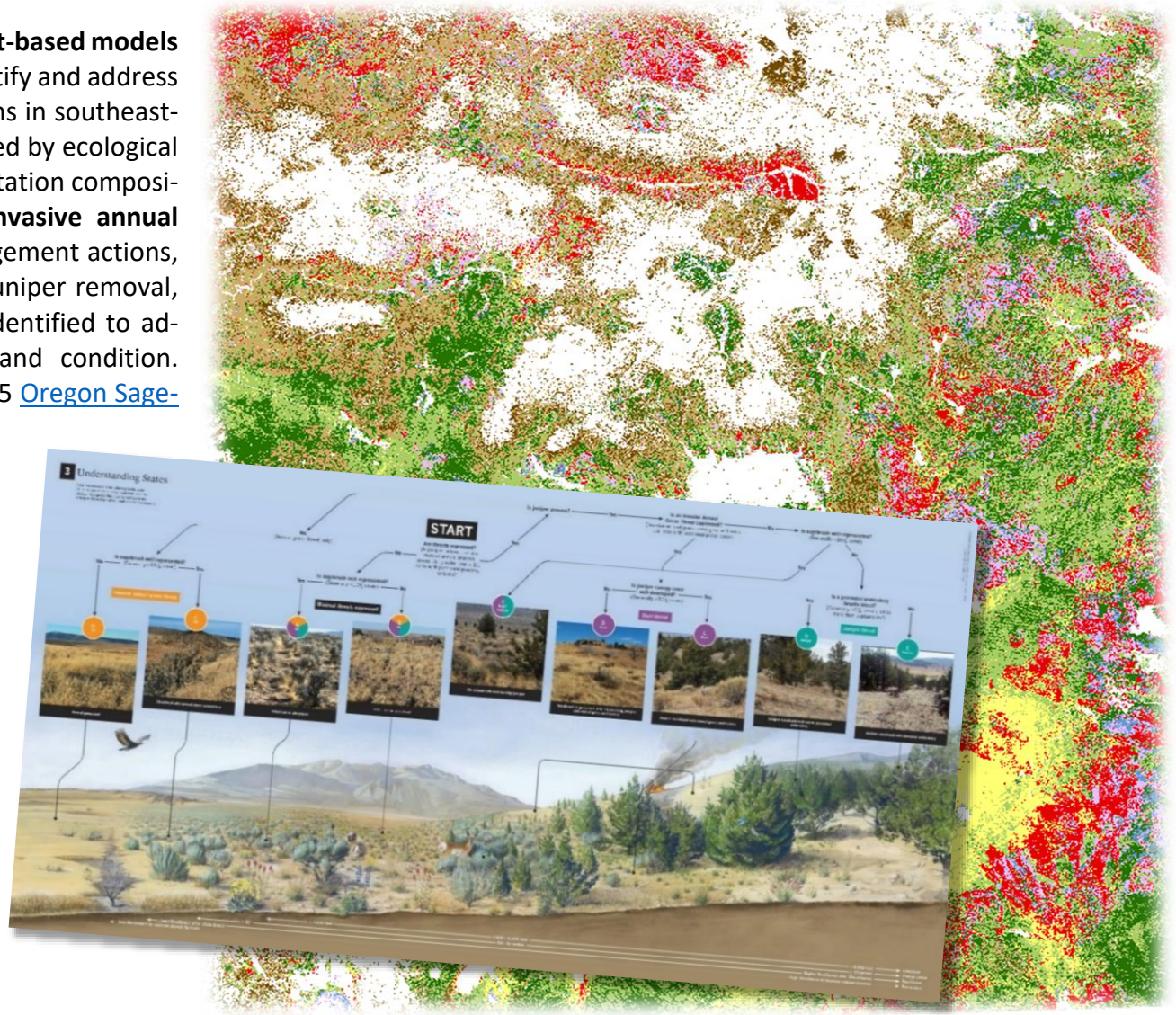
Threat-Based Land Management in Oregon Rangelands: Ecostate Time Series Maps (version 3)

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 in the Plan as 'state-and-transition models') and applications in Oregon rangelands span across local scales (assessment of properties enrolled in Programmatic Candidate Conservation Agreements (CCAAs) to broad scales (state-wide monitoring of rangeland condition).



