Wetland Intrinsic Potential (WIP) Tool

Answers to Six Questions from the CMER / Policy Interaction Framework Document

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Presented by the Wetland Science Advisory Group (WetSAG)
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Type of Product in Review:
Prospective Answers: ☐ Charter ☐ Scoping Document ☐ Study Design
Retrospective: ☐ Completed Pilot/Study Phase ■ Completed Final Study Report

Brief Description: This is a final report for the Phase II of WIP project. Phase II improved the WIP tool from Phase 1 through the use of a random forest model.

1. Does the study inform a rule, numeric target, performance target, or resource objective?

No. The study was designed to find a more accurate method of remote sensing for finding wetlands, especially those that are obscured by tree cover. It is a WIP tool that can help to find appropriate wetland sites for future studies.

2. Does the study inform the Forest Practices Rules, the Forest Practices Board Manual guidelines, or Schedules L-1 or L-2?

No. However, this tool can be used to show the location, size and spatial distribution of likely wetlands in order to find similar wetland sites for future planned studies that inform Forest Practice rules, such as the impacts of forested wetlands harvest and WMZ rules. The study exists in the CMER work plan under the Wetland Intrinsic Potential (WIP) and answers the critical question, "How should wetlands be located, classified, and mapped?"

3. Was the study carried out pursuant to CMER scientific protocols (i.e., study design, peer review)?

Yes. The study met the process as outlined by the CMER Protocols and Standards Manual. The study was originally initiated and designed by the Washington Department of Ecology through an EPA grant. CMER contributed funding to this project through the Phase I component of the study and gained an additional deliverable of an open-source tool that can be used with ArcGIS software. Phase II was used to further improve the ability of the tool through the use of a random forest model.

All phases of the study were provided to WetSAG and CMER for peer review. Phase I and II each included a study design, implementation, review, an effectiveness report and user's manual.The WIP tool did not go through ISPR as it is a rule tool and not an effectiveness study and this step was not considered necessary.

4a. What will the study tell us?

The WIP tool estimates probability of wetland occurrence and it improves the detection of potential wetland locations in forested areas. The tool will greatly assist in finding sites to conduct CMER's planned wetland studies. In Washington State, the existing statewide wetland maps (National Wetland Inventory [NWI] maps) are 30-40 years out of date and inaccurate in many locations. In particular, wetlands within forested areas are often missing from the NWI. This may be in part because wetlands under partial or closed canopy are difficult to identify in aerial imagery. Incomplete mapping of forested wetland area at a landscape scale means we may be vastly underestimating the ecosystem services that forested wetlands provide (e.g. carbon sequestration, water storage).

The NWI was created through time intensive manual interpretation of aerial photos supplemented by other ancillary datasets such as soils data and topography maps and therefore is not updated with a high frequency. The Wetland Intrinsic Potential (WIP) tool was developed to fill this data gap by identifying areas in forest ecosystems that are likely to be wetlands. While the WIP tool is not a replacement for the NWI, as it does not delineate or fully characterize wetland habitat, it had a higher overall accuracy at identifying wetlands than the current NWI for all four of our study areas.

4b. What will the study not tell us?

As with other geospatial models, results from the WIP tool should not be interpreted as having 100% certainty for any feature in the map. The WIP tool does not delineate wetland borders or classify wetland types. For any study, policy, or management application, the WIP tool is best used as an initial screening

for follow-up on the ground.

There are several limitations of the WIP tool:

1.) The WIP tool does not identify jurisdictional wetlands boundaries and cannot replace wetland delineation that occurs on the ground.
2.) While in theory the WIP tool should effectively map wetlands in Eastern Washington, none of our study areas for this project were located in Eastern Washington.
3.) The WIP tool may not provide useful results for slope wetlands and these wetlands will likely be missed in any WIP tool product. We did not have adequate training data locations of slope wetlands to train our model and therefore we could not test out the effectiveness of mapping slope wetlands using the WIP tool.
4.) The WIP tool output depends on the accuracy and precision of the data on which it is based. The data layers that are input to the tool have varying levels of precision and accuracy, which will affect the precision of the predicted wetland likelihood at a given location.
5.) The WIP tool is based on topographic features and surface water flow models. It does not account for well-drained soils. Certain areas may identify strongly as wetlands, but in fact be false positives due to underlying geology and soil types.
6.) The WIP tool was created primarily for forested wetlands. It may be useful for other non-forested areas but this was not the focus of this research, and therefore it has not been assessed.
7.) The WIP tool may not produce useful results for areas with constructed human modification of water flows (i.e. drains, ditches) as these are not mapped as part of the lidar-derived hydrologic flow models used as inputs to the WIP tool.

5. What is the relationship between this study and any others that may be planned, underway, or recently completed?

The WIP tool can be used to find study sites for the Forested Wetland Effectiveness Project (FWEP) and the Wetland Management Zone (WMZ) effectiveness programs. Remote sensing of the wetlands in watersheds of interest allows the opportunity to choose wetlands of similar size, HGM class and spatial location within watersheds for study. Both of these studies are in the CMER master schedule for implementation in 2022 and 2024, respectively.

6. What is the scientific basis that underlies the rule, numeric target, performance target, or resource objective that the study informs? How much of an incremental gain in understanding do the study results represent?

The tool uses a combination of factors such as precipitation, water table height, geologic aspect and morphology through LiDAR, aerial imagery analysis and hydrological modeling to find the most likely locations for wetlands in a specific study area.

The implementation of this tool can increase the ability to use remote sensing to detect wetlands over the USFWS National Wetlands Inventory (NWI) layer that serves as the industry standard. However, the accuracy of the WIP tool to map a new location depends on the location and accuracy of the training data. For example, model performance is highest when field-verified training data are used from geographically similar areas or neighboring watersheds. The utility decreases when training data are transferred from areas that are geographically dissimilar. In those cases, it may be more appropriate to use NWI for training data.

In the study it was demonstrated that the overall accuracy of the random forest model trained using the Puyallup data when run on the Mashel watershed had an overall accuracy of 96% and an error of omission of 21% (Figure 8). When the random forest model was run using training data specific to the Mashel the overall accuracy only had a slight improvement (97% overall accuracy, 16% error of omission). However, both models, had much higher overall accuracy than the NWI for the area, which was 86.5% with an error of omission of 54%.

The model trained on the Puyallup watershed could be extrapolated to the Mashel watershed without much decrease in accuracy, however, the Puyallup model did not perform as well for the two other study areas. The Mashel watershed is neighboring the Puyallup watershed and has similar topographic and wetland characteristics, while the Hoh and Coulter Creek study area are very different than the Puyallup watershed.