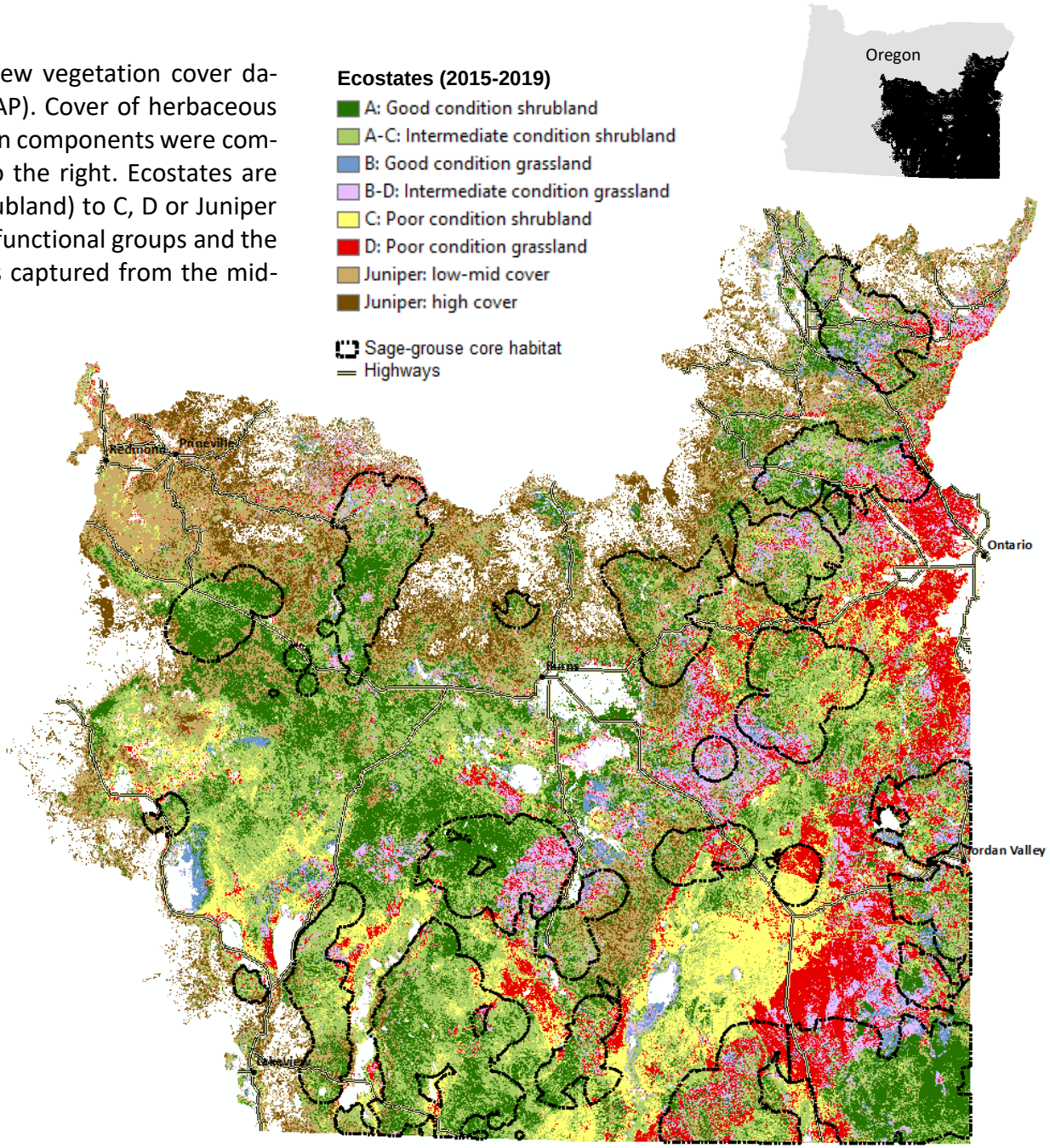
Threat-Based Land Management in Oregon Rangelands: Ecostate Time Series Maps