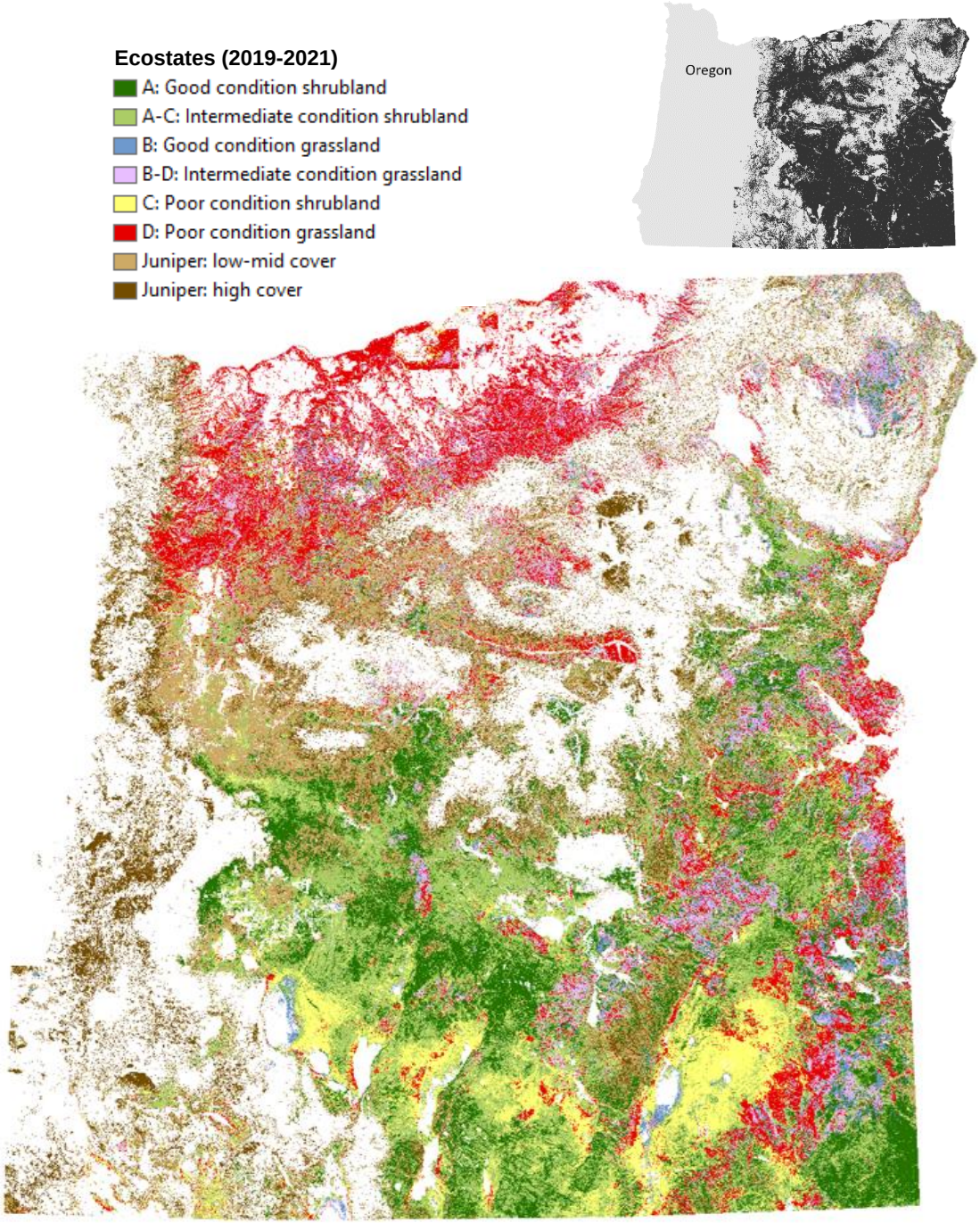
This document describes the SageCon **Ecostate Time Series** maps (v3) depicting threat-based ecostates in Oregon rangelands from circa 1990 to present. More information is provided in the following pages and data can be accessed from the threat based ecostate mapping webpage and the SageCon Landscape Planning Tool.

