Indicator 3.3 – Hydropattern

What is the desired restoration condition?

The desired restoration condition for hydropattern is to restore the natural timing and pattern of inundation throughout the ecological communities of South Florida. The goal is to match the long-term average and the interannual variability in hydropatterns predicted for the natural areas under natural conditions.

Why is this indicator important and why is it a good indicator of CERP restoration?

The annual duration of land surface inundation (hydroperiod) determines in large part the flora and fauna associated with a specific location. Because of this strong linkage, hydroperiod is an important indicator of a functioning ecosystem. Currently, the flood protection and water supply constraints on the regional water management system cause hydroperiods in many areas to be significantly different than would be expected under natural conditions. Comprehensive Everglades Restoration Plan (CERP) implementation components are expected to create a spatial distribution of hydroperiods (i.e., hydropatterns) that will establish and sustain native flora and fauna communities.

How will the interim goal for this indicator be predicted?

The South Florida Water Management Model (SFWMM) predicts the average daily stage (water level) in each cell of the domain. This information, combined with ground surface elevation data can be used to predict inundation (water above the land surface) for groups of cells organized by landscape type (Figure 3.3.1). The percentage of the total area of each of these landscapes types that is inundated on each day can be calculated as an indicator and this statistic is called the pond count.

Hydropatterns change in response to interannual variability in rainfall. The interannual variability in the pond count statistic is therefore an important indicator of ecosystem function. Over time, the responses of regional hydropatterns to rainfall amounts are expected to match the interannual variability in pond count predicted in the interim and D13R (full CERP implementation) simulations. In future evaluation periods, these pond counts will be used to determine progress toward the desired restoration condition during years with above or below average rainfall. For example, during years with high rainfall, the landscape-scale hydropatterns estimated from field data will be compared to the pond count predictions for years in the simulation period of record with above average rainfall (e.g., 1995). During years with below average rainfall, similar comparisons will be performed between field measurements and pond counts predicted for dry years in the simulation period of record (e.g., 1989). In this context, landscape hydropatterns measured during interim years with above or below average rainfall should reflect the SFWMM pond count statistics during periods with similar climatic conditions.