The Oregon SageCon Partnership uses **threat-based models** (Johnson et al 2019) as a framework to identify and address the primary threats to rangeland ecosystems in southeastern Oregon. Rangeland condition is described by ecological states (ecostates) that express current vegetation composition and level of threat from **wildfire**, **invasive annual grasses**, and **juniper encroachment**. Management actions, such as adjustments to livestock grazing, juniper removal, herbicide application and others, can be identified to address these threats and improve rangeland condition. Threat-based models are central to the 2015 Oregon Sage-Grouse Action Plan (referenced as 'state-and-transition models') and applications in Oregon rangelands cross from local scales (assessment of properties enrolled in Programmatic Candidate Conservation Agreements (CCAAs) to broad scales (state-wide monitoring of rangeland condition).

This document describes the SageCon **Ecostate Time Series** maps depicting threat-based ecostates in Oregon rangelands from the mid-1980s to present. More information is provided in the following pages and data layers can be viewed and download from the SageCon Landscape Planning Tool.

Ecostate Maps in Oregon

The Ecostate Time Series maps are based on new vegetation cover datasets from the Rangeland Analysis Platform (RAP). Cover of herbaceous (annual and perennial), shrub, and tree vegetation components were combined into eight ecostates shown in the map to the right. Ecostates are expressed as letters from A (good condition shrubland) to C, D or Juniper states, depending on the cover of key rangeland functional groups and the severity of threats present. Change over time is captured from the mid-1980s to late 2010s (see page 4 for more detail).