Overview of Ecostate Maps in Oregon

The Ecostate Time Series maps are based on vegetation cover datasets from the Rangeland Analysis Platform (RAP) v3, released in January 2022. Cover of herbaceous (annual and perennial), shrub, and tree vegetation components were combined into eight ecostates shown in the map to the right (see pg 3 for details on how classes are defined). Ecostates are expressed as letters from A (good condition shrubland) to more degraded C, D or Juniper states, depending on the cover of **key rangeland functional groups**. Change over time is captured from circa 1990 to present in 3-year overlapping time windows, with the intention to update maps each year.

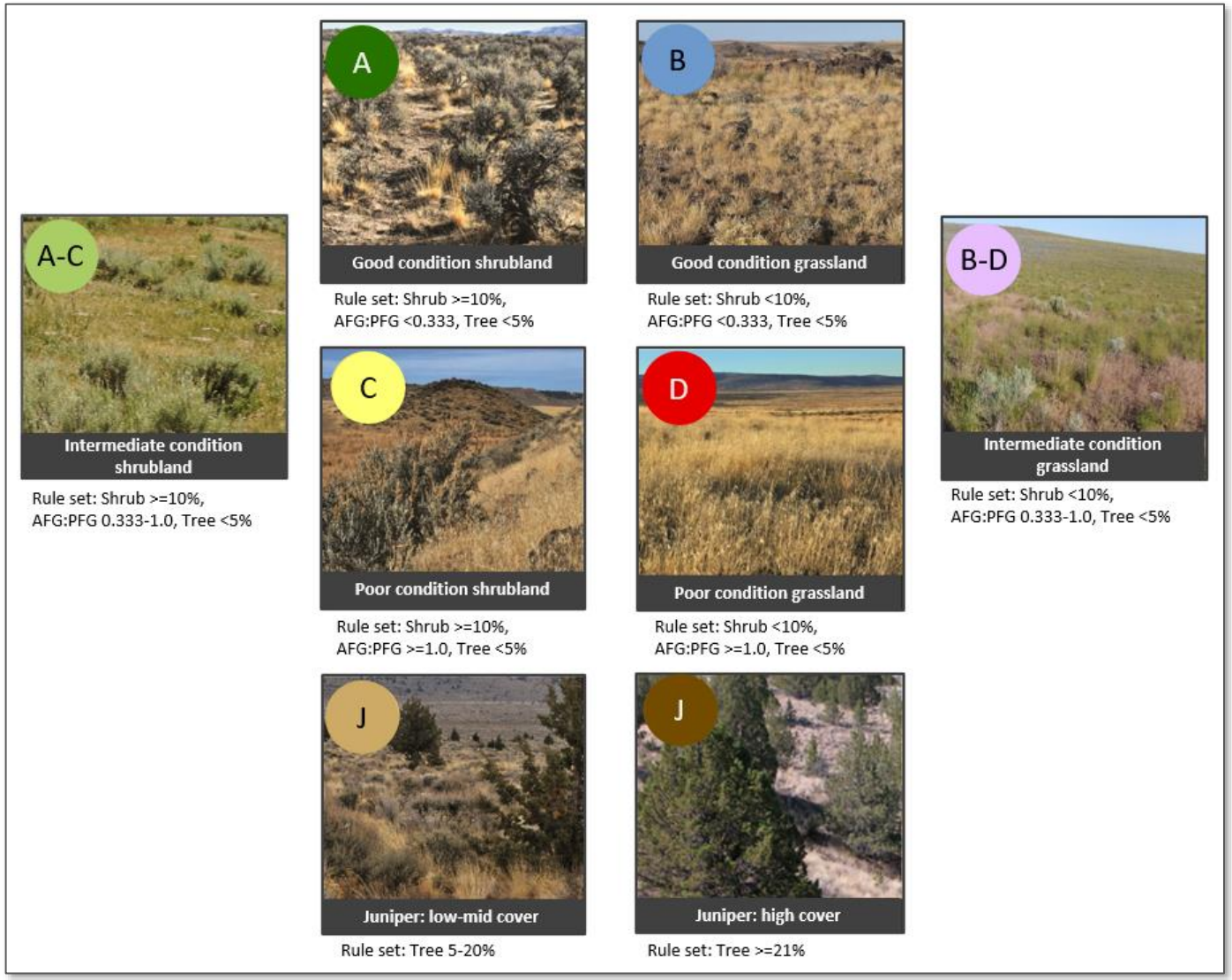
These maps provide a **generalized snapshot of broad vegetation conditions** to identify and map the severity and extent of major ecosystem-level threats. As such, these maps provide a helpful big-picture view but should always be complemented with other data sources. For more detail about vegetation 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 and grass species, presence or absence of desirable forbs, and the implications for wildlife habitat and other values.

