

Research Update

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Bottom Line

This research project links models of riparian vegetation growth to hydrology and hydraulic models of river systems.

Better, Faster, Cheaper

Riparian vegetation is essential to the success of Reclamation's river restoration programs. River restoration projects use large volumes of water and modify large tracts of land to promote or manage riparian vegetation. Reclamation is developing tools to allocate water more efficiently and improve design projects that manage riparian vegetation.

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Riparian Vegetation: Reclamation's Ally in River Restoration

Developing tools to improve riparian vegetation management

Problem

Reclamation is responsible for implementing several large-scale river restoration programs and projects throughout the Western United States. These include the San Joaquin River Restoration Program, Central Valley Project Improvement Act, Trinity River Restoration Program, and the Middle Rio Grande Endangered Species Collaborative Program. In all of these basins, a healthy riparian corridor is critical to habitat sustainability. In all of these restoration programs, there are large reservoirs that regulate flows and there is the ability to affect the recruitment, growth, and survival of riparian species. Climate variability will potentially create additional stress on native species within the riparian corridor, thus putting additional stress on the habitat. On some regulated rivers, however, reservoir releases could be managed to protect riparian ecosystem.

This Reclamation Science and Technology Program research project sought to answer the following questions:

- What set of reservoir operations can be used to encourage successful native vegetation recruitment and survival under projected climate changes?
- Can reservoir operations be used to control other potential indirect effects, such as invasive species?

Solution

The Sedimentation and River Hydraulics Group in Reclamation's Technical Service Center developed a dynamic tool called SRH-1DV, which quantifies ecologic change in response to geomorphic change by simulating vegetation adjustments to altered flow regimes, sediment regimes, groundwater, and terrain. This tool was built upon the SRH-1D model, which is a mobile bed sediment transport model. Investigating the impacts from the rapid spread of an invading riparian species is also possible with this platform. Representation of vegetation is based on the vegetation continuum that ascribes plant species distribution to individualized species response to the environment. A unique set of responses and coping mechanisms define the zone of coverage that is specific to each vegetation type, and zones may partially overlap and be shared between species. Terrain, flow, sediment, and groundwater conditions in a daily simulation can be linked to plant germination, growth, and mortality; including plant removal from desiccation, inundation, erosion, shade, competition, burial, and senescence.



Application and Results

Three different applications of SRH-1DV are documented in separate reports. The model applications were performed on the Sacramento, San Joaquin, and Trinity Rivers in California, which are all part of large restoration programs: Central Valley Project Improvement Act, San Joaquin River Restoration Program, and Trinity River Restoration Program, respectively. All three rivers have large Reclamation reservoirs on them that, to some extent, regulate the flow in the river. Riparian vegetation plays a critical role in all three of these restoration programs, as it is critical to the sustainability of habitat along the river corridors. These rivers were chosen for model application because there was large-scale riparian vegetation mapping (separated by approximately a decade) that could be used to evaluate model performance.

Numerical modeling can help identify distinctions between flow management alternatives by tracking the complex response of vegetation to geomorphic change. SRH-1DV applications also offer secondary benefits by enhancing Reclamation's understanding of complex processes and responses. Reclamation can include SRH-1DV simulations in project studies to assist managers in developing well-considered flow, sediment, and land actions for optimal environmental benefits.

Future Plans

Future research includes improvements and continued verification of plant growth mechanisms and parameter selections for SRH-1DV. It also includes developing a complementing two-dimensional vegetation model for more detailed assessment of local conditions.



Riparian vegetation along the Sacramento River just downstream from Red Bluff, California.

“Riparian vegetation is our primary ally in building successful river restoration projects. It never takes a day off.”

Blair Greimann
Hydraulic Engineer
Reclamation's Technical Service Center

Collaborators

U.S. Forest Service, Fort Collins, Colorado

More Information

www.usbr.gov/research/projects/detail.cfm?id=1596

www.usbr.gov/research/projects/researcher.cfm?id=128