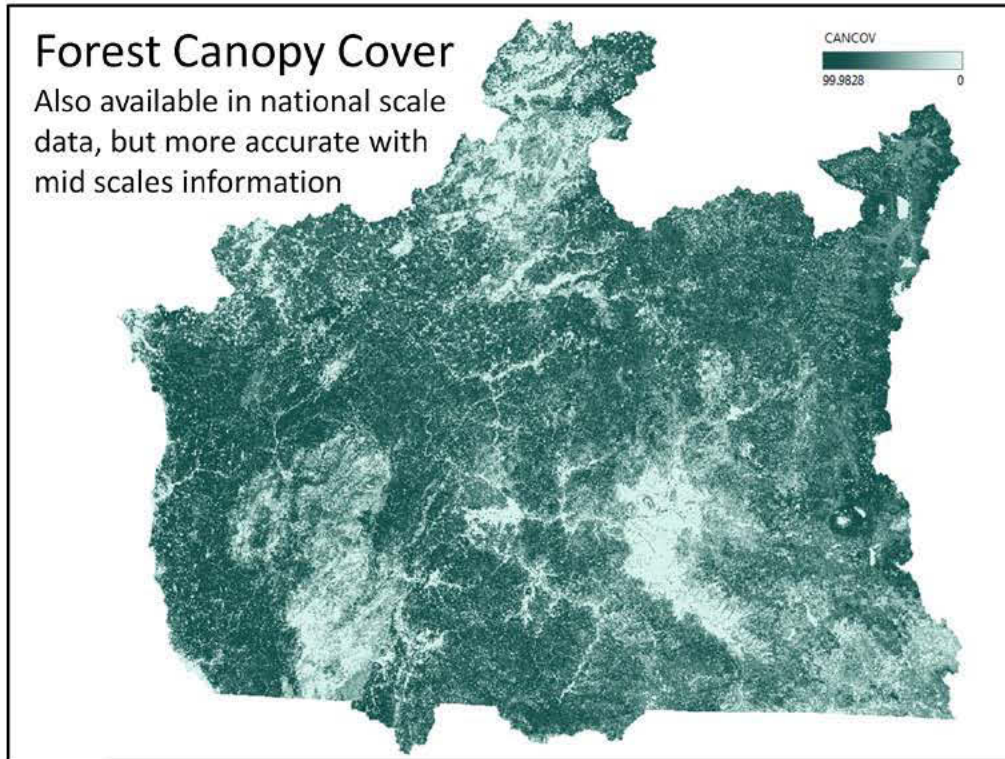
Showing: Nearest Neighbor imputation grid of Southeastern Oregon, Shrub Cover (23% cover in the same identify point from GAP).

From this map, we also know that this location is dominated by Wyoming Big Sagebrush, Blue Bunch Wheatgrass, Idaho Fescue, and Rabbitbrush. It has no cover for exotic annual species, and high cover for native bunchgrasses.

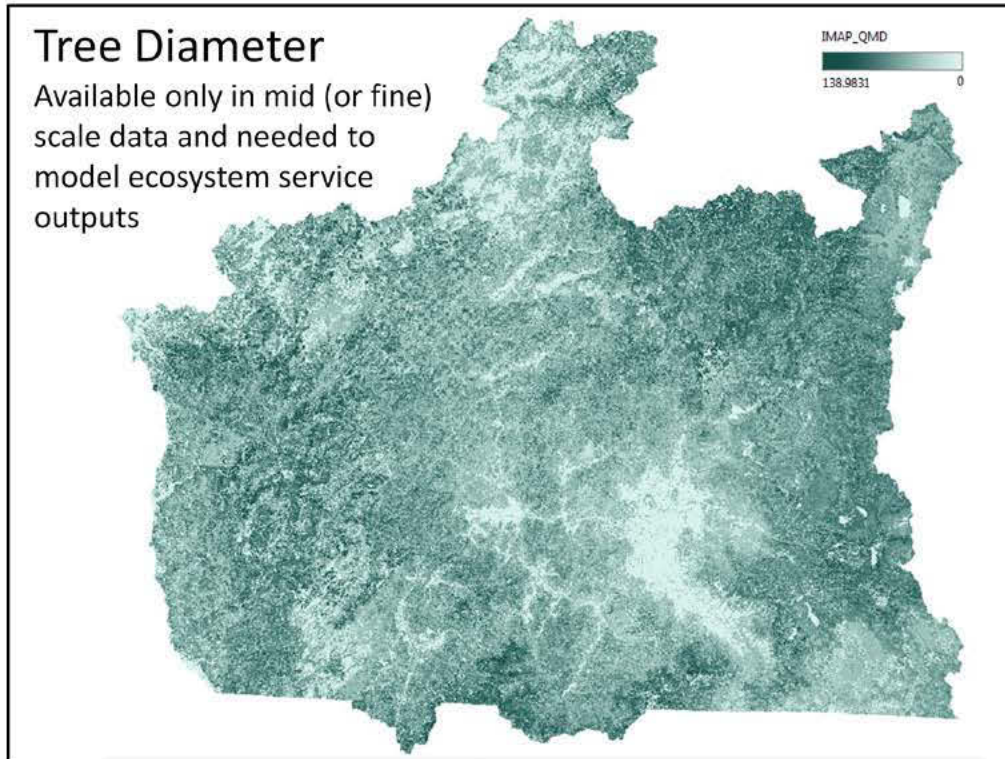
It is likely to provide very good habitat for the Greater Sage Grouse.

GAP is useful in estimating possible grouse habitat, but the mid-scale nearest neighbor grid yields much more useful ecological detail.