Users can **access data** (including the full time series) and more information from the threat based ecostate mapping resource page on Oregon Explorer, and download the most recent Ecostate Map and other data layers from the SageCon Landscape Planning Tool.



Ecostate Descriptions and Components

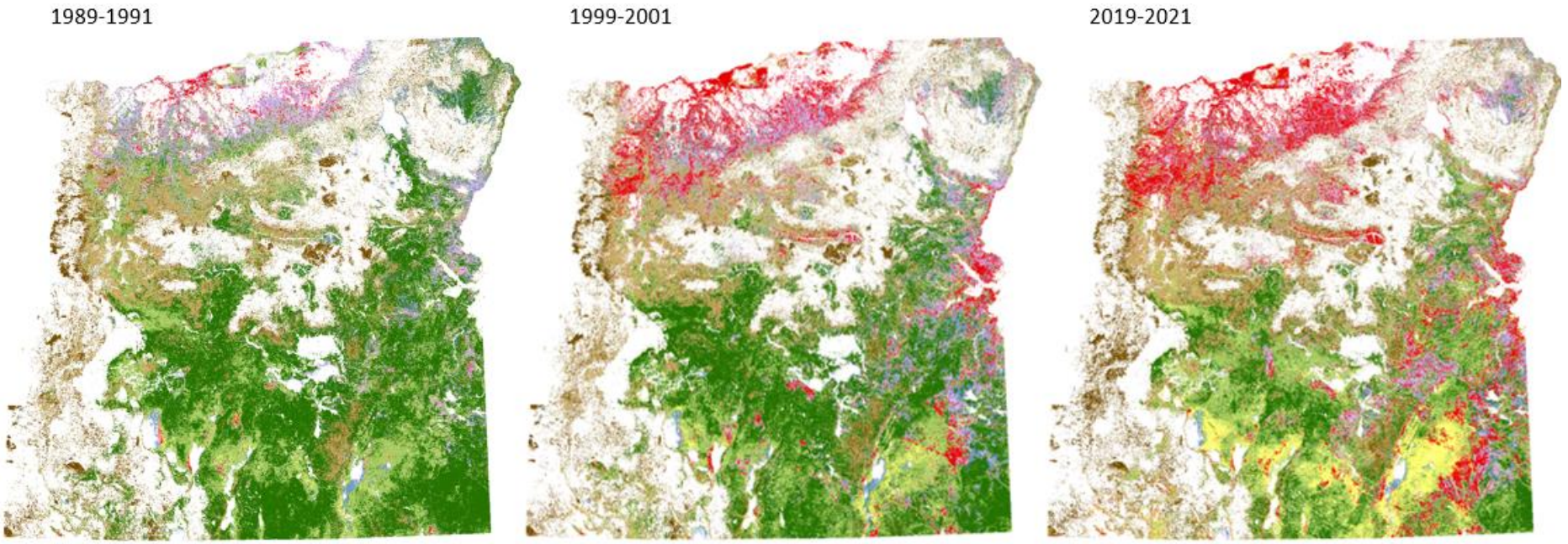
The adjacent diagram shows a representative photograph for each of the eight mapped ecostates, and the rule set for assigning each pixel into an ecostate using percent cover of annual forbs & grasses (AFG), perennial forbs & grasses (PFG), shrubs, and trees from RAP v3. Areas with trees (>=5% cover) are divided into two states based on the amount of tree cover (J or juniper states at the bottom) without differentiating understory condition for simplicity. 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 threshold). 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 perennials (C and D), and intermediate condition where perennials are slightly dominant (A-C and B-D). The AFG:PFG ratio was used to characterize understory condition instead of a cover threshold because it expresses the relative dominance of AFG and PFG across areas that differ in site potential. The maps cover all eastern Oregon rangelands excluding forests, agriculture, developed areas, and non-vegetated areas.