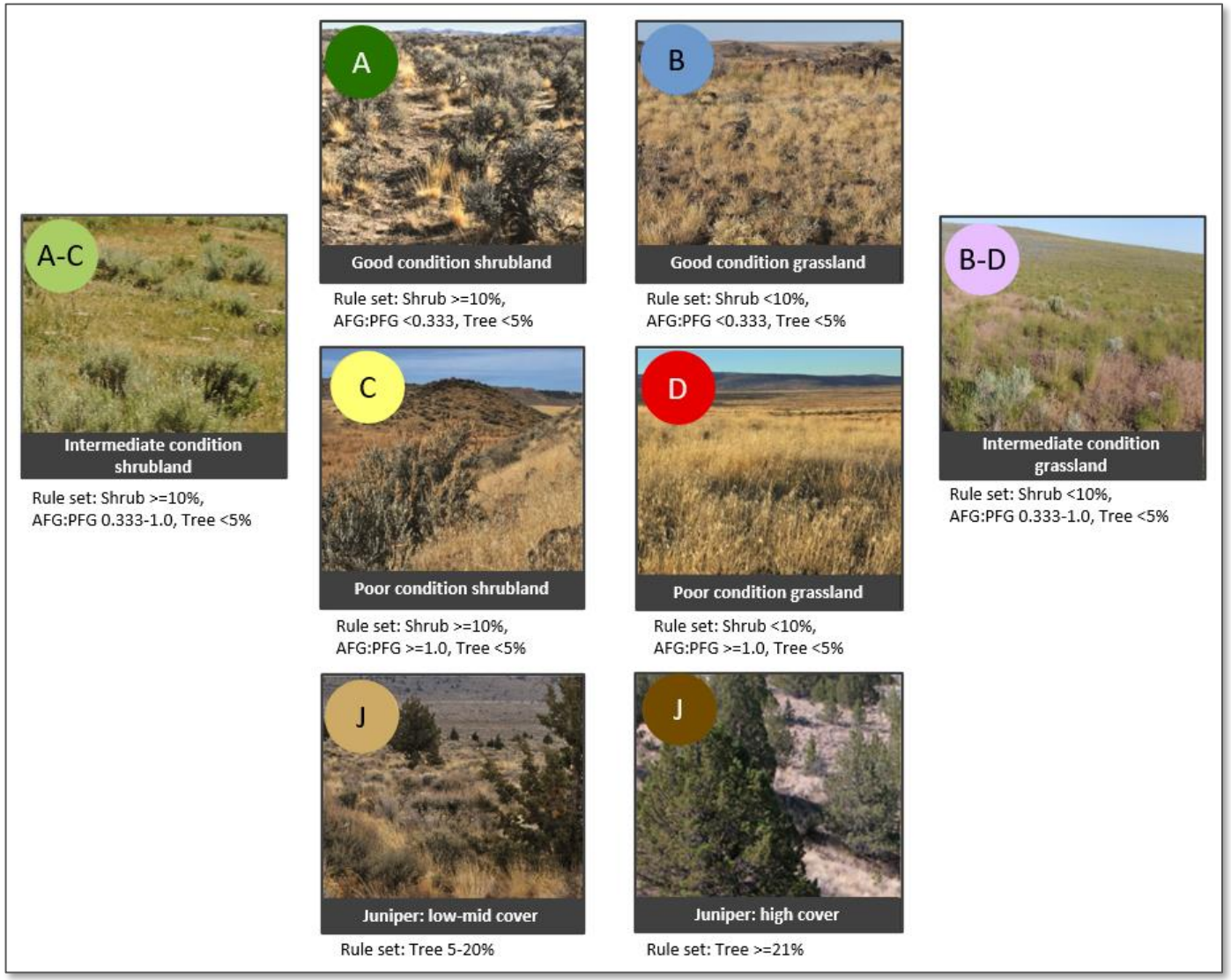


These maps provide a generalized snapshot of broad vegetation conditions to identify and map the severity and extent of primary ecosystem threats. As such, these maps provide a helpful big-picture view but should always be complemented with other data sources. For more detail about vegetation condition, use available monitoring plot data and vegetation cover maps of individual functional groups of interest. For instance, shrub cover maps may be used to determine if some areas identified as 'state A' contain shrub cover that is higher than desired, and monitoring plots can further distinguish the shrub species present and the implications for wildlife habitat structure.

Users can and download the most recent Ecostate Map and other data layers from the SageCon Landscape Planning Tool or download the full time series dataset, including seven maps of 5-year time slices from 1985-2019. RAP vegetation cover maps (shrubs, trees, annual herbaceous, perennial herbaceous, and bare ground cover) can also be viewed and summarized from the RAP web tool.

Ecostate Descriptions and Components

The adjacent diagram shows a representative photograph for each of the eight mapped ecostates, and the rule set for assigning each pixel into an ecostate using percent cover of annual forbs & grasses (AFG), perennial forbs & grasses (PFG), shrubs, and trees. Areas with juniper (>=5% cover) are divided into two states based on the amount of tree cover (J states at the bottom). Areas with <5% juniper cover are divided into shrubland (A, A-C, C) and grassland ecostates (B, B-D, D) based on shrub cover (10% cover thresh-old). Herbaceous condition is determined by the ratio of annuals to perennials (AFG:PFG), with sites considered in good condition where there are >3 times more perennials than annuals (A and B), sites in poor condition where annuals are dominant over per-ennials (C and D), and intermediate condition where perennials are slightly dominant (A-C and B-D). The AFG:PFG ratio was used instead of a cover threshold because it expresses the relative dominance of AFG and PFG across areas that differ in site potential.

