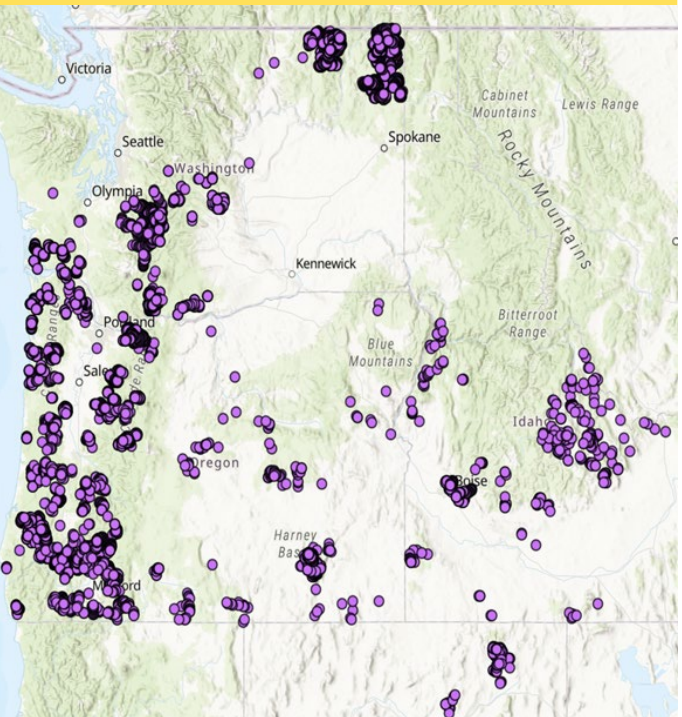
USDA Forest Service
U.S. DEPARTMENT OF AGRICULTURE
PACIFIC NORTHWEST RESEARCH STATION | DECEMBER 2022

Predicting and Documenting Dry Streams in Forests Across Western Oregon



Building upon an innovative method for collecting streamflow data into a centralized database, USDA Forest Service, U.S. Geological Survey (USGS), and USDI Bureau of Land Management (BLM) researchers and land managers have developed a new model for predicting surface water presence.

The **Western Oregon WeT DRy (WOWTDR)** model predicts flow permanence in stream reaches using data collected via the recently developed **FLOw PERmanence (FLOwPER)** mobile application.

A Centralized Database for Streamflow Observations

Streamflow fluctuates over time depending on snowmelt, precipitation, watershed characteristics, and other factors. Understanding flow permanence, and where streams maintain surface flow year-round, is important to forest management. For example, the presence of year-round surface flow determines the size of riparian management areas required by the Northwest Forest Plan, the Oregon Forest Practices Act, and best management practices.

The variability of surface streamflow over space and time complicates decisionmaking for resource managers who implement these policies and practices. The challenge is often exacerbated by scarce data for streamflow conditions or status. In many locations, data do not exist, particularly in the headwaters of stream networks; or the data may have been collected and lost.

A centralized database where field observations across ownerships can be archived and are easily accessed by multiple parties improves our current understanding of water availability. It also serves as a source of information for evaluating changes in surface flow over time into the future.

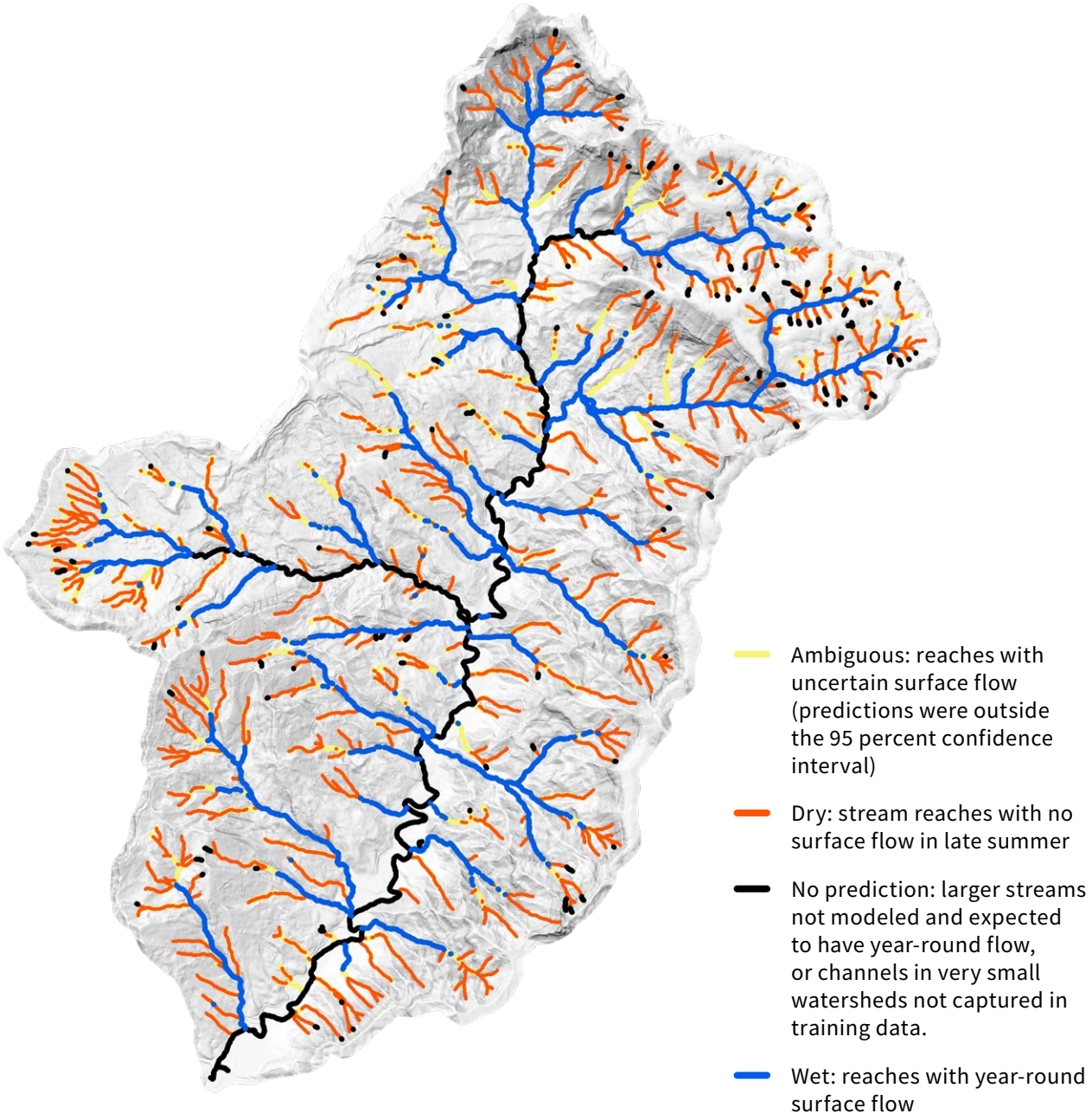
← Figure 1—Snapshot of FLOw PERmanence (FLOwPER) Database: More than 9,000 late summer streamflow observations (circles) in the Western United States have been collected and databased with the FLOwPER application as of September 2022.

