

### Track and report results

Monitoring the effectiveness of conservation actions and adapting these actions to respond appropriately to new information or changing conditions requires that results be tracked and reported. The following steps can be taken in partnership with the Fish and Wildlife Monitoring Team, Oregon Department of Fish and Wildlife's Natural Resource Information Management Program, Oregon Natural Heritage Information Center, Oregon Watershed Enhancement Board, and other partners.

- Identify how progress will be measured (that is, specific metrics to be used such as number of acres restored, number of stream miles improved, or number of landowners given technical assistance).
- Implement consistent procedures for data entry so that progress reporting can be done through queries to a database. Where possible, develop tools to automate the reporting process.
- Design web-based data tools to ensure consistent data entry by multiple partners, maintain data integrity, and improve data sharing. The web-based portals are one way this could be achieved.

### Current Ongoing Efforts to Monitor Species and Habitats in Oregon: How to Build on Existing Efforts

#### Overview

The Conservation Strategy recognizes that there are several major ongoing efforts to monitoring the condition of natural resources in Oregon, and intends to build on these ongoing efforts. The Fish and Wildlife Monitoring Team will develop criteria to link ongoing efforts and indicators to monitoring Strategy Species and Habitats. Some key considerations when designing programs to monitor the status of Strategy Species and Strategy Habitats include:

- Monitoring efforts for Strategy Species should emphasize, as needed, either inventory or limiting factors at appropriate spatial scales. Depending on the existing knowledge base, for some species monitoring should focus on basic knowledge of distribution; for other species it should focus on their response to a particular type of management or human activity; or, for other species it should be highly specific (i.e., the degree of contaminants in fish the Lower Columbia River).
- In long-term, ongoing monitoring efforts, emphasize Strategy Species or Habitats and/or support regional or continental programs.

Incorporate Strategy Species monitoring into other monitoring efforts. When necessary, monitor priority species one at a time to collect baseline data as needed. Use and build on existing data sets and monitoring efforts to determine status, distribution and trends.

- Use indicators or surrogates where valid.
- Where possible, monitoring should be integrated across taxa, habitats, ecoregions, and management objectives.
- Create incentives for monitoring changes in species and habitat distribution over time, in addition to the short term monitoring that guides management.

### Major Plans and Initiatives that Identify Priorities for Monitoring Oregon's Natural Resources

The Conservation Strategy supports and complements monitoring priorities provided by other existing, ongoing efforts within Oregon. Oregon Department of Fish and Wildlife reviewed the following plans for priorities and ongoing efforts, There are additional ongoing efforts not reflected here, especially at the local level.

#### Ecologic Function and Habitats

- Oregon Benchmarks
- State of the Environment Report
- Oregon Plan for Salmon and Watersheds habitat and species monitoring
  - OWEB Monitoring Strategy for the Oregon Plan for Salmon and Watersheds
  - ODEQ Watershed Health Initiative and Volunteer Monitoring Program
  - ODFW Oregon Plan Monitoring Program
  - ODF Forest Practices Monitoring Program
- Northwest Forest Plan and related BLM and USFS local plan updates
- Pacific Northwest Aquatic Monitoring Partnership (PNAMP)
- ODEQ Total Maximum Daily Load (TMDL) planning and process
- ODA SB 1010 plans
- Subbasin plans
- City planning (i.e., City of Portland, City of Bend, etc)

#### Species and Species Groups

- Regional Seabird Conservation Plan (California Current System only)
- Northern Pacific Coast Regional Shorebird Management Plan
- Intermountain West Regional Shorebird Plan
- Oregon-Washington Partners in Flight Conservation Plans (5 ecoregional plans)
- Intermountain West Region Waterbird Conservation Plan
- Regional Waterbird Plan for the Northern Pacific Coast
- Pacific Flyway Management Plans
- Oregon-Washington PIF Special Species Monitoring and Assessment in Oregon and Washington

- Pacific Northwest Aquatic Monitoring Partnership (PNAMP)
- U.S. Geological Survey Amphibian Research and Monitoring Initiative (ARMI)
- Oregon Bat Grid reports (led by U.S. Forest Service; partners include Oregon Bat Working Group and Western Bat Working Group)
- Ongoing (SageMAP)

Additional concepts were derived from an all-bird monitoring workshop held by Oregon Department of Fish and Wildlife in November 2004. During the workshop, participants identified current monitoring efforts and made recommendations for priorities. Some of these recommendations are included in the following tables. Further recommendations will be incorporated throughout the Conservation Strategy in the Implementation chapter and Ecoregional chapters, as appropriate.

