Hydroperiod Analysis Toolsets: Innovative Tools To Build New Analyses

Lawrence Spencer[1], Sandra Fox[2], and Stephen Bourne[3]

[1]South Florida Water Management District, West Palm Beach, FL, [2]St. Johns River Water Management District, Palatka, FL, and [3]Atkins Global, West palm Beach, FL

Tool Background

Hydroperiod Tool: Using GIS to Analyze Water Depth and its Effects

The Hydroperiod Tool (HT) is a GIS app that:

- Estimates change in temporal and spatial patterns of **inundation** and **water depth**.
- Input is **elevation data** in the form of a digital elevation model and **water levels** (time series) derived from stages (Figure 1).
- Interpolation of point-based hydrologic data is used to represent **water surfaces**.
- Output from HT is used to create metrics relating to depth and seasonality of wetland inundation (Figure 1) – useful for understanding historic patterns and for comparing management scenarios.
- The tool requires the ESRI suite of geoprocessing tools, but the Python version of the SFWMD tool can be used outside of an ArcGIS session, lowering processing overhead and offering improved performance.

Study Introduction

The central portion of the Kissimmee floodplain (Figure 2) is being restored in a cooperative project between South Florida Water Management District (SFWMD) and the US Army Corps of Engineers (USACE). **Broadleaf Marsh (BLM)** is a native community that nearly disappeared from the Kissimmee floodplain after the river was channelized.

Current BLM cover is 19% but expectations for the river restoration call for a recovery of this community to historic levels of about 50%. **Invasive plants** currently occupy potential BLM territory. A full recovery of BLM will require **management intervention** using prescribed fire, herbicides, water depth manipulation or a combination of these interventions.

Using the Hydroperiod Tool (HT), this study looks at possible management areas on the Kissimmee floodplain to determine which is most conducive to growth of BLM based on hydrologic data.

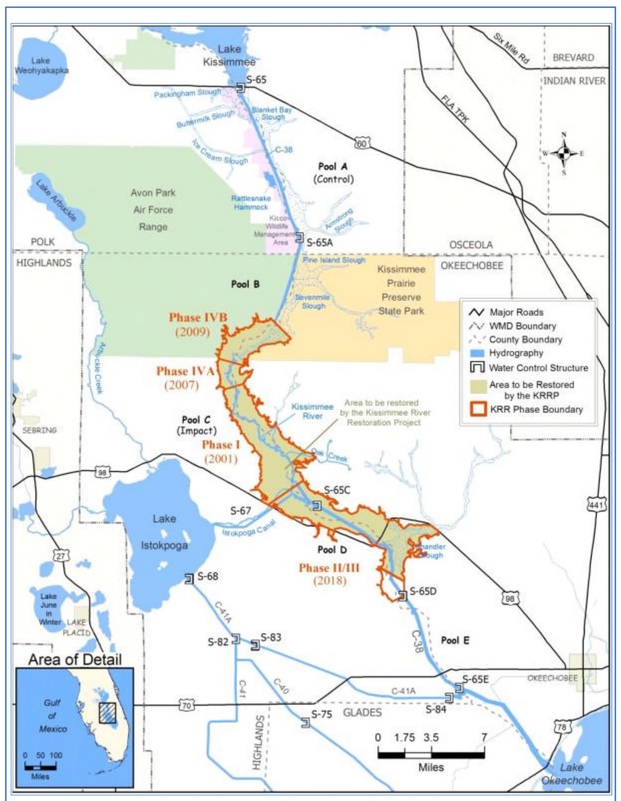

Figure 2. Map showing Kissimmee River Restoration Project phase boundaries. The analysis depicted in this poster used data from the Phase I region.

