



**Reference SON:** 2016-ER-22:  
*Improving USACE Ecological  
Modeling Practices*

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## Improving Ecological Modeling Practices for the USACE Planning Community of Practice<sup>1</sup>

### Research Need

USACE decisions affect the environment across all business lines. Ecological models provide a means of quantifying decision outcomes. SMART Planning timelines require teams to rapidly develop and apply models in short horizons (often 18-24 months!). There is an urgent need to improve ecological modeling practice within the USACE Planning, Regulatory, and Operational Communities.

### Project Objectives & Plan

This research project seeks to improve ecological modeling practice and decision-making within these USACE communities. To accomplish this objective, we will provide a set of analytical tools for practitioners to apply, with guidance on best practices for ecological modeling. We will develop an ecological modeling platform that standardizes the application of index-based models (e.g., habitat models) for the USACE planning community of practice, that meets the guidelines set in EC 1105-2-412 (or subsequent policies). This model platform will be explicitly designed to meet the needs of the SMART planning paradigm by facilitating the development and application of models in a faster, more efficient manner, while maintaining scientific integrity and transparency throughout model development process. Additionally, this project will develop guidelines and training for ecological modeling for practitioners of ecosystem restoration, regulatory, and operations communities of practice.

Two sets of deliverables are the emphasis of this work unit. First, an ecological modeling toolkit will be provided to facilitate the development and application of index-based models, which will contain several quantitative tools to:

- Generate equations for index-based models,
- Integrate equations into overall suitability indices in an error-checked, consistent platform,
- Perform basic analyses for model evaluation, and
- Produce integrated documentation of model equations and relevant, user-defined comments and assumptions.

The second set of deliverables will provide a thorough set of ecological modeling best practices covering each step of the model development process (i.e., conceptualization, quantification, evaluation, and application) in a complement of technical notes, journal papers, webinars, training courses, and web resources, as requested by field practitioners.

## Payoff

This effort will result in a standardized methodology for developing and applying index-based models USACE-wide for applications in the ecosystem restoration, operations and, potentially, regulatory communities of practice. Standardizing the approach for index-based ecological modeling will be an advancement over current, ad-hoc approaches and will enable Corps managers and planners to more effectively and efficiently support USACE decision-making. The emphasis on modeling best practices will enhance agency capacity by providing repeatable processes and associated training in the development of ecological tools for a variety of purposes and applications.

## Products

### Book Chapters

McKay, S.K. (2018). Visualization as a tool for ecological analysis, In: Fath, B.D. (Ed.) *Encyclopedia of Ecology, Second Edition*. Elsevier, Cambridge, Massachusetts.

### Journal Articles (JAs)

Herman, B., McKay, K., Altman, S., Richards, N., Reif, M., Piercy, C., and Swannack, T. (2019). Unpacking the black box: demystifying ecological models through interactive workshops and hands-on learning. *Frontiers in Communication: Science and Environmental Communication* 7.

### Technical Notes (TNs)

McKay, S.K., Richards, N., Swannack, T.S. (2019). Aligning ecological model development with restoration project planning (ERDC/TN EMRRP-SR-89), Technical Note. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Carrillo, C.C., McKay, S.K., Altman, S., and Swannack, T.M. (2022). Ecological model development: toolkit for interactive modeling (TAM) (ERDC/TN EMRRP-SR-90), Technical Note. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

McKay, S.K., Richards, N., and Swannack, T.M. (2022). Ecological model development: evaluation of system quality (ERDC/TN EMRRP-EBA-26), Technical Note. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

### Conference Presentations/Webinars/Workshops

(2017). Mod Squad Workshop, ERDC Vicksburg. Organized by Dr. Pat Deliman, TD and Dr. Trudy Estes, PM for EMRRP. ERDC/IWR/HEC researchers met, along with Division, District and EcoPCX representatives, to discuss modeling related issues, including pros and cons of proprietary

platforms, how best to categorize and organize available models and their capabilities in a user friendly fashion, and identifying capability gaps and redundancies.

(2018). Empowering USACE Districts through collaborative ecological modeling, Presentation, USACE HQ, Washington, D.C.

(2018). Ecological modeling workshop with Fort Worth District - Cypress Valley watershed, development and certification of Toolkit for Interactive Modeling (TAM) prototype Excel model calculator, completed Blue Book model database.

## Models and Applications

Index-based model construction tool.

Model – Index-based model construction tool prototype development

Habitat Suitability GIS Tools – Spatial Toolkit

National Certification – Toolkit for Interactive Modeling (TAM). The ECO-PCX review team found the tool to have sufficient technical and system quality and to be compliant with USACE policies. The ECO-PCX Director has certified the toolkit for use by study teams nationwide. Any models developed in the future using the toolkit are subject to review and certification under EC 1105-2-412. The ECO-PCX and ERDC will announce the availability of the model development tool in an upcoming planning community newsletter and other publications across the Corps community.

<sup>1</sup>Project Alias – Work Unit Documentation Title: *Improving Ecological Modeling Practices for the USACE Planning Community of Practice*