**Natural resource monitoring can take one of several different approaches:**

What is monitored?	Why?	How is it done?	What are ways to work with current efforts?
Strategy Species	Determine presence, distribution or population status of species; demographic information	Direct surveys of populations or species of interest. Alternatively, link to indicator species	Work with ongoing species monitoring efforts (detailed below)
Indicator species	Strategy Species often are not appropriate as indicator species because they are generally not relatively common and often require specialized habitat.	To be a good indicator, a species needs to be relatively common, occur frequently enough to be monitored and respond to certain actions or represent a desired condition.	The Fish and Wildlife Monitoring Team will work with ongoing programs and evaluate the successes and failures of similar efforts in the past to: develop criteria identify, evaluate, and link indicator species to Strategy Species and Habitats.
Strategy Habitats	Assess habitat conditions over time. Ask: How much habitat is there? Where is it? What is its ecological condition? What is its conservation status?	Direct land use/land cover measurements. Or, link to indicator species	Work with state agency partners. Oregon State University's Institute for Natural Resources will track long term habitat status and trends at a statewide level. Oregon Progress Board recently adopted benchmark to measure the amount and distribution of natural habitats in Oregon's ecoregions.
Aquatic and Watershed Monitoring	Helps ensure good water quality and healthy watersheds; essential for many species and ecological functions	Monitoring the status of aquatic habitats presents unique challenges (i.e., difficult to map). In the Conservation Strategy, aquatic habitat will be expressed in area for some wetland habitat, and stream reach or stream miles for others.	Work with agency partners and ongoing efforts (see Table). Example metric: Indices of biotic integrity (IBIs) combine information from many structural, compositional, and functional parameters and facilitate quantitative comparison of different settings.
Ecological Function	Taken together, habitats and species provide valuable ecological functions. Monitoring ecological function can provide a more efficient and direct measure of impacts than monitoring individual species or habitats.	Measures of hydrology (e.g., channel morphology; flood-plain presence and connectivity; wetland function); physical indicators (e.g., riparian condition; stream connectivity); and water quality (e.g., dissolved oxygen or nutrient levels).	Work with agency partners and ongoing efforts (see Table below).
Limiting Factors	Measuring limiting factors, or statewide conservation issues, at the ecoregional level provides context for conservation priorities both within and across ecoregions.	Measures of hydrology (e.g., channel morphology; flood-plain presence and connectivity; wetland function); physical indicators (e.g., riparian condition; stream connectivity); and water quality (e.g., dissolved oxygen or nutrient levels). Quantify, categorize and graph limiting factors so that they can be presented visually and compared among ecoregions	Link to Oregon benchmarks and other ongoing programs

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What is monitored?	Why?	How is it done?	What are ways to work with current efforts?
Indicators	Represent valued ecological attributes and can help determine if an impact exists	National Research Council (2000) identified several example indicators: extent and status of ecosystems; ecosystem function and performance	Work with agency partners and ongoing efforts. For example, the Oregon Department of Forestry is engaged in a process to identify indicators that could be used to provide information on the status of native plants and animals on forest lands.
Effectiveness Monitoring	Evaluate the outcomes of conservation actions, or the effects of limiting factors, or to assess progress or status relative to some desired condition.  Integral to Adaptive Management.	Measure resource condition before and after change (e.g., management action; conservation action)	Develop registry of conservation actions. Work with ongoing efforts (see Table below). For example: several programs use birds to monitor effectiveness. The USFWS PECE process is another example of an effort to ensure effectiveness of conservation actions.