This map shows the forest cover, one of the most widely used characteristics to define habitat and ecological integrity of forests. This map comes from the LEMMA GNN imputation regional forest map put together by the PNW Research Station and Oregon State University. However, a similar map can be generated from the National Land Cover Database (NLCD).



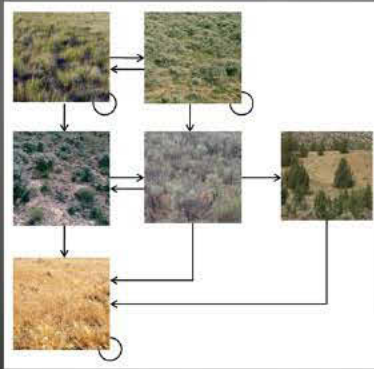
In Oregon, Washington, California, Arizona, New Mexico, and central Colorado, we are fortunate to have the GNN imputation map, because it can also provide a large array of additional habitat characteristics which can often be critical in differentiating intact or functional plant communities from less functional ones. This maps shows the QMD or the quadric mean diameter of the forests, which basically represents how big the trees are, and can be a surrogate for how old they are. Toggle back and forth between this map and the previous map, to see how different the information they contain is.

## Why Is Mid Scale Data Needed to Model Ecosystem Service Outputs for Land Management Agency Planning?

Because it is the data needed to make  
State and Transition Models work

## State-and-Transition Models (STMs)

- Simulate changes in vegetation over time due to succession, disturbance, and management activities
- Are a modeling form of Box and Arrow Diagrams
- Agency models historically were developed in the Vegetation Dynamics Development Tool (VDDT) which are non-spatial simulations.
- These simulations run in the Path Landscape Model
- A spatial version (ST-Sim) is available from APEX ([apexrms.com](http://apexrms.com))



# State-and-Transition Models

Herbaceous → Open shrub → Closed shrub → Woodland

Herbaceous layer:

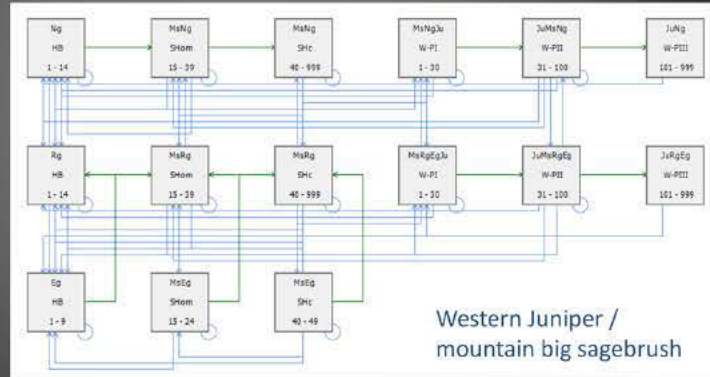
Perennial bunchgrasses

Mixed grass

Exotic annual grasses

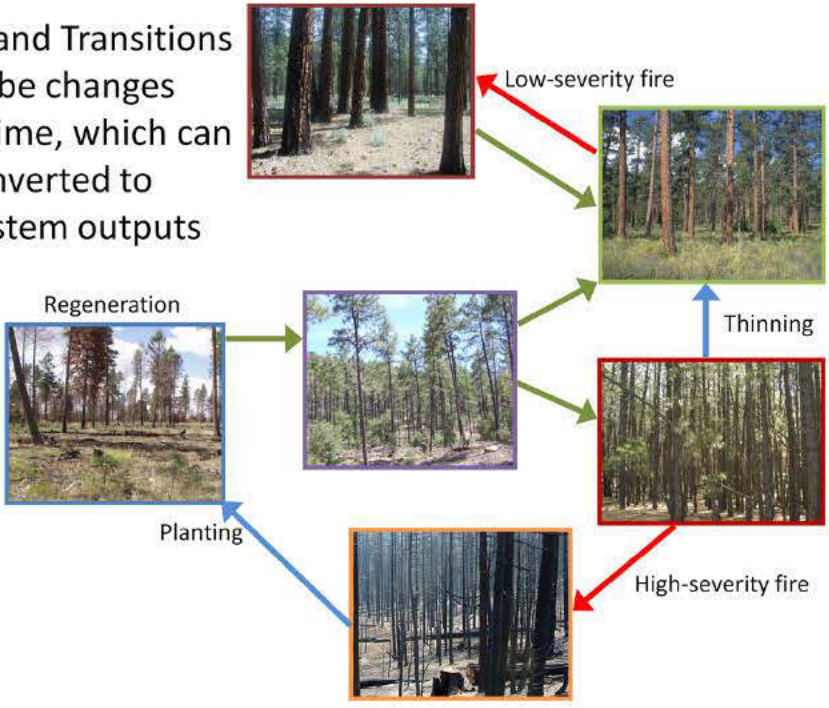
DEGRADATION

SUCCESSION

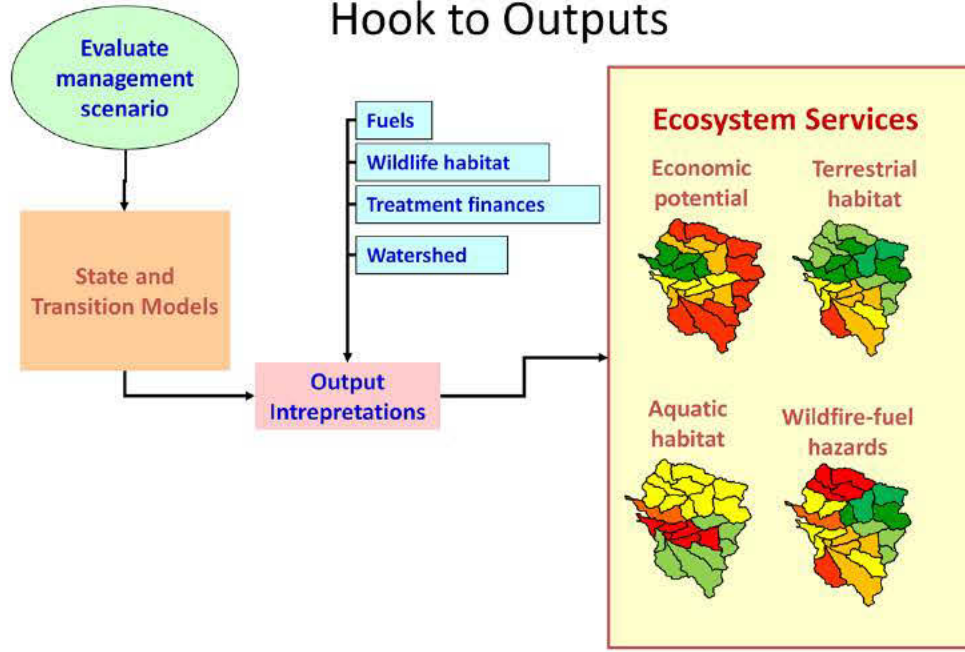


DISTURBANCE

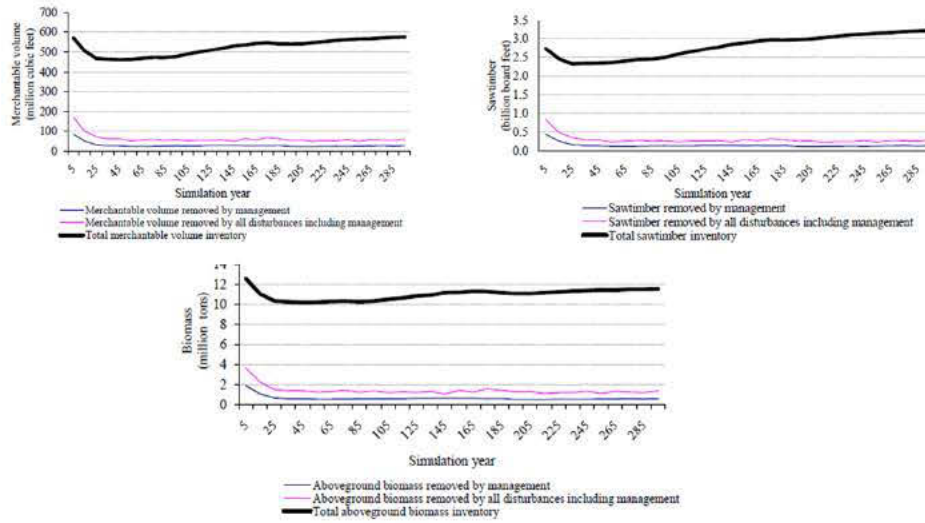
State and Transitions describe changes over time, which can be converted to ecosystem outputs