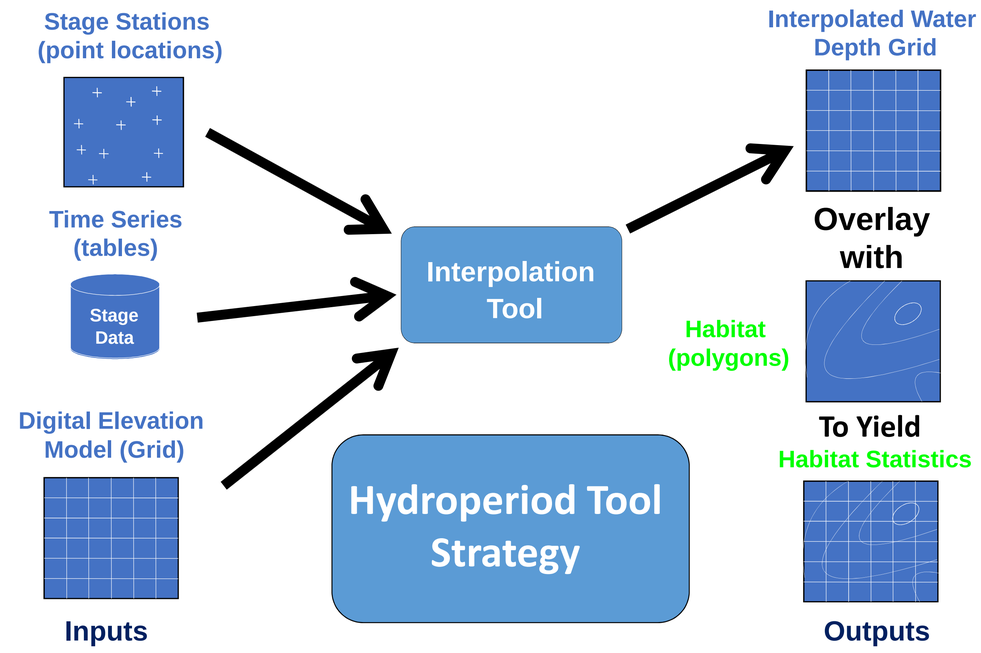

Figure 1. Simple Schematic of Hydroperiod Tool analysis sequence. A water depth grid is prerequisite to further analyses.

Methods

Two possible BLM management regions were mapped at Starvation Slough and Oak Creek (see Figure 3).

The HT was used to produce:

1. Water Year (WY) 2016 mean estimate maps for depth and inundation duration
2. A multiyear depth duration curve for BLM using vegetation maps from 2003, 2008, and 2011 and interpolated stage data from WYs 2004, 2009, and 2011.
3. A depth-duration curve for each of the proposed management regions.

Results

- HT mean output maps for WY2016 suggest that Oak Creek has greater average depths (Figure 3) and longer inundation durations (Figure 4) than Starvation Slough.
- Depth-duration results (Figure 5) confirmed that Oak Creek has a similar depth-duration relationship to the floodplain-wide BLM while Starvation Slough appears to be drier than necessary for wide-spread BLM growth.
- Therefore, appropriate management techniques for propagation of BLM would likely work better within the Oak Creek area.

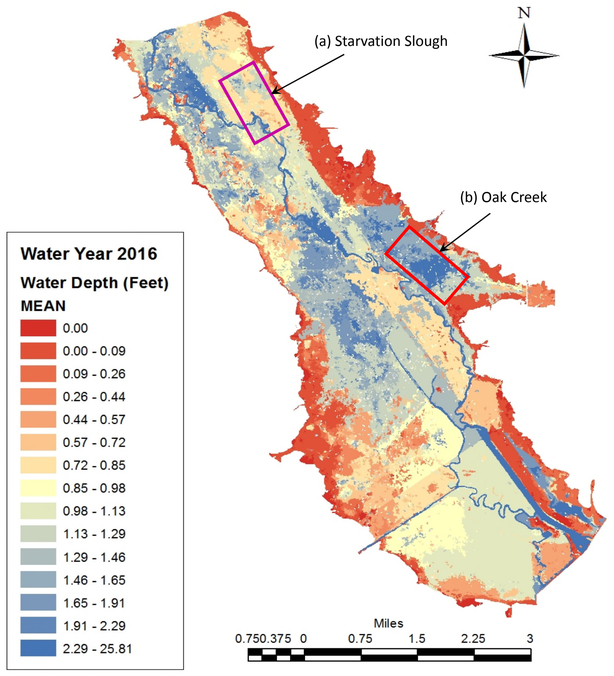

Figure 3. Map of water depth on Kissimmee floodplain Pool C restored area. Rectangles depict possible management regions in (a) Starvation Slough and (b) Oak Creek areas. Management regions are approximately 1 square mile in area.

Tool Update

Script Changes:

Developed in VBScript, the Hydroperiod Tool has adapted to changes in both the GIS and scripting worlds. When the tool was developed, VBScript was the language "native" to ArcGIS, but issues abounded at SFWMD because the VBScript tool required custom updates. After several tool "breaks" over the years, and continuing complaints of user-unfriendliness, SFWMD moved the tool functions into the Python scripting language to make the tool both more portable and more efficient. This followed directly from the SFWMD IT philosophy to use commercial off-the-shelf (COTS) software whenever possible and to limit custom development of tools to be used with ArcGIS and related GIS software.