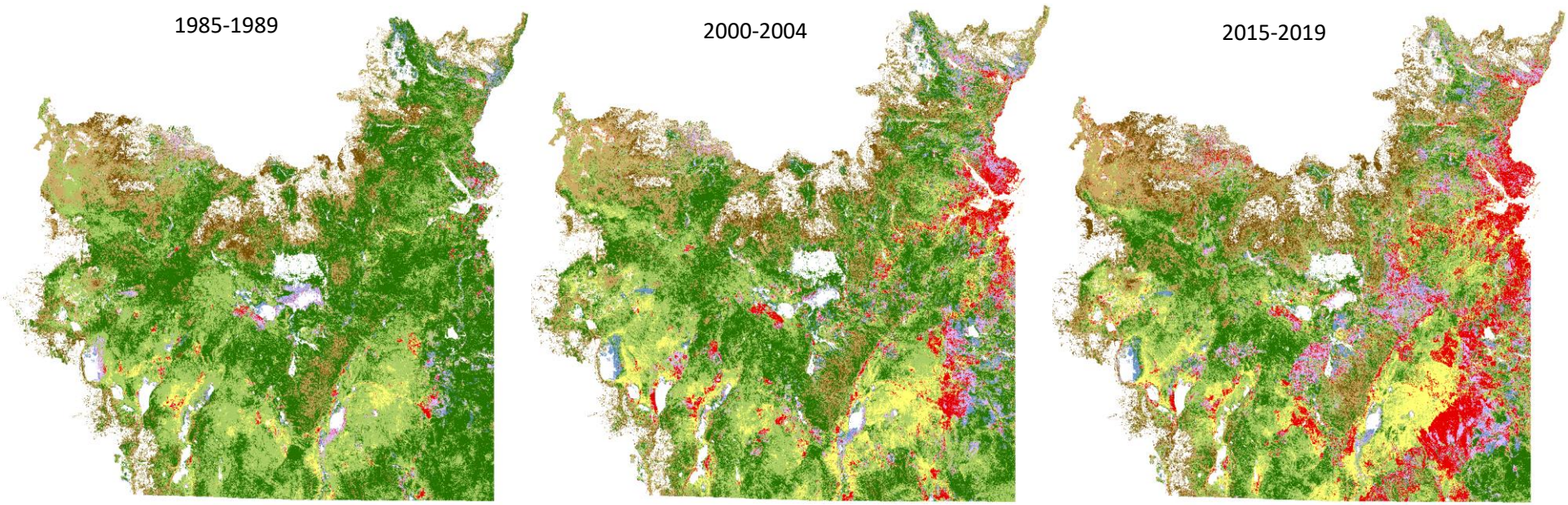


It is important to note that there are no definitive thresholds between ecostates; vegetation condition in reality represents a continuum across a wide range of conditions. These maps can be updated and improved as new science emerges and maps are applied in practice. Ecostate maps exclude forests, agriculture, developed, and non-vegetated areas.

Also be aware that the RAP data underlying the Ecostate Time Series maps depict very broad functional groups: tree cover (all species, not just juniper), shrub cover (all species, not just sagebrush), and AFG and PFG cover (in both cases, cover of grasses and forbs are combined). Other applications of threat-based models often distinguish more specific functional groups, such as separating sagebrush from other shrubs (shrubs such as rabbitbrush and bitterbrush are often ignored), and/or separating deep-rooted perennial grasses from total PFG cover, as deep-rooted grasses are key for providing soil stability and resilience.

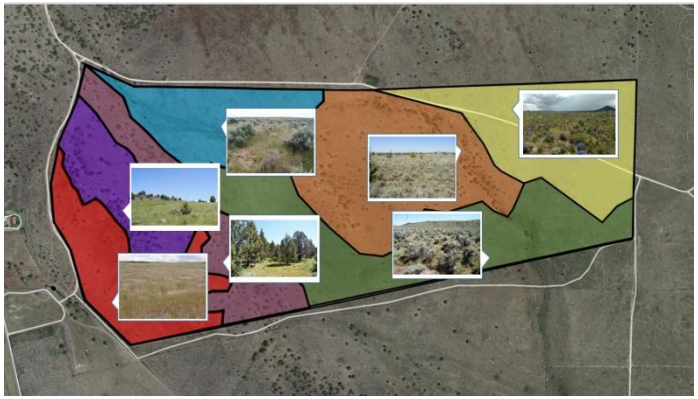
Ecostate Time Series

The Ecostate Time Series maps based on RAP cover datasets allow us to **track change over time** from the mid-1980s to present. To simplify this multi-decade time frame, we summarized maps into 5-year time slices, producing seven total maps for conditions in 1985-1989, 1990-1994, 1995-1999, 2000-2004, 2005-2009, 2010-2014, 2015-2019. Cover values for each functional group were averaged across each 5-year time window and the rule set (described on page 3) was applied to those averages, resulting in a relatively small number of maps that depict broad trends over time while reducing noise from interannual variability. Three of the Ecostate Time Series maps are shown below to illustrate broad patterns of change across southeastern Oregon over the past 35 years. This time series provides a powerful tool to evaluate change in the distribution and severity of primary threats over the last few decades. The SageCon Rangeland Condition Report will be updated in summer of 2021 with more information about vegetation change in southeastern Oregon.