# Use Mid Scale Data to Run Models and Hook to Outputs

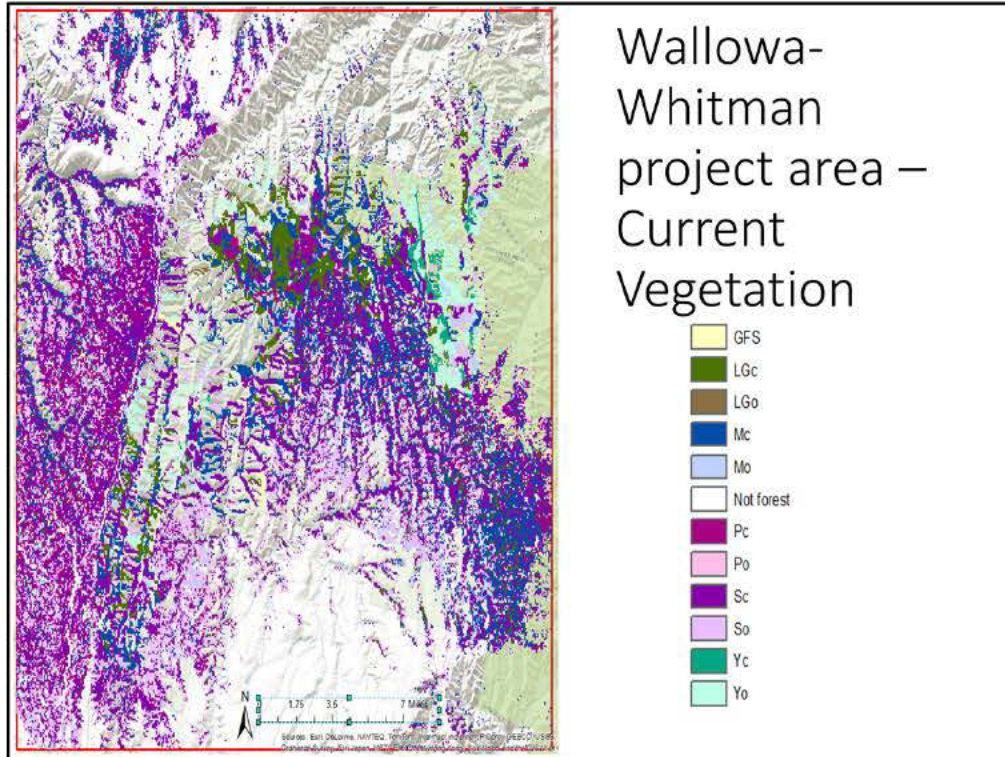


# Merchantable Volume, Sawtimber, Biomass

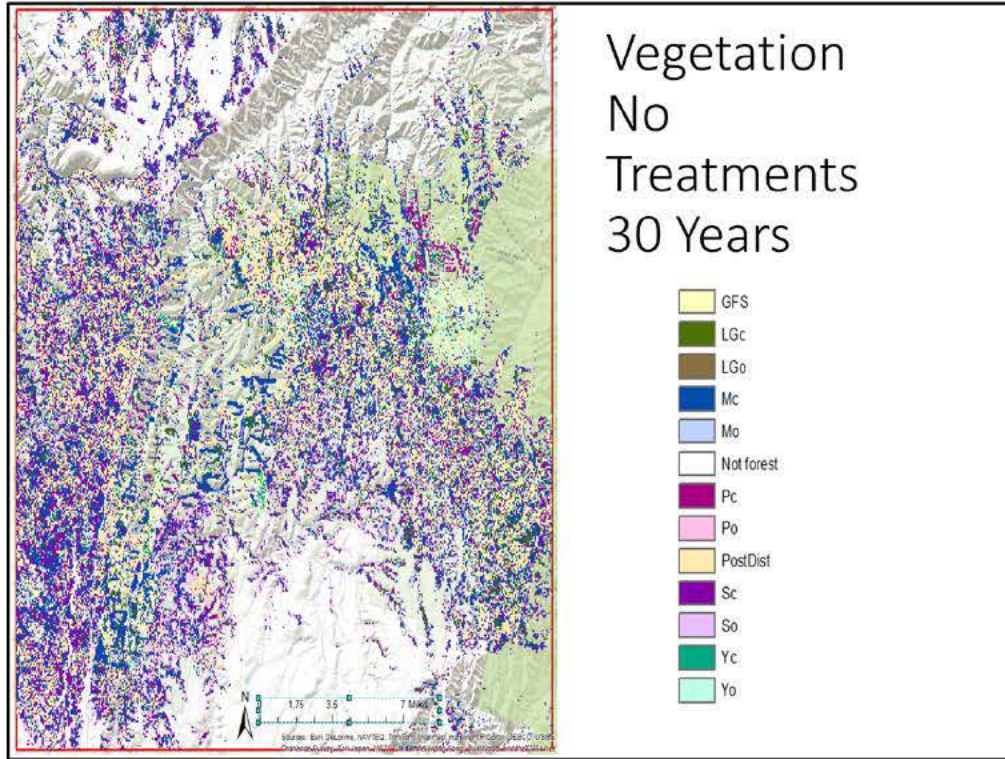


Deschutes National Forest Output Example

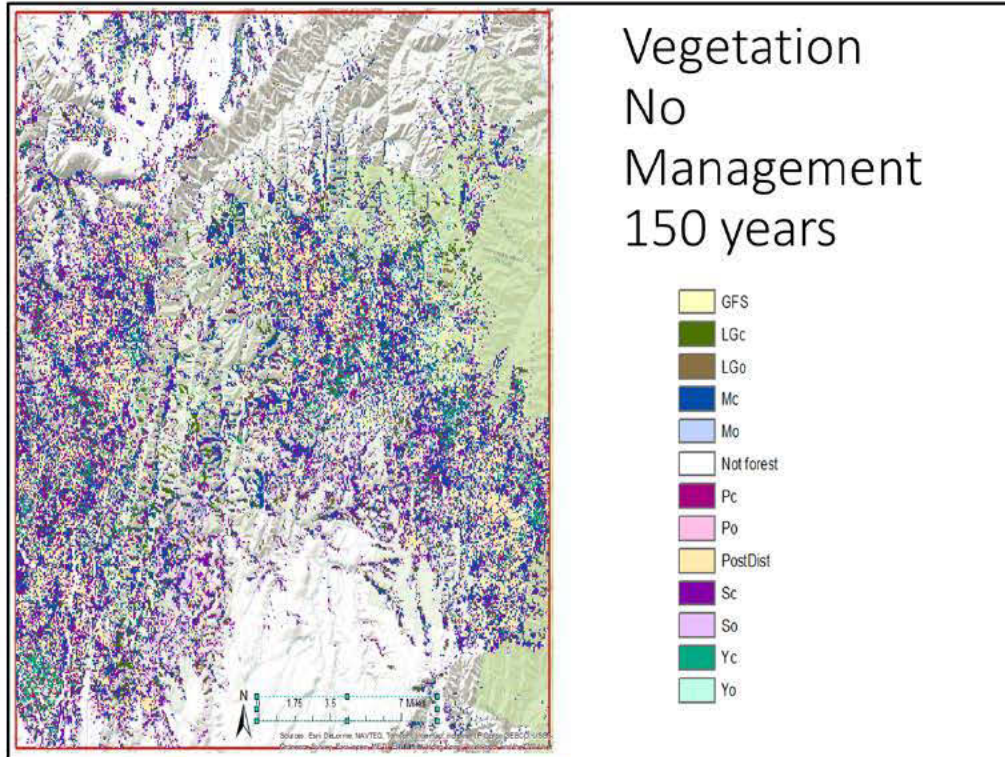




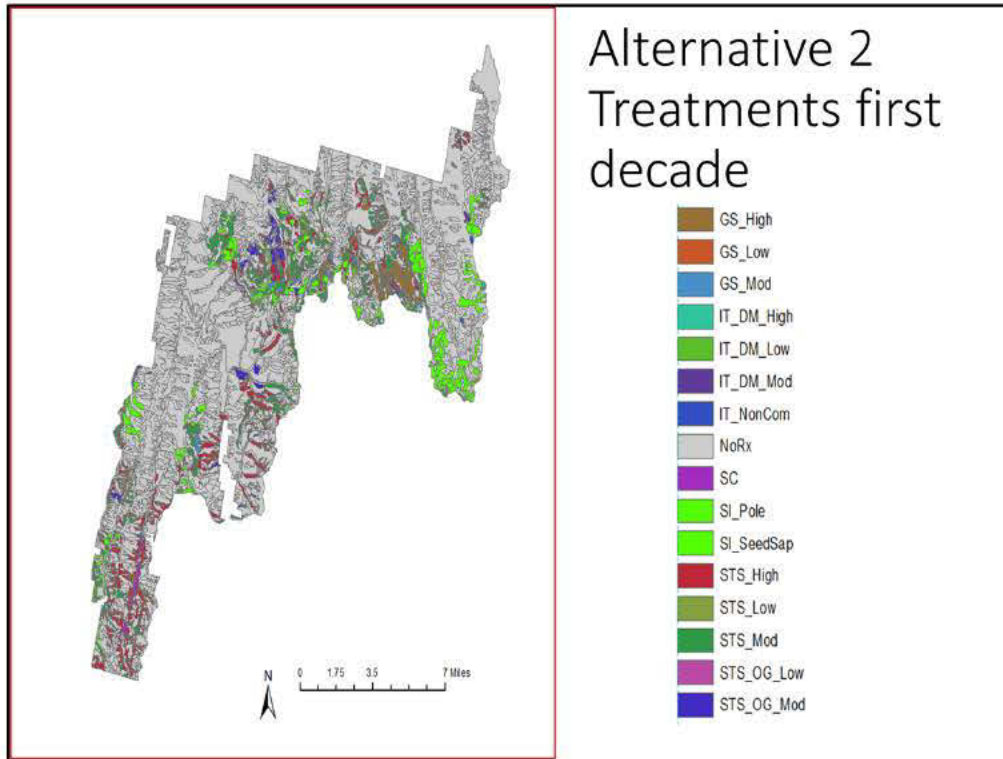
Light green background means FS land. Somewhat darker green background is Hells Canyon National Recreation