### **Current Major Efforts, Gaps, and Priorities**

In addressing monitoring, the goal of the Conservation Strategy is to identify key gaps and priorities after considering ongoing efforts. Recognizing that species, habitats and ecological function are interrelated, both Effectiveness and Status Monitoring for Strategy Species and Habitats and ecological function are considered.

Efforts, gaps and priorities occur at various scales and levels of details. For example, many broad topics such as short-and long-term monitoring, single and multiple-species monitoring, the seasonality of monitoring, and monitoring objectives (inventory, abundance, density, demographics, trend, response to management, etc.) will have their own set of efforts, gaps, and priorities. For the Conservation Strategy, broad, multi-site or multi-partner efforts, major gaps, and highest priorities for the next 5-10 years are emphasized.

### **Strategy Habitats, Limiting Factors, and Ecologic Function**

#### **(a) Effectiveness monitoring:**

Example Efforts	Gaps and Issues	Priorities
<ul style="list-style-type: none"> <li>■ Oregon Plan and OWEB monitoring team: review of riparian restoration projects</li> <li>■ Pacific Northwest Aquatic Monitoring Partnership (PNAMP)</li> <li>■ Oregon Biodiversity Project</li> <li>■ Oak restoration monitoring and information sharing</li> <li>■ NW Forest Plan monitors late successional conifer habitats and associated species</li> <li>■ Water quality: <ul style="list-style-type: none"> <li>○ IBI (fish, invertebrates)</li> <li>○ National Water Quality Assessment Program (Willamette and Sandy River basins; urbanization, agriculture, mercury impacts; nationwide rollout)- Section 401 certification monitoring- NPDES permitting for discharges</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>■ Effectiveness of conservation actions recommended for most Strategy Habitats.</li> <li>■ Most Strategy Habitats are currently not being monitored.</li> <li>■ Use of historical data on habitats can be hindered by differences in remote sensing methodology used</li> <li>■ Need way to changes in habitat quality over time (e.g., percent native plants, structure), not just aerial extent of habitat.</li> <li>■ Oregon Plan identified gaps: more eastside work; more on estuaries, large rivers and oceans; more knowledge to link trends to recovery</li> </ul>	<ul style="list-style-type: none"> <li>■ Create new or expand existing centralized database to track projects, including methods and lessons learned.</li> <li>■ Collect baseline condition on condition of Strategy Habitats and monitor change over time.</li> <li>■ Compile summary of effective indicators (biotic and abiotic; one is being developed by USFS).</li> <li>■ Monitor Strategy Habitats at landscape level to determine changes in extent, patch size and fragmentation/connectivity.</li> <li>■ Monitor select Strategy Habitat sites within Conservation Opportunity Areas to evaluate habitat quality.</li> <li>■ Oregon Plan identified challenges: stable funding; interagency coordination; effectiveness monitoring.</li> <li>■ Maintenance and monitoring of focal points for biodiversity conservation</li> </ul>