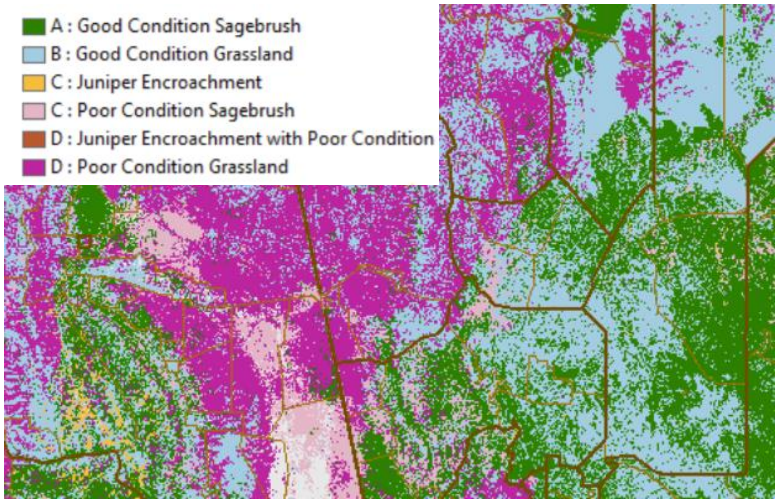
The Evolution of Threat-Based Models in Oregon

Threat-based land management has evolved in Oregon over the past decade as methods are refined and new technology enables mapping of ecostates across multiple scales and over longer time frames. Initial models were simply called "state-and-transition models" and consisted of three conceptual models applied primarily at the ranch scale. Applied to individual properties, polygons are drawn to identify the ecostates across each pasture or management unit (right), and maps are adjusted over time as conditions change or threats are addressed (e.g., conifer removal). This framework is still used at the property scale for many lands enrolled in CCAAs to protect sage-grouse habitat.

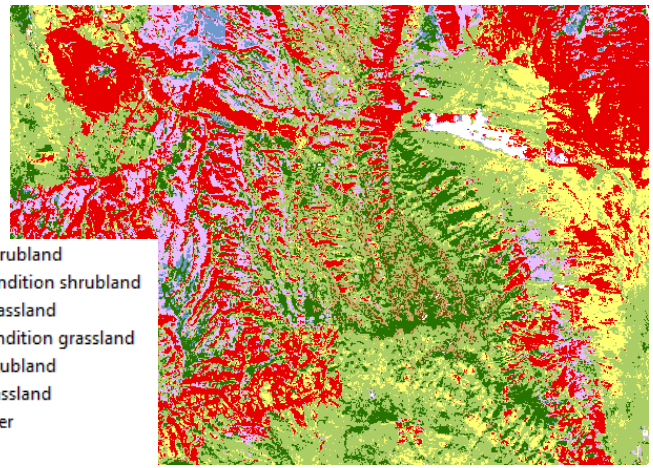


The threat-based land management framework was further developed into a single, unified threat-based model, described in the 2019 Threat-Based Land Management Field Guide and Manager's Guide.

Also in 2019, the first Ecostate Map covering all of southeastern Oregon was developed from the Southeast Oregon Nearest Neighbor Vegetation Composition Map (below, left). This map represented the best spatial estimate of threat-based ecostates across all of Oregon at the time but was limited in its use at relatively fine spatial scales (e.g., pastures that cover tens or hundreds of acres). Other threat-based maps have been developed for targeted geographic areas within Oregon rangelands (e.g., individual BLM Districts) but have not been made public.



Remotely sensed technology has been rapidly progressing, and the newer RAP version 2 datasets released in 2020 depict vegetation cover with higher accuracy, at a wider range of spatial scales (including smaller pastures or properties), and covering a multi-decade time series. Based on these newer maps, we developed the current **Ecostate Time Series Maps**, representing the best available maps of ecostates in Oregon as of spring 2021 (right).



For questions about the Ecostate Time Series maps contact Megan Creutzburg: megan.creutzburg@oregonstate.edu.