RAP v3 vegetation cover maps used to build the ecostate time series can also be viewed and summarized from the RAP web tool.

Ecostate Time Series version 3

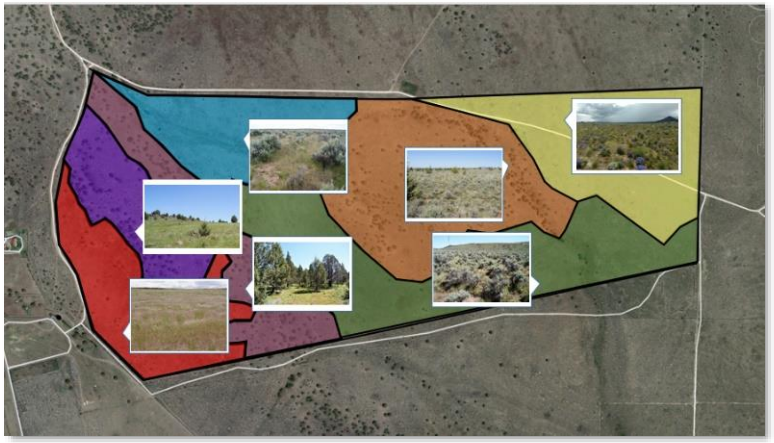
The current set of Ecostate Time Series maps provide a **recent snapshot of ecosystem condition** (with planned annual updates over time) that also allow us to **track trends over time**. In version 3 of the time series we provide maps as **3-year averages** to reduce the effects of short-term interannual variability on broader trends, and each map is labeled with the 3-year time frame it represents. Therefore these maps are not appropriate for detecting year-to-year changes, but are intended to capture landscape-level change on medium to long time frames, such as evaluating post-fire recovery or treatment effectiveness over >5-10 years. The three Ecostate Time Series maps shown below illustrate broad patterns of change across southeastern Oregon over the past three decades.