**(b) Status monitoring:**

Example Efforts	Gaps and Issues	Priorities
<ul style="list-style-type: none"> <li>■ Oregon Benchmarks</li> <li>■ Oregon Plan: OWEB monitoring team; salmon populations and watershed health</li> <li>■ Pacific Northwest Aquatic Monitoring Partnership (PNAMP)</li> <li>■ State of Oregon Riparian Restoration and Management Policy (OWEB, DLCD)</li> <li>■ State of Oregon freshwater wetlands assessment (DSL)</li> <li>■ Water quality:                             <ul style="list-style-type: none"> <li>○ Watershed Councils' Citizen-based water quality monitoring (OWEB)</li> <li>○ TMDLs (develop and implement 2004-2010) (ODEQ)</li> <li>○ Agricultural Water Quality Plans (ODA)</li> <li>○ City of Portland models used to assess watershed health</li> </ul> </li> <li>■ Climate</li> <li>■ Fire frequency and severity (historic and current)</li> <li>■ Oregon Gap Analysis Project</li> <li>■ Environmental Monitoring and Assessment Program</li> <li>■ State and local aerial photography and data</li> <li>■ National Land Cover data sources:                             <ul style="list-style-type: none"> <li>○ National Land Cover Data</li> <li>○ Regional Vulnerability Analysis</li> <li>○ EROS Data Center</li> <li>○ North American Landscape Characterization</li> <li>○ Global Land Cover Characterization</li> <li>○ Forest Inventory and Analysis</li> <li>○ Landscape Analysis and Assessment</li> <li>○ National Resource Inventory</li> </ul> </li> </ul>	<p>Include and consider:</p> <ul style="list-style-type: none"> <li>■ Changes in land use and land cover over time (e.g., urbanization rates).</li> <li>■ Spread rates for key invasive species.</li> <li>■ Ecologic processes such as hydrologic function and biological interactions (e.g., competition, mutualism, predator-prey relationships).</li> <li>■ Need effective biotic indices that incorporate several measures of ecologic integrity.</li> <li>■ Identifying trends in habitat status will require repeated observations</li> </ul>	<ul style="list-style-type: none"> <li>■ Monitor priority limiting factors such as invasive species to determine status (i.e., increasing or decreasing?).</li> <li>■ Develop scorecard to evaluate magnitude of issues.</li> <li>■ Develop approach to show changes in habitat at fine spatial (less than 30 meters) and temporal (annual) scales. Satellite imagery currently useful for coarse-scale changes in vegetation, development and disturbance.</li> <li>■ Consider more frequent satellite imagery, balancing additional costs for higher resolution and/or increased frequency</li> <li>■ Consider working with USGS to enhance National Land Cover to include additional categories for natural landscapes</li> <li>■ Work with Progress Board to implement new natural habitat benchmark</li> <li>■ Evaluate Oregon Benchmarks to determine if additional benchmarks are needed to address Conservation Strategy goals.</li> <li>■ Develop and test biotic indices for Strategy Habitats (e.g., The Nature Conservancy's Measures of Success program).</li> <li>■ Implementing effectiveness monitoring is a continual challenge facing state water quality plans</li> </ul>

**Strategy Species (and other important species monitoring efforts)****(a) Effectiveness monitoring:**

Example Efforts	Gaps and Issues	Priorities
<ul style="list-style-type: none"> <li>■ Demonstration of Ecosystem Management Options (DEMO) – multi-taxa</li> <li>■ Pacific Northwest Aquatic Monitoring Partnership (PNAMP)</li> <li>■ Effects of fuels reduction on birds in southwest Oregon (Klamath Bird Observatory).</li> <li>■ Effects of forest management practices on headwater amphibians</li> <li>■ Aquatic macroinvertebrate monitoring to indicate water quality</li> <li>■ Effects of conservation actions on rare plants (e.g., Nelson's sidalcea, pumice grape-fern, and Applegate's milk-vetch)</li> </ul>	<ul style="list-style-type: none"> <li>■ Identification and validation of the most representative parameters to monitor when implementing conservation actions in Strategy Habitats.</li> <li>■ Limited use of effectiveness monitoring on private lands where government funds are being used to conduct management and/or restoration activities.</li> </ul>	<ul style="list-style-type: none"> <li>■ Develop relationships between and among species and their habitats (OSU INR; NatureServe; Universities; NCASI; Weyerhaeuser; other partners).</li> <li>■ Support effectiveness monitoring efforts in Strategy Habitats and to benefit Strategy Species that address priority conservation issues.</li> <li>■ Use existing conservation plans and efforts to determine priority actions.</li> <li>■ Develop tools such as scoring system for species' traits that make them susceptible to limiting factors (e.g., scoring system for variable amphibian species' traits that could make them sensitive to climate change).</li> <li>■ Work with private landowners to develop and implement effectiveness monitoring where government funds are being used for conservation actions.</li> </ul>

