



Reference SON: *2023-1937- Integrating ecological community and process-based perspectives to improve habitat suitability models for restoration planning*

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Project Development

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Other Partners: *USFWS, USGS, UMRR Program*

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Integrating Ecological Community and Process-based Perspectives to Improve Habitat Suitability Models for Restoration Planning

Research Need

This project will assess practical shortcomings of Habitat Suitability Models (HSI), Hydrogeomorphic Models (HGM), and other index-based analytical approaches for project analyses and will develop a framework to address identified shortcomings. USACE project habitat conditions span from terrestrial, aquatic, and wetland environments, but cross walking an assessment that addresses simultaneous functions of these environments have proven difficult. This has led to increasing interest of evaluating ecological-process and community level models for project analysis.

Research is needed to determine the source of HSI and other index-based model inaccuracy, limitations in HGM applicability outside of wetland contexts, and linkages to species outcomes. From these findings, we will develop an analysis framework, perhaps linking HGM and HSI for their respective strengths, to aid Districts in conducting effective project analyses.

Project Purpose & Objectives

A more holistic approach that targets the overall ecosystem rather than select species management, as well as incorporates additional environmental stressors (e.g., invasive species, changing conditions, sea-level change) is needed to adequately address potential impacts to the environment from project actions. USACE has a great opportunity to develop physical process models that fit these objectives and aligns with the current scientific paradigm of integrating ecosystem models for managing at the ecosystem level.

Primary Objectives:

- Evaluate shortcomings of existing environmental project evaluation procedures, i.e., HEP/HSI, in a workshop with SMEs and USACE District practitioners.
- Review alternative process-based habitat evaluations in the context of multiple reference conditions: historic, best attainable, existing, future without action, socially desired, and multiple project alternatives.
- Develop a process-based and spatially explicit set of environmental attributes that can be used in USACE project planning. Example attributes include terrain geometry, inundation frequency, vegetation characteristics.

- Review and evaluate products with SMEs and District practitioners as they are developed. Feedback would be solicited from regulatory agencies responsible for the review of analyses/results within the permitting/NEPA approval process.
- Develop guidelines for process-based and spatially explicit ecologically planning models. Apply these planning models to previous projects to determine model performance.

Value of Research and Development (Payoff)

Review of existing model frameworks relative to restoration planning objectives will provide an opportunity to make recommendations for consistent ecological evaluation throughout project phases, from planning to monitoring. HSI may be a weak habitat model because it is performed at the planning stage but doesn't fully leverage the surmountable monitoring datasets that USACE collects for project planning and implementation. Since this framework would require monitoring data for biological validation, it presents the opportunity to discuss consistent model use throughout planning and adaptive management. A model that can be used and improved through adaptive management will not only reduce uncertainty, but also better align USACE restoration with USACE business practices to Plan-Do-Check-Act (ER 5-1-11, Appendix A). There is also the possibility that this framework increases satisfaction and effectiveness of existing tools.

Products and Deliverables

Journal Articles (JAs)

Technical Reports (TRs)

Jung, J.F., A.E. Harris, T.M. Swannack, S.R. Wiest, C.L. Saltus, J.F. Berkowitz, S.D. Bufkin, E.S. Stowe, A.M. McFarlane, M.B. McGuire, and D.F. Potter. (In Prep). A framework for incorporating an ecosystem-based approach to aquatic and floodplain systems in the Upper Mississippi River system. (ERDC/EL TR-XX-XX), Technical Report. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Technical Notes (TNs)

Wiest, S.R., C.L. Saltus, J.F. Jung, J.F. Berkowitz, S.D. Bufkin, A.M. McFarlane, and A.E. Harris. (In Review). Opportunities to Improve Index-Based Habitat Modeling: A Case Study in the Upper Mississippi River System. (ERDC/TN EMRRP-XX-XX), Technical Note. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi. – Currently in Review in EPAS

Other Reports/Models/Tools/Datasets

Harris, A.E., T.M. Swannack, C.L. Saltus, S.R. Wiest, and E.S. Stowe. (In prep.) A completed analysis of an aquatic framework for an ecosystem-based model in the Upper Mississippi. Model Dataset. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

Jung, J.F., T.M. Swannack, C.L. Saltus, S.D. Bufkin, and J.F. Berkowitz (In prep.) A completed analysis of a floodplain framework for an ecosystem-based model in the Upper Mississippi. Model Dataset. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi.

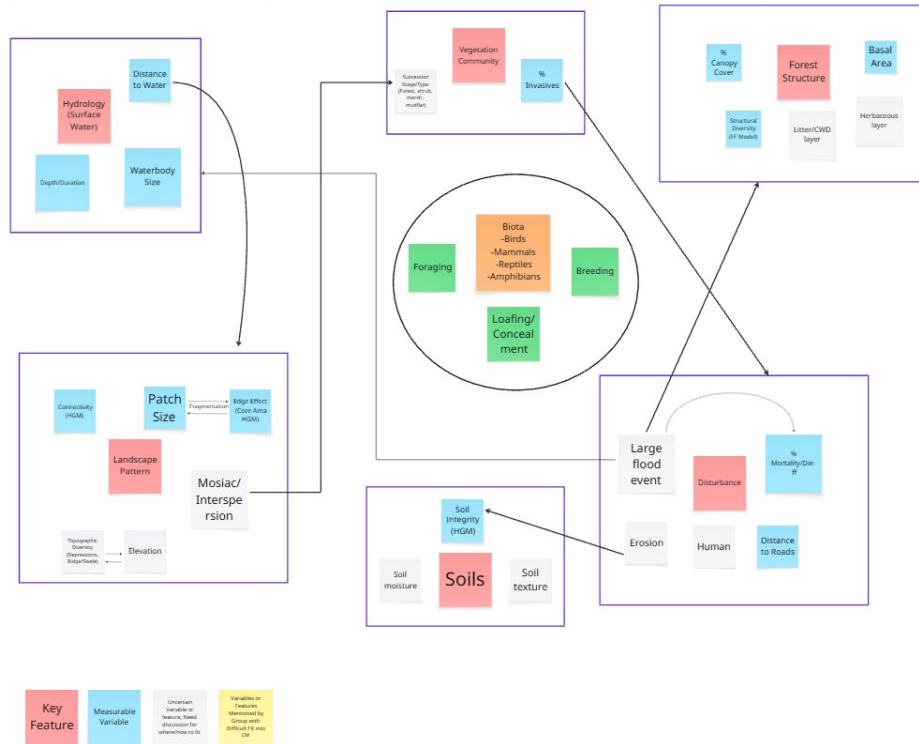


Figure 2: Conceptual model developed during the July 2025 virtual workshop by SME from ERDC and those associated with the Upper Mississippi River Restoration Program to address needs with floodplain resources at the ecosystem level.