The Salmonid Population Viability Project

A system to forecast the demographic and genetic viability of Salmonid fish across broad regions under climate change















Research Team

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- □ US Fish & Wildlife Service: Doug Peterson



Stakeholder Groups

- **Trout Unlimited**
- U.S. Forest Service
- U.S. Fish and Wildlife Service
- Bureau of Land Management Utah Dept. of Natural
- Nevada Dept. of Wildlife
- California Dept. of Fish and Wildlife
- Oregon Dept. of Fish and Wildlife

- Montana Fish and Wildlife and Parks
- Seattle City Light

Resources

Private Land Owners

Meeting with Stakeholders April 2016, Reno, NV



ST-PVM & CDMetaPop

Spatio-Temporal Population Viability Model (ST-PVM)

- Demographic population viability assessment
 for multiple isolated populations simultaneously
 - Data-rich populations inform management for data-poor populations

CDMetaPOP

- Demo-genetic population viability assessment for metapopulations
 - Individual-based simulations of fish movement and population genetics



The Motivation for ST-PVM: Improved Conservation Planning

- Value added to existing data
- How healthy is each population?
- Which would benefit most from management actions?
- Where/how would reintroductions be most beneficial?





ST-PVM: Lahontan Cutthroat Trout

Ideal for ST-PVM development:

- Small, isolated populations
- Intensively sampled (lots of data)
- Conservation priority
- Stakeholder cooperation





ST-PVM: A Bayesian Hierarchical Model

Observation Model

Sampling Model

Process Model



ST-PVM: Observation Model



ST-PVM: Observation Model





ST-PVM: Sampling Model



Crowdsourcing desiccation data

- Desiccation is difficult to predict
- Observation data are limited
- App for crowd-sourcing data from backcountry hikers

(iNaturalist platform)





ST-PVM: Process Model



ST-PVM: Process Model



- Stream Temperature
- High Flow Magnitude
- Low Flow Magnitude
- Severe floods
- Wildfires

- Population Extent
- Brook Trout Density
- Low Flow Magnitude
- NDVI



ST-PVM Covariates: Stream Temperature



ST-PVM Covariates: Hydrology











NOAA's National Weather Service

Cooperative Observer Program

ST-PVM Covariates: Brook Trout Density

Observation Model

Sampling Model

Process Model



Year



ST-PVM Covariates: Riparian Vegetation

Normalized Difference Vegetation Index (NDVI) Normalized Difference Water Index (NDWI)







ST-PVM Covariates: Wildfires



Proportion of drainage burned each year









Covariate Effects on Population Parameters





ST-PVM: Process Model



ST-PVM: Forecasting



Google Earth Interactive Map





Reintroduction Scenarios

Introduce 10 fish

Introduce 10 fish 3 years in a row



Brook Trout Management Scenarios

Observed BKT Densities

Simulated BKT Removal





Brook Trout Management Scenarios

Observed BKT Densities

Simulated BKT Increase





Metapop Reconnection Scenarios







Metapop Reconnection Scenarios







Going forward

Ongoing model development

- New covariates, new fish data, alternate model structures, etc.
- Apply to new species
- Simulate effects of changing climates
- □ Hand-off to partners (state management agencies)
 - Fish database
 - STPVM model
 - Management scenario simulation tool
- Remaining hurdle:

How will managers collect data for covariates at new sites? e.g. Average NDVI in upstream riparian zone



GeodataCrawler.com

A Centralized National Geodatabase & Automated Multi-scale Data Crawler



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