**(b) Status monitoring:**

Example Efforts	Gaps and Issues	Priorities
<ul style="list-style-type: none"> <li>■ Oregon Bat Grid</li> <li>■ Pacific Northwest Aquatic Monitoring Partnership (PNAMP)</li> <li>■ Forest Carnivore Monitoring</li> <li>■ Deer and elk herd composition and population trends</li> <li>■ Game mammal, furbearer, and gamebird harvest</li> <li>■ Landbird Migration Monitoring Network of the Americas (LaMMNA) (landbird migration monitoring improvements; coordination; data management)</li> <li>■ The North American Breeding Bird Survey</li> <li>■ Christmas Bird Counts</li> <li>■ Bonney Butte Hawk Migration count</li> <li>■ Spring and Fall migration day counts</li> <li>■ Midwinter Aerial Waterfowl Survey</li> <li>■ MAPS (Monitoring Avian Productivity and Survivorship)</li> <li>■ Regional colony counts for Common Murres and Brandt's and Double-crested Cormorants via aerial photography</li> </ul>	<ul style="list-style-type: none"> <li>■ The following taxa are poorly monitored: invertebrates, amphibians, reptiles, and some birds (e.g., waterbirds and shorebirds). Protocols and programs are needed for long-term monitoring for these taxa.</li> <li>■ Difficult to monitor Oregon frogs using calls, a protocol favored in some nationwide amphibian monitoring efforts</li> <li>■ Knowledge of the level of effort sufficient for long-term monitoring (e.g., annual vs. every 3 years).</li> <li>■ MAPS in oak and riparian habitats.</li> <li>■ There are numerous gaps in the types and degree of monitoring needed to guide conservation actions to benefit Strategy Species. These are presented in the Strategy Species tables in the ecoregional chapters.</li> <li>■ Federal funding is declining for T&amp;E monitoring, especially for plants, which affects cost sharing and ability to monitor.</li> </ul>	<ul style="list-style-type: none"> <li>■ Support development of a coordinated bird monitoring program within Oregon and between Oregon and regional/continental levels.</li> <li>■ Support the coverage of BBS routes with qualified participants (e.g., staff time, outreach, incentives).</li> <li>■ Enhance BBS program for bird conservation (e.g., habitat relationships, methods to reduce bias, population estimates and objectives).</li> <li>■ Support data collection efforts that contribute to quantitative habitat and population objectives (e.g., bird densities, demographics, landscape analyses)</li> <li>■ Determine causal factors in population changes (e.g., vital rates).</li> <li>■ Develop and implement monitoring programs for bird species poorly monitored by existing programs, both within Oregon and for migratory and wintering birds that breed outside Oregon (e.g., migration monitoring).</li> </ul>

