Connecting Communities Through Data, Visualizations & Decisions
Visualization for Terrestrial and Aquatic Systems (VISTAS)
http://blogs.evergreen.edu/vistas

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The *VISualization of Terrestrial and Aquatic Systems* (VISTAS) team, an NSF/BIO/ABI-funded collaboration among environmental-, computer-, and social-scientists, has integrated new technologies and computer science research into terrain visualization software for environmental scientists. The system allows scientists to overlay 2D data onto 3D elevation maps to emphasize landscape topography and better understand how terrain affects ecological processes. VISTAS also provides animations over time, fly-throughs, and analytics. Visualizing natural phenomena with VISTAS helps scientists build better models and formulate hypotheses for remote sensing and model data. The VISTAS team is now developing visualizations to better explore time-series and to exploit machine learning to categorize, explore, and analyze. Our collaborators use VISTAS visualizations both to improve their own understanding of natural phenomena and to help explain results to decision makers—in particular how questions under study impact stakeholders and the broader community.

This NSF/CISE/CPS project **Connecting Communities Through Data, Visualizations, and Decisions** brings together computer and social scientists with ecologists and environmental scientists who work with decision makers on problems such as climate change impacts and land use change. Our collaborators increasingly work *with decision makers and stakeholders to jointly produce information for later use in decisions*—in knowledge co-production. We use social science methods to study how software developers, environmental scientists, and decision makers create new technology (in particular visualization) to co-develop models to explore the complex problems in the local context. To that end, we partner with three projects that work with stakeholders: 1) climate change impacts at the local level (P. Ruggiero with OSU/ENVISION), 2) salmon recovery on Native Lands (Squaxin Island Tribes), 3) vegetation changes in the Great Basin (Bachelet with OSU/BLM). We aim to address our collaborators' expanding needs for easy-to-produce and effective visual analytics of large complex data sets. Our primary research questions include:

1. Climate change is a critical problem facing Earth; what tools can best understand and communicate impacts?
2. How do negotiations between user needs and technological capacity shape the type of tools developed and implemented?
3. How do tools impact scientific results and community responses to critical ecological challenges?

We utilize a comparative pre/post-test case study design to measure the impacts of project involvement on participants. In our research, we find that visualizations are critical for communicating and understanding information for scientists and stakeholders. This is particularly important for displaying topographic (3D) information. Co-production between environmental scientists and software developers is a viable (and recommended) way to produce visualizations with participants having increased confidence in the information after it was visualized. This has general implications to areas where confidence in scientific information is low. Project collaborators report that VISTAS is significantly easier to use and faster than other software that performs similar visualization functions. As collaborators have become more comfortable with visualization tools and processes, their requests to software developers are increasingly sophisticated, over time becoming true co-developers.