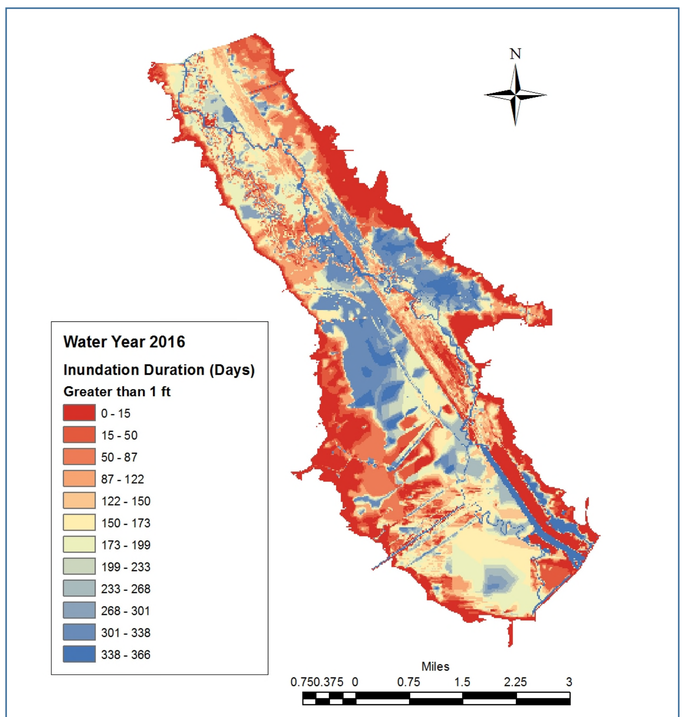

Figure 4. Inundation duration map of Kissimmee floodplain Pool C restored area.

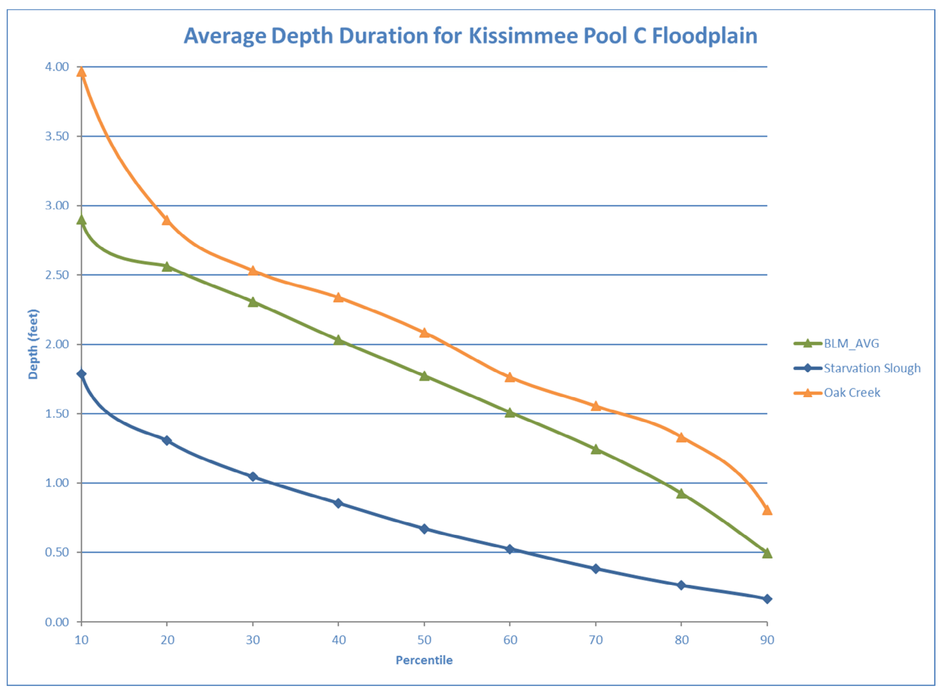

Figure 5. Depth-duration curves for floodplain-wide Broadleaf Marsh (BLM) and for two possible management areas within the floodplain that could be used to promote an increase in BLM distribution.

Tool Take-Away:

- Extended raster-based GIS tools available through the HT allow for quick turn-around for this analysis.
- The simple modeling tools using interpolation of hydrologic time series over elevation datasets can help visualize complex hydrologic relationships.
- Overlays of polygon-based datasets of various types allow the tools to relate habitat or vegetation maps to hydrologic characteristics for regions where particular habitat types predominate.
- Flexibility of these tools has been enhanced by recent movement to the Python scripting environment.

South Florida Water Management District
3301 Gun Club Road • West Palm Beach, Florida 33406
561-686-8800 • 1-800-432-2045 • www.sfwmd.gov
MAILING ADDRESS: P.O. Box 24680 • West Palm Beach, FL 33416-4680

sfwmd.gov

Presenter: Lawrence Spencer (lspencer@sfwmd.gov)
Conference: Greater Everglades Ecosystem Restoration
Venue: Marriott Coral Springs, Ft. Lauderdale, FL, April 17-21, 2017