Watershed Planning and Evaluation Tools[1]

Research Need

Watershed planning goes beyond project planning (for specific USACE projects) towards more comprehensive and strategic evaluations and analyses that include diverse political, geographic, physical, institutional, technical, and stakeholder considerations. Watershed planning addresses identified water resources needs from any source, regardless of agency responsibilities, and provides a joint vision of a desired end state that may include recommendations for potential involvement by USACE, other federal agencies, or non-federal interests.

In conducting watershed planning, USACE uses its planning capability in a broader sense, to meet the changing water resources needs of the nation. Ultimately, watershed assessments should inform multiple audiences and decision makers at all levels of government, and provide a strategic roadmap to inform future investment decisions by multiple agencies. A system-wide watershed planning tool that integrates water quantity, water quality, ecological data, and uncertainty with stakeholder values and regulatory requirements is needed to effectively evaluate and integrate watershed management alternatives to achieve multiple objectives.

Project Objectives & Plan

ERDC-EL, ERDC-CHL, IWR-HEC and others will develop software and tools for Watershed Assessment Teams, informing modeling of watersheds, rivers, and reservoirs and enabling more effective alternatives comparison and stakeholder communication. These tools will include:

- Serious Games to support Stakeholder Collaboration
- Satellite Data Tools to support Systems Analysis
- Weather Generator to support Systems Analysis
- Vulnerability Assessment Tools for Future Risks

Reference SON: *2016-ER-23 Watershed Planning and Evaluation Tools*

Lead PI: *Billy Johnson (ERDC), John Kucharski (ERDC)*

Project Development Team (PDT): *Matthew Bates (ERDC); Guillermo Mendoza, Jennifer Olszewski (IWR); Gregory Karlovits, William Lehman, Todd Steissberg (IWR-HEC); Bart Wickel (SEI), Patrick Ray (UC)*

District Collaborators: *Brian Skahill (CHL); Andrea Carson (IWR); Aaron Snyder (MVP); Jason Smith (MVR); Randall Goss (SAJ); Cindy Tejeda (SPD); Hunter Merritt, Rhiannon Kucharski (SPK); Eileen Takata (SPL)*

Other Partners: *CA DWR, Cornell University, University of Cincinnati, Deltares, Stockholm Environmental Institute and others*

Funded: *2016-2020*

Keywords: *Watershed planning, Climate change, Precipitation, Flow modeling*

Last updated: 09/23/2024

Pilot studies will be conducted in: South Pacific Division, Chesapeake Bay & CA Central Valley and Sacramento Watershed. A tabletop version of the Serious Games concept has been developed and demonstrated within USACE; the game concept is being refined as a Stakeholder communication tool enabling stakeholders with widely varying technical backgrounds to understand the tradeoffs of various project alternatives; a later interactive module is planned as a follow-on effort. The Satellite Data Time Series Animation Proof of Concept has been developed and will be applied to a concept case study; this tool will enable not only systems analysis but also effective stakeholder communication, by visually illustrating the spatial impacts of various watershed project alternatives.

An atmospheric module and a weather generator are under development that will exploit the connection between climate and weather, capturing the causal mechanism – the weather regime – and addressing certain deficiencies in current modeling capabilities, including:

- Disparity of resolution between catchment being modeled and general circulation models
- Lack of understanding of how drought influences flood, and vice versa
- Inability to model low flow events or reproduce long term drought events

Payoff

To date, limited effort has been put into developing multi-criteria decision frameworks to evaluate potential actions across a watershed. Thus, there is a need to develop a complement of system-wide watershed planning tools encompassed by this effort. This R&D will provide capabilities currently not available to the USACE planning community, increasing their ability to successfully assess projects on a watershed scale for multiple objectives, scenarios, and criteria, resulting in a more efficient planning process and greater optimization of management and restoration alternatives over a watershed scale.

Products

Technical Reports (TRs)

Cole, R.A. (2016). Case study application of the biodiversity security index to ranking feasibility studies for ecosystem restoration projects of the U. S. Army Corps of Engineers (ERDC/EL CR-16-1), Technical Report. US Army Engineer Research and Development Center, Vicksburg, Mississippi.

Kucharski et al. (In preparation). Flood risk management performance metrics in a systems based analysis with a case study using the Hydrologic Engineering Center Watershed Analysis Tool (HEC-WAT), Technical Report. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Kucharski et al. (In preparation). Vulnerability based risk mitigation and robust plan selection at the Iolanda Water Treatment Plant, Technical Report. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Maynard, E.E., Gardner, J.S., Price, D.L. and Fischenich, J.C. (In review). A retrospective investigation of Corps aquatic ecosystem restoration projects: data summary and analysis, Technical Report. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Olszewski and Kucharski (In preparation). Identifying critical storm durations for flood risk management systems based on maximum risk conditions, Technical Report. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Technical Notes (TNs)

Crawford, B.A., Katz, R.A. and McKay, S.K. (2017). Engaging stakeholders in natural resource decision-making (ERDC/TN EMRRP-SR-83), Technical Note. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

White Papers

Bureau of Reclamation and U.S. Army Engineer Research and Development Center, (2016). National large wood manual: assessment, planning, design, and maintenance of large wood in fluvial ecosystems: restoring process, function, and structure, White Paper.

Conference Presentations/Webinars/Workshops

(2017). Watershed planning and evaluation tools scoping workshop, Workshop. Davis, California.

(2017). Collaborative risk informed decision analysis training workshop, Workshop. USAID

(2018). Workshop on natural and nature-based flood risk management, Workshop. Asian Institute of Technology, Bangkok, Thailand.

Project Activities

Multi-agency coordination to identify needs of planners dealing with complicated watershed alternatives analysis and optimization, and stakeholder communication. Development of a cross section of tools pertaining to climate and water supply/flooding projections, use of time series satellite images for alternatives impacts visualization, and planning-oriented serious games stakeholder communication tools.

[1]Project Alias – Work Unit Documentation Title: *Watershed Planning and Evaluation Tools*