Area. Current forests dominated by medium (15-20 inches), small (10-15 inches) and pole (5-10 inches) stands, mostly in closed conditions.



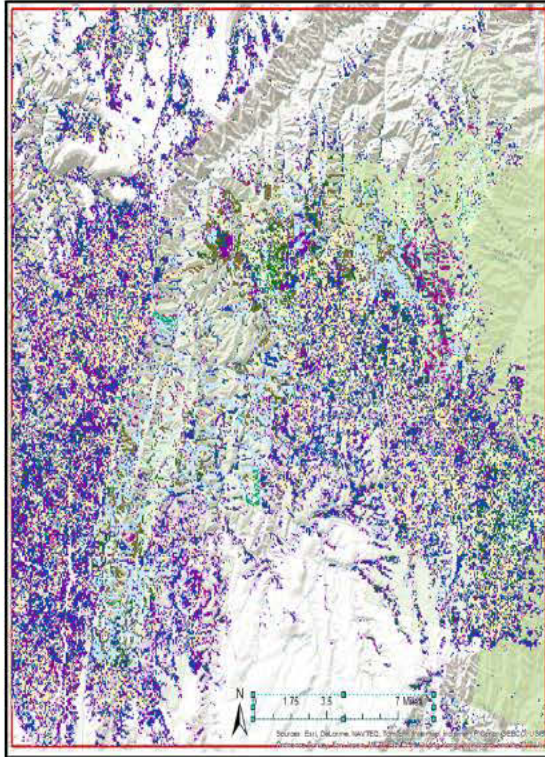
Lots of fire and insect disturbance in first 30 years (and after that as well), resulting in lots of post-disturbance condition....which recovers to forested in a decade or so.



Very little Large/Giant tree structure at all after 150 years.