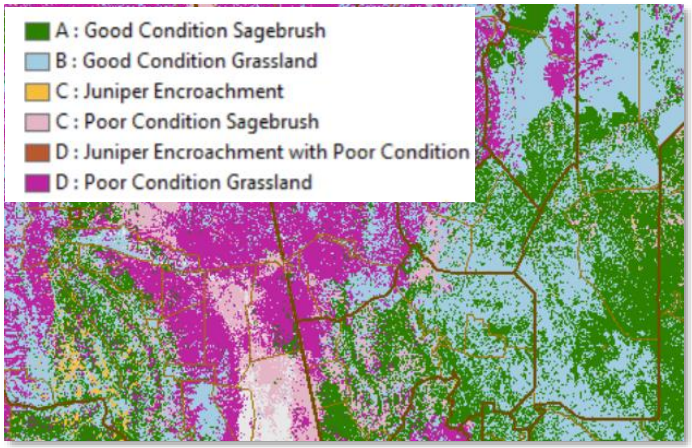
It is important to note that the broad ecostate classes simplify rangeland condition to **focus on the primary threats to ecosystem function** and serve as a basic **communication tool**, which means that they do not include many important detailed and site-specific factors and will not work well at every site. Although we categorize vegetation into distinct categories for the purpose of mapping, in reality there are no definitive thresholds between ecostates that capture vegetation state change across all of the diverse rangelands in the state. The underlying vegetation maps contain errors and 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 such as rabbitbrush and bitterbrush, and/or separating deep-rooted perennial grasses from total PFG cover, as deep-rooted grasses are key for providing soil stability and resilience.

The Evolution of Threat-Based Models in Oregon

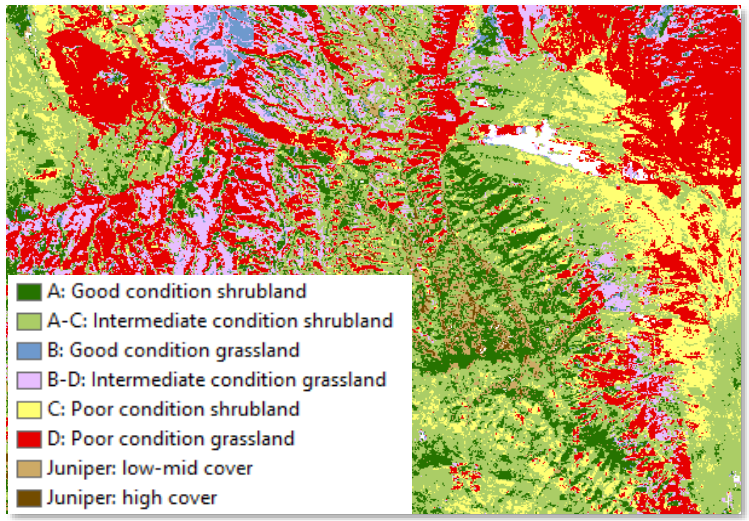
Threat-based land management has evolved in Oregon over the past decade as methods are refined and new technology emerges. Initial models were simply called 'state-and-transition models' and consisted of three conceptual models applied primarily at the ranch scale. Applied to individual properties, polygons are drawn to identify the ecostates across each pasture or management unit (upper 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.



In 2019, the first Ecostate Map covering all of southeastern Oregon was developed from the Southeast Oregon Nearest Neighbor Vegetation Composition Map (lower left). This map represented the best spatial estimate of threat-based ecostates across southeastern Oregon at the time but was limited in its use at fine spatial scales. Other threat-based maps have also been developed for targeted geographic areas but have not been publicly accessible.



Remotely sensed technology has been rapidly progressing, and in 2020 we changed the underlying data source for our ecostate mapping to RAP (version 2), which improved map accuracy, allowed the maps to be used at a wider range of spatial scales (including smaller pastures or properties), and covered a multi-decade time series. Version 2 of the Ecostate Time Series, released in 2021, consisted of seven maps representing 5-year time slices through 2019 (lower right). In 2022, RAP version 3 was released, with improved and updated imagery and plot data. In Ecostate Time Series version 3, we used this newer data source and also changed the time frame of the maps from 5-year non-overlapping time windows into 3-year overlapping time windows, allowing more flexibility for users to evaluate trends over customized time frames.



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