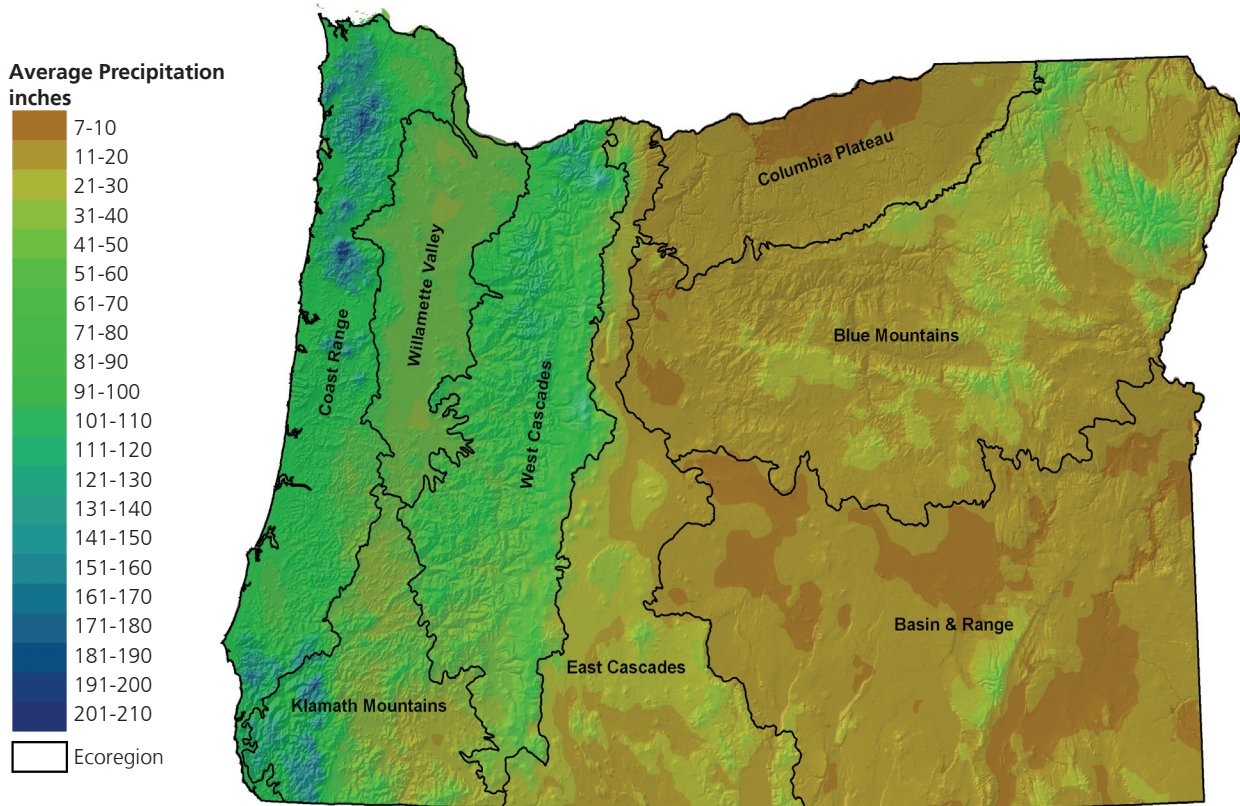
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**(b) Status monitoring: (Continued)**

Example Efforts	Gaps and Issues	Priorities
<p><i>(continued)</i></p> <ul style="list-style-type: none"> <li>■ Valentine’s Day Herp Count</li> <li>■ Fourth of July Butterfly Count</li> <li>■ Dragonfly Migration Monitoring</li> <li>■ Oregon Flora and Atlas Project</li> <li>■ Forest Service monitoring</li> <li>■ Threatened and endangered species monitoring (e.g., bald eagles, spotted owl, marbled murrelet, Fender’s blue butterfly, Kincaid’s lupine, etc.)</li> <li>■ ODFW Native Fish Conservation Plan</li> <li>■ Leach’s Storm Petrel productivity and burrow counts (USFWS)</li> <li>■ White-headed Woodpecker reproduction and survival</li> <li>■ American peregrine falcon surveys</li> <li>■ Northern goshawk population trends (USFS)</li> <li>■ Terrestrial salamander monitoring (citizen-based national effort)</li> <li>■ Greater sage-grouse (SageMAP)</li> <li>■ USGS Amphibian Monitoring Initiative: spotted frog, western toad, Cascades frog, yellow-legged frog (distribution and/or breeding success).</li> </ul>	<p>(see previous page)</p>	<p><i>(continued)</i></p> <ul style="list-style-type: none"> <li>■ Identify population linkages of migratory bird between Oregon populations and their critical life history stages outside Oregon.</li> <li>■ Track population and habitat changes in alpine habitats to evaluate potential effects of climate change.</li> <li>■ Evaluate success of conservation programs (e.g., LIP, CRP) to provide appropriate conservation values for bird species and habitats.</li> <li>■ Support the MAPS program in appropriate Strategy Habitats not already well-covered in the program (e.g., oak, riparian)</li> <li>■ Support the BBIRD program (i.e., nest monitoring) for Strategy Species and/or in Strategy Habitats and also where opportunities exist to verify reproductive indices with MAPS.</li> <li>■ Inventory and catalogue important sites for colonial nesting birds.</li> <li>■ Develop and implement monitoring protocols for reptiles and amphibians</li> <li>■ Produce products to provide technical guidance for citizen scientists (e.g., OWEB Water Quality Monitoring Guidebook)</li> <li>■ Use current efforts and methods to evaluate species status over time (e.g., NatureServe’s ranking system).</li> <li>■ Determine Strategy Species status and relationships to natural and human-created factors over landscapes.</li> <li>■ Assess demographic parameters (e.g., productivity, recruitment, survivorship) significant to Strategy Species at appropriate scales.</li> <li>■ Establish species range benchmarks for Strategy Species. Track changes in distributions over time.</li> </ul>