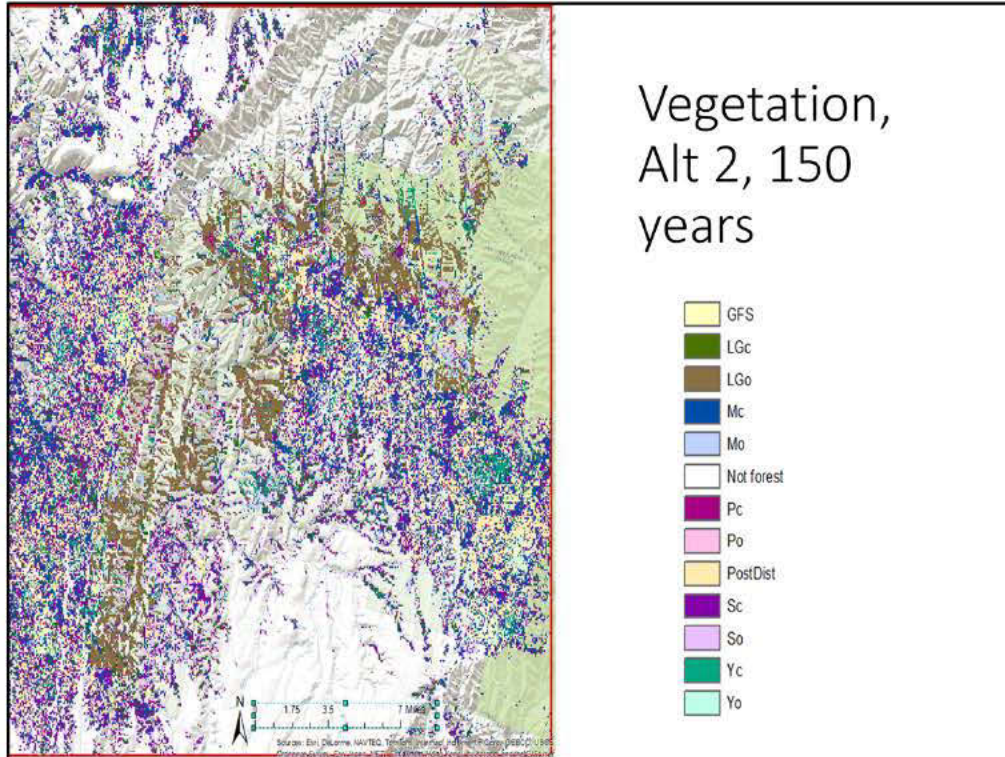


FS land in project area is about 100,000 acres. GS = group selection. IT = variable density thinning. NoRx = no treatment. SC = stream corridor. SI = single tree selection. STS = single tree selection. STS-OG = single tree selection in designated old growth. Prescribed fire not shown because it is randomly assigned to stands while other treatments are stand-specific. Gray (not treated) areas are not forested or in some protected status.



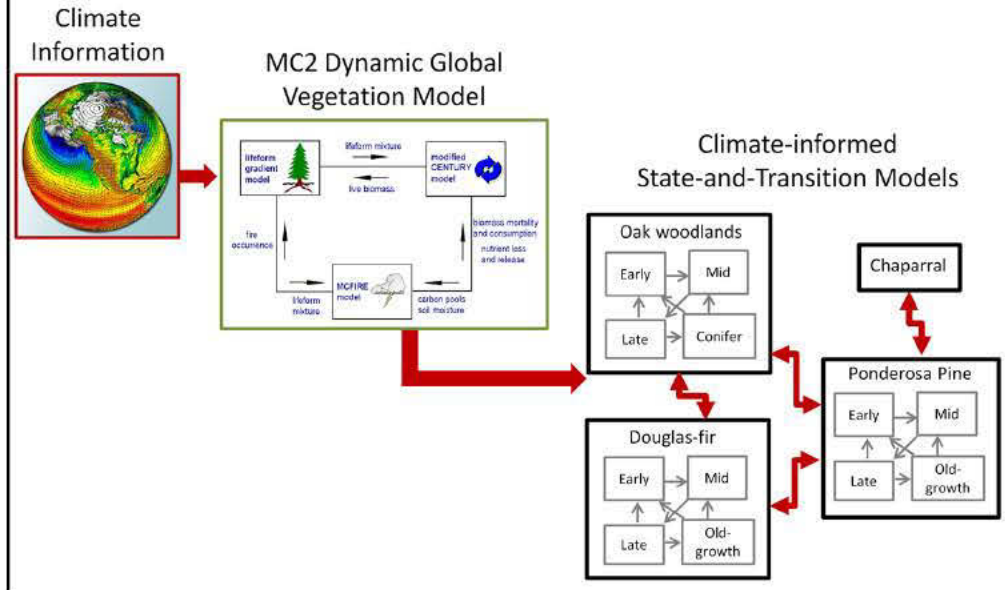
# Vegetation, Alt. 2, 30 Years

- GFS
- LGc
- LGo
- Mc
- Mo
- Not forest
- Pc
- Po
- PostDist
- Sc
- So
- Yc
- Yo

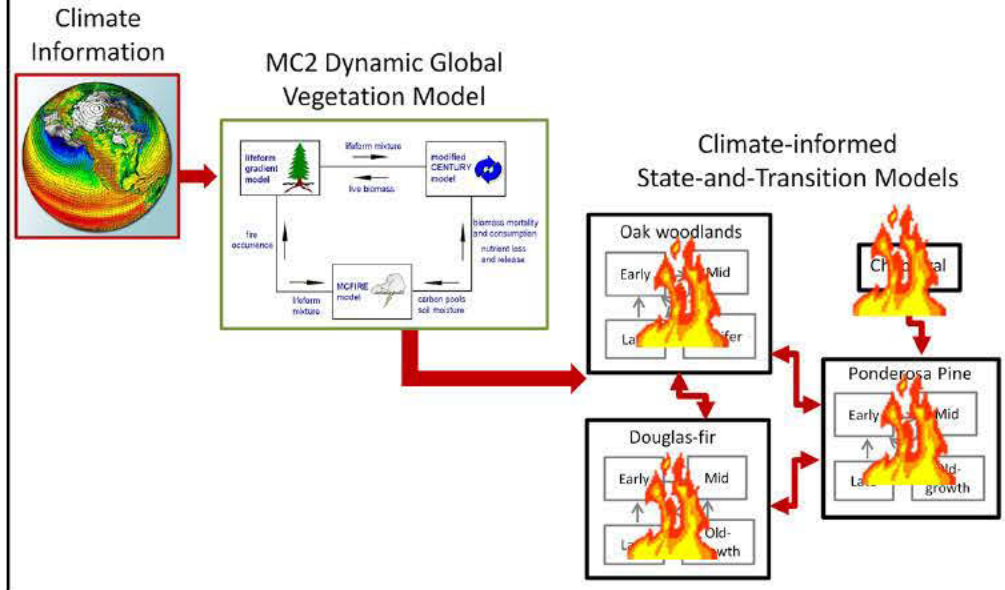


Alternative 2 does quite a bit of thinning from below and under-burning, resulting in Large/Giant open (brown) stands. These will quickly regain an understory if not frequently burned to become Large/Giant closed (dark green).