Researchers from the USDA Forest Service, Pacific Northwest (PNW) Research Station (Jonathan Burnett, Sherri Johnson, and Steven Wondzell) and USGS (Jason Dunham and Kristin Jaeger) teamed up with BLM and USDA Forest Service, Pacific Northwest Region managers to meet these needs. The resulting mobile app, FLOwPER, enables to users to collect data on surface flow and upload to a centralized database. The app has made collecting and archiving the presence or absence of surface water in small streams broadly available to diverse users and stakeholders for multiple uses, including forest planning.

Now, the researchers have used these data to develop the WOWTDR model, which predicts flow permanence broadly beyond the locations of data collection. The ability to go from individual points to spatially continuous predictions throughout entire headwater stream networks is critical to the work of resource managers and applied scientists who must work across large landscapes and develop plans quickly and efficiently.

Working with the FLOwPER App

The FLOwPER app increases the efficiency of collecting and organizing field observations of streamflow status by providing a flexible (Android and iOS) mobile GIS platform for standardizing the process and leveraging the advantages of cloud geodatabase technology to consolidate and share data. Designed for use by federal, state, tribal, and private forest resource managers and researchers in western Oregon, FLOwPER is increasingly being used in a variety



↑ Figure 2—Western Oregon WeT DRy (WOWTDR) predictions: Example map of flow status predictions for an Oregon subwatershed using the Western Oregon WeT DRy model. These are available for hundreds of subwatersheds around western Oregon with hundreds more being added in mid-2023.

of biomes across the Western United States. The database currently contains more than 9,000 unique flow observations collected to document current conditions, inform planning projects, and strategize for future climates across state, tribal, federal, private, public, NGO, and university lands (fig. 1).

Using FLOwPER Data in the Western Oregon Wet Dry (WOWTDR) Model

WOWTDR model predictions provide a region-wide view of late summer streamflow status at a very fine scale, which is useful for informing forest planning at multiple scales, including decisions involving the retention and size of forested buffers along streams. The WOWTDR model predicts the probability of late summer surface flow using empirical, machine learning algorithms. The model uses streamflow data collected with the FLOwPER app and high-resolution digital topographic information (LiDAR technology) and comprehensive climate data (PRISM) to predict the flow status of spatially continuous, individual stream reaches (fig. 2). It also provides the model uncertainty for these predictions, which is helpful for informing management strategies, field validation efforts, and areas that would benefit from additional data.

Together, these tools empower resource managers, planners, and partners to collectively answer critical questions about late summer streamflow status by providing highly usable, standardized, and updated data. Simply stated, this approach affirms the adage that many hands make light work.

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USDI Bureau of Land Management Coos Bay, Medford, Roseburg, and Northwest Oregon Districts

Portland Water Bureau

Oregon State University Aerial Information Systems Laboratory

Key Links

- FLOwPER Mobile App
  - FLOwPER Quick Guide pdf
  - FLOwPER Detailed Users Guide pdf
- Publicly accessible FLOwPER stream data
- Informational FLOwPER flyer (811 KB)
- WOWTDR map of wet-dry status for streams, Dashboard (Beta version)
- USDA Forest Service and USGS Web pages with more details

SCAN ME
bit.ly/FS-FLOWPER

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