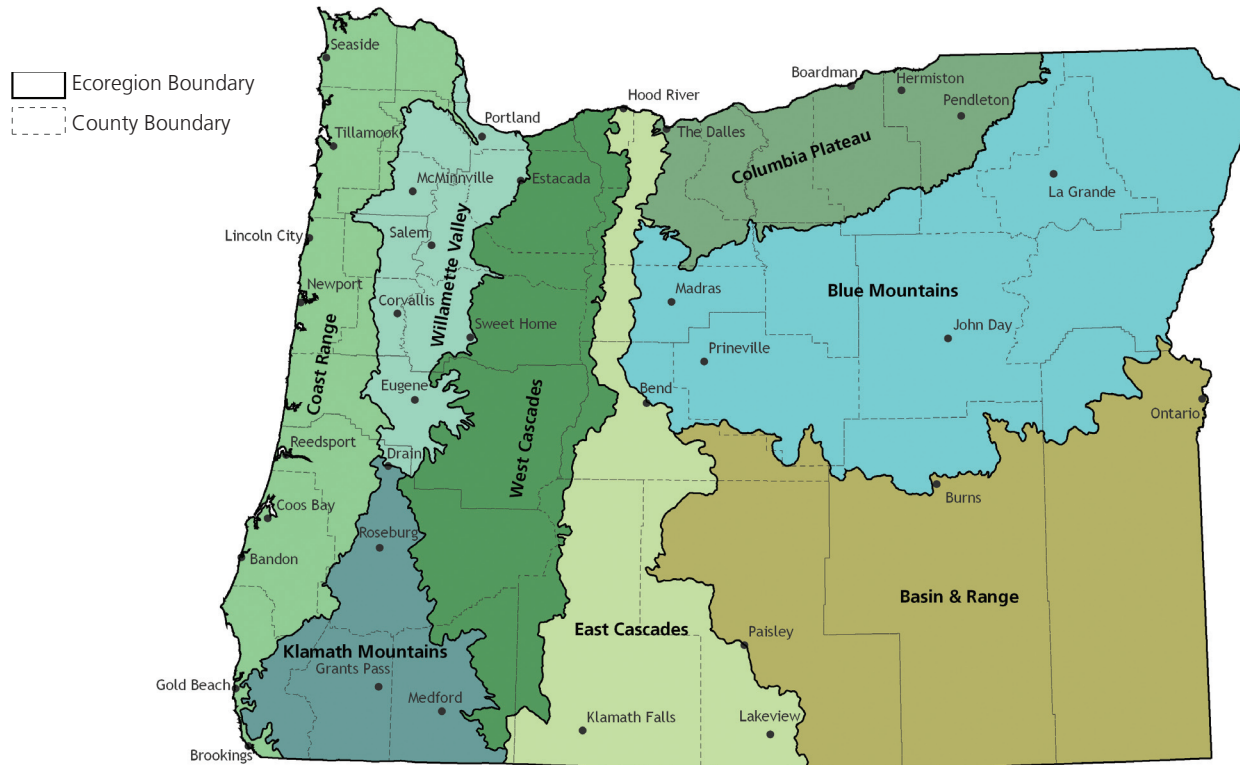


### Oregon Average Annual Precipitation



Data Source: Oregon State University Spatial Climate Analysis Service

### Ecoregions of Oregon



Data Source: U.S. Environmental Protection Agency