# Integrating Climate Change & Land Management Models

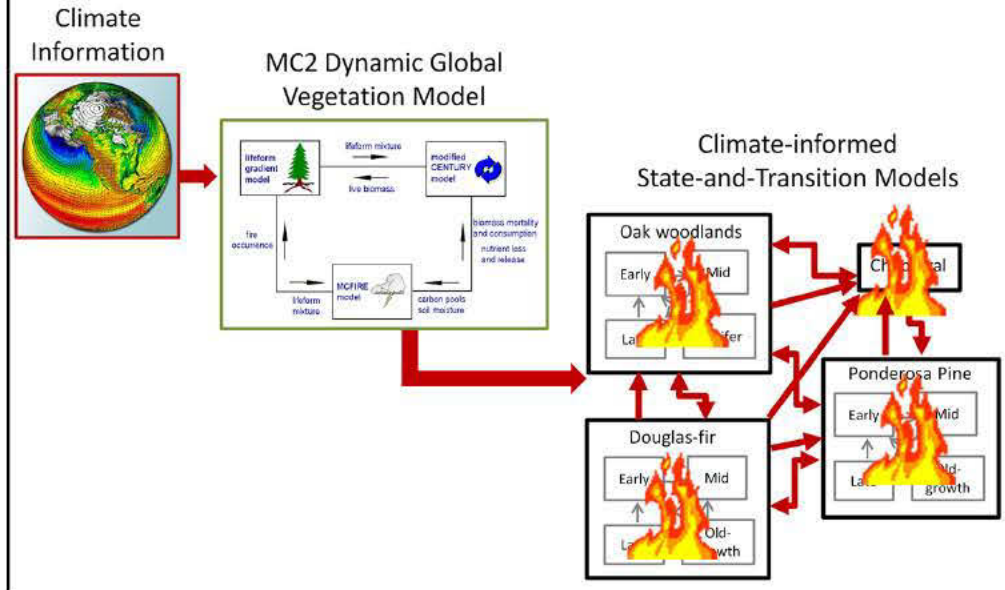


# Integrating Climate Change & Land Management Models





# Integrating Climate Change & Land Management Models



# Midscale data is not all Terrestrial

NWI is relatively high spatial resolution with uncertain accuracy...yet can

Wetland Restoration Planning Tool

**Map Layers**

- Wetland Scores... [more info](#)
- Existing Wetland Conditions
- Landscape Integrity
- Ecosystem Services
- Conservation Significance
- Wetland Condition
- Wetland Restoration & Management
- Wetland Complex
- Wetland Type
- Hydroic Soils
- Watershed Units (WCU)
- HUC\_12
- Regions
- Newses
- Oregon Counties

Layer is scale dependent. Zoom in to see layer on selected. Layer will not display at all scale.

Find on Map

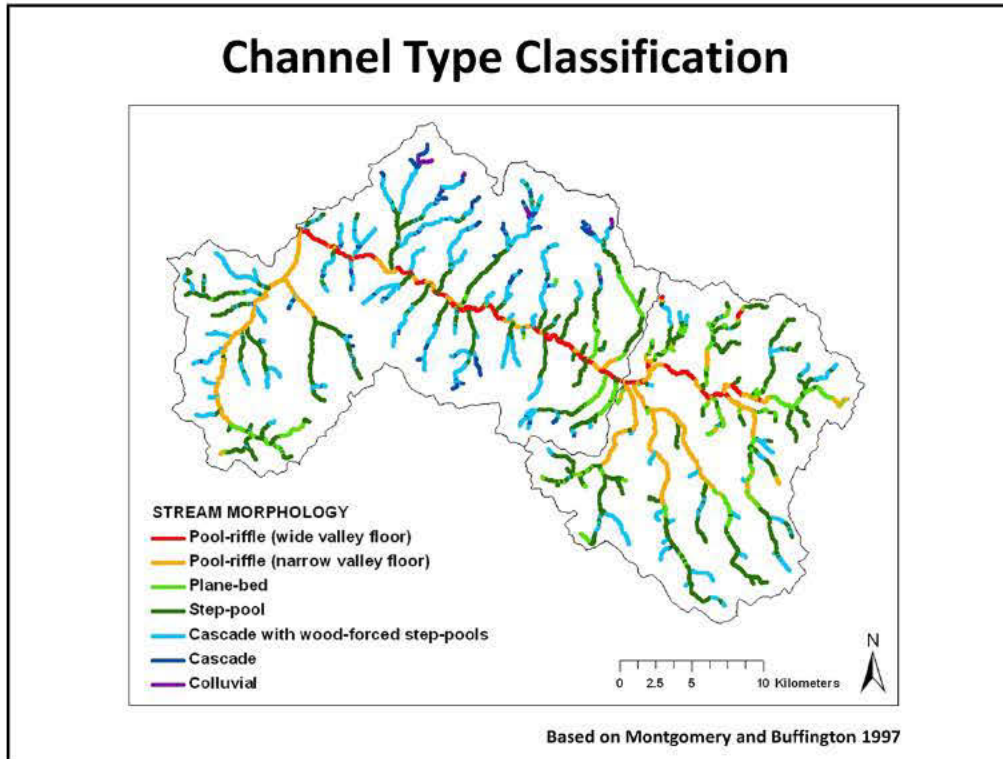
**Wetland Information**

Wetland Score: 94

Ecosystem Services:

**Wetland Attributes**

Wetland Type	Palustrine (Freshwater)
Area	233.46 Acres
AbstrID	27162
Shape	Polygon
AcresID	4365
ComplexID	10026
WgsID	Lower Rogue
12-Digit HUC (Subwatershed)	17100110204
Watershed Unit	811111
Subsiding Critical Ecosystem Services	34
100 Year Floodplain	Yes
300Yr Floodplain	Yes
300Yr Flood Stream (Temp exten)	Yes
300Yr Flood Stream (Other)	No
DDQ designated drinking water area (Surface)	Yes
DDQ designated drinking water area (Drunk)	No
Streamflow Restoration Priority Rating (S/R)	Medium streamflow need
CAPD Inventory	62
State land status	Not available for red screen
Restoration status	Not available for red screen



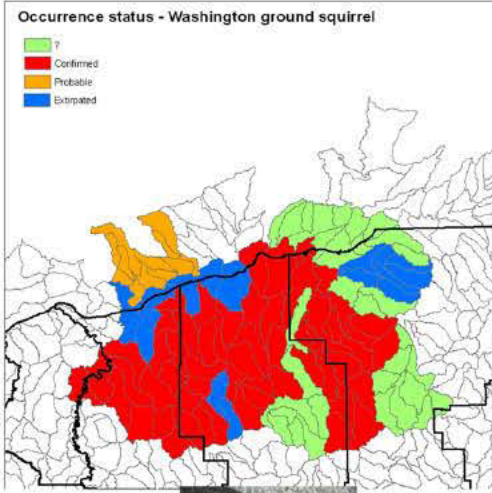
Stream reaches are classified into morphologic types using the Montgomery and Buffington (1997) classification with some modification to channel gradient thresholds based on field data.

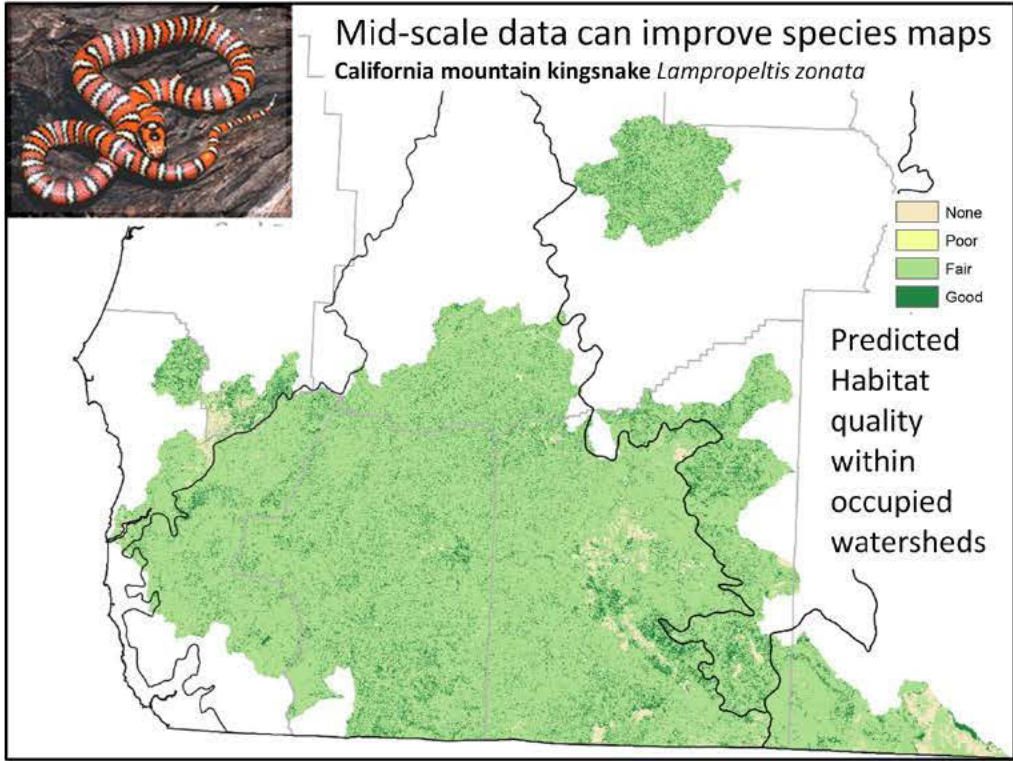
Total stream network = 535 km

#### Montgomery and Buffington Classification

Morphology	Gradient (m/m)	Drainage Area (km <sup>2</sup> )
Pool-riffle (wide)	$\leq 0.006$	$> 2$
Pool-riffle (narrow)	$> 0.006, \leq 0.015$	$> 2$
Pool-riffle (narrow)	$> 0.015, \leq 0.03$	$> 30$
Plane-bed	$> 0.015, \leq 0.03$	$< 30$
Step-pool	$> 0.03, \leq 0.065$	$> 2$
Cascade w.f. step-pool	$> 0.065, \leq 0.12$	$> 2$
Cascade	$> 0.12, \leq 0.20$	$> 2$
Colluvial	$> 0.20$	$> 2$

# And Can Include Species





## Conclusions

- Mid Scale data can provide information to improve modeling of ecosystem service outputs
- Mid Scale data provides critical inputs into state and transition models which predict many ecosystem service outputs from management decisions
- Mid Scale data is created from nationally available datasets with proven methods
- Mid Scale data is available in some areas of the US, and can be developed across the country if federal agencies worked together and decided to make it happen

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