



Air, Water and Aquatic Environments Science Program

Rocky Mountain Research Station



Water Resources Availability Trends & History

Research

Technology Transfer

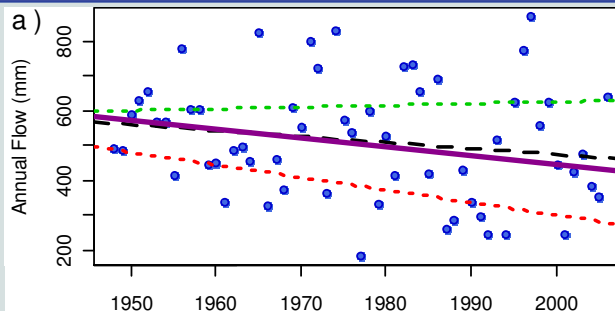
Science Application

Key Findings:

- Dry years are getting drastically drier throughout the Pacific Northwest.
- Average annual flows are also declining.
- Shifts in timing can be accounted for by these precipitation driven shifts.
- Changes of this nature and magnitude are more likely drivers for vegetation change in much of northern Rockies than simple shift in timing.
- Linkages look more like a trend on top of ENSO driven variability than simple PDO correlation.

Challenge

Climate change is altering the flow of water through forest and stream ecosystems throughout the west. Understanding the nature of those changes is critical to being able to adapt to them.



Context

A large body of research has suggested that the timing of western runoff is changing, but that the water balance (how much water is available) is not. There is an increasing recognition of the severe consequences should trends exist (e.g. Colorado River), but no documentation of significant trends. Ecological research has focused on the effects of timing changes and more recently on changes in potential transpiration.

Results

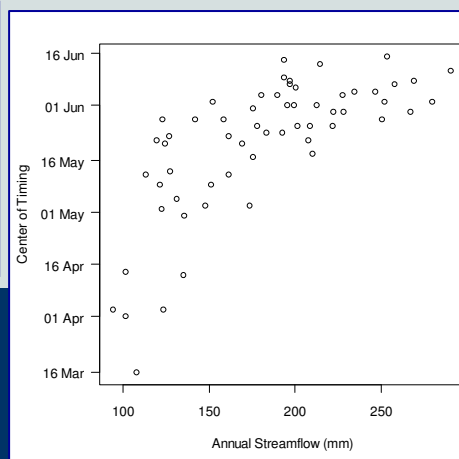
Using quantile regression to examine the non-stationary distribution of streamflow in the Pacific Northwest, we found a wide-spread strong trend of drier dry years. Declines in dry-year flows ranged from 10% to 50%. We further noted a strong correlation between summer low flows and annual flow, meaning that these declines affected the driest conditions. Evaluation against natural cycles and trends suggests that the trend does not result from low-frequency variability, driven by the Pacific Decadal-scale oscillation. Declines in the lowest quartile can explain statistically significant timing changes without temperature changes.



Castle Rock Fire

So What?

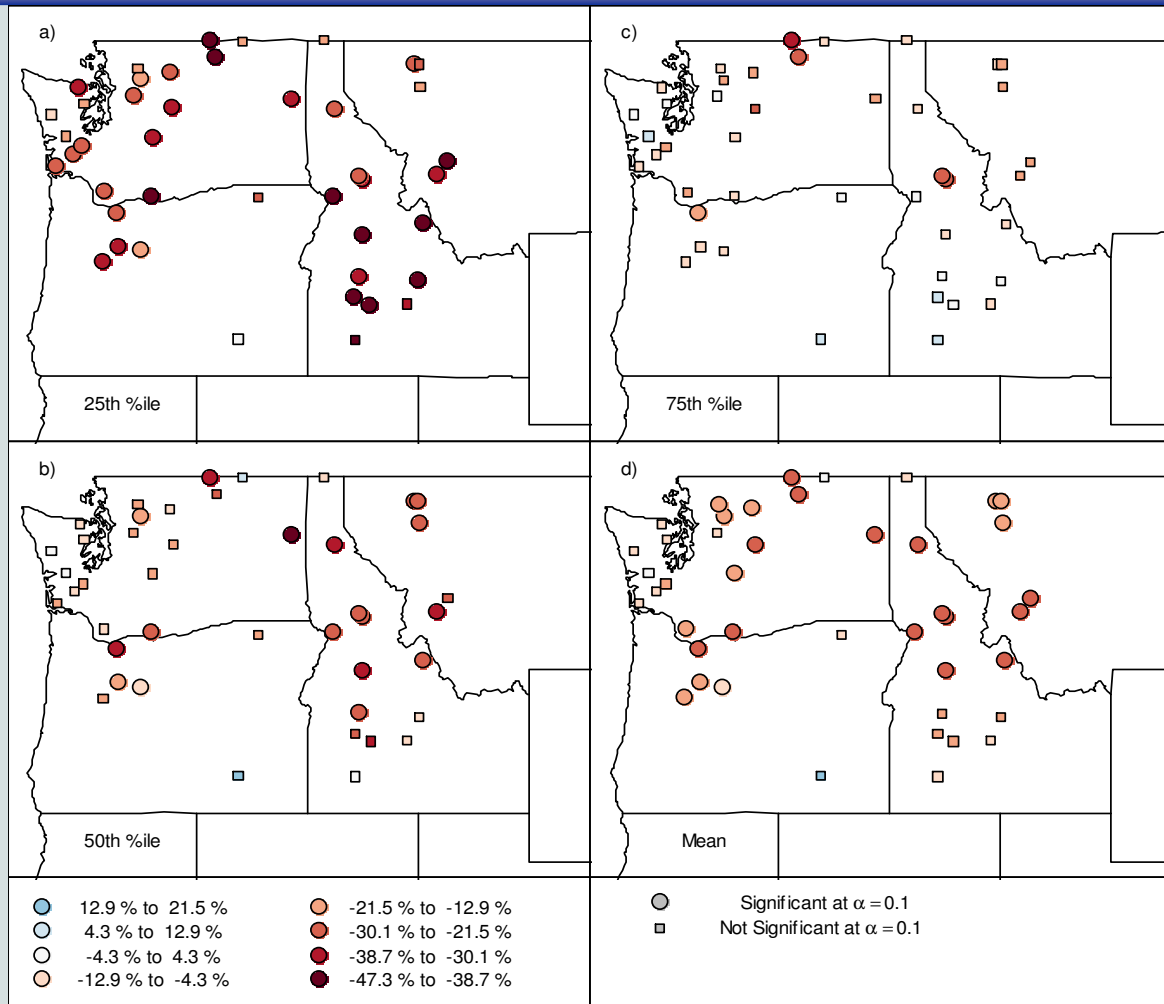
Dry years are limiting ecologically and limiting for water managers. Declines in the availability of water in dry years could contribute significantly to fire extent and severity trends, for example. Adaptations for water management aimed at correcting timing issues could be detrimental if those timing effects are driven by a decline in flows.



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Trends in Streamflow: 1948-2006



Related Publications

Luce, C. H., and Z. A. Holden (2009), [Declining annual streamflow distributions in the Pacific Northwest United States, 1948-2006](https://doi.org/10.1029/2009GL039407), *Geophys. Res. Lett.*, 36, L16401, doi:10.1029/2009GL039407.

Related News Articles

Charles Luce, Hydrologist, and Ecologist Zack Holden. "[New study shows river runoff decreases in driest years in Oregon, Northwest.](#)" *Declining annual streamflow distributions in the Pacific Northwest United States, 1948-2006* (2009): n. pag. Web. 17 Sep 2009.

Project Science Team



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