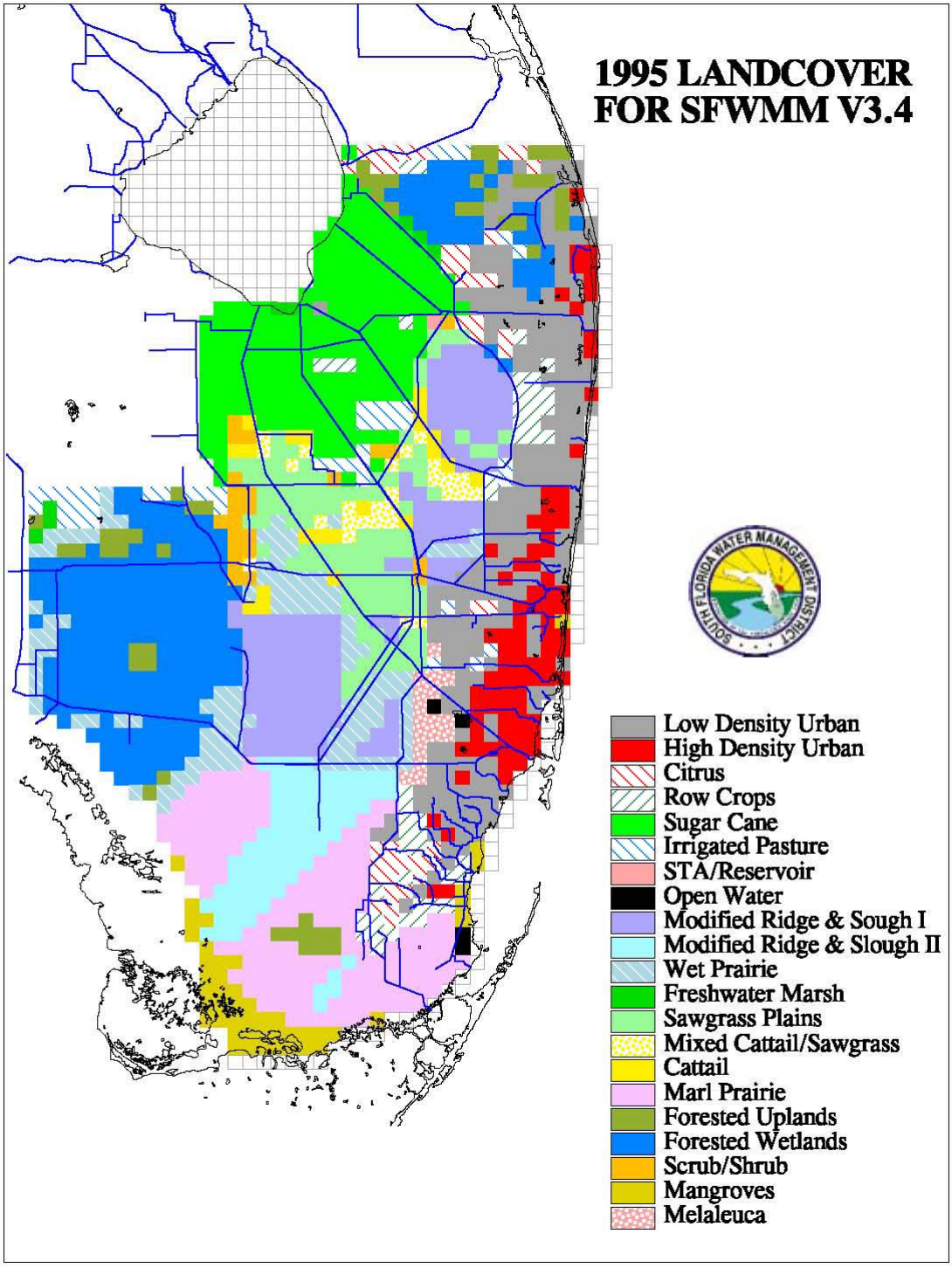

Figure 3.3.1. Land cover used in SFWMM simulations

Progress toward the desired restoration condition will be displayed using graphs similar to those in Figures 3.3.2 to 3.3.4. These graphs should include the observed data, the baseline condition, and each of the interim simulations to show the trends approaching full CERP implementation through time. Additional examples of this method can be viewed at http://www.sfwmd.gov/org/pld/restudy/hpm/frame1/maps/pondcount.htm.

Uncertainty in the model predictions

The uncertainty associated with the pond count statistics produced by the SFWMM has not been quantified. Accurate pond counts statistics predicted by the SFWMM will rely on the accuracy of both the stage predictions (~ ± 0.5 feet) and on the ground surface elevations in the model from which depths and inundation patterns are derived. The accuracy of these two components of the pond count statistic vary depending on the location in the SFWMM domain, and this should be considered when comparing model output to observations for particular areas. The size of the grid cells in the SFWMM (4 square miles) should also be considered when comparing model predictions to observed inundation patterns. For example, the SFWMM predicts water depth and inundation based on the average land surface elevation within a cell. However, land surface elevations typically vary on much smaller spatial scales than the SFWMM grid-scale, and thus the observed inundation patterns will also vary on much smaller scales. Observations of water depths and inundation derived from point measurements (i.e., water level recorders) should therefore be carefully aggregated using topographic data to the grid scale prior to comparisons with SFWMM output.

What are the predictions for five-year increments?

Comparisons of average daily pond counts calculated over the simulation period of record for 1995B, interim, and D13R (full CERP implementation) conditions are presented below for the ridge and slough (Figure 3.3.2), marl prairie (Figure 3.3.3.), and sawgrass (Figure 3.3.4) landscape types. These graphs show that for each of these landscape types, the average daily pond counts are smaller in the dry season (November - May) and expand as a result of the rains of the wet season (June - October). These average daily pond counts will serve as a long-term indicator of progress toward this goal. Pond counts predictions for each year of the simulation period of record are provided at http://www.sfwmd.gov/org/pld/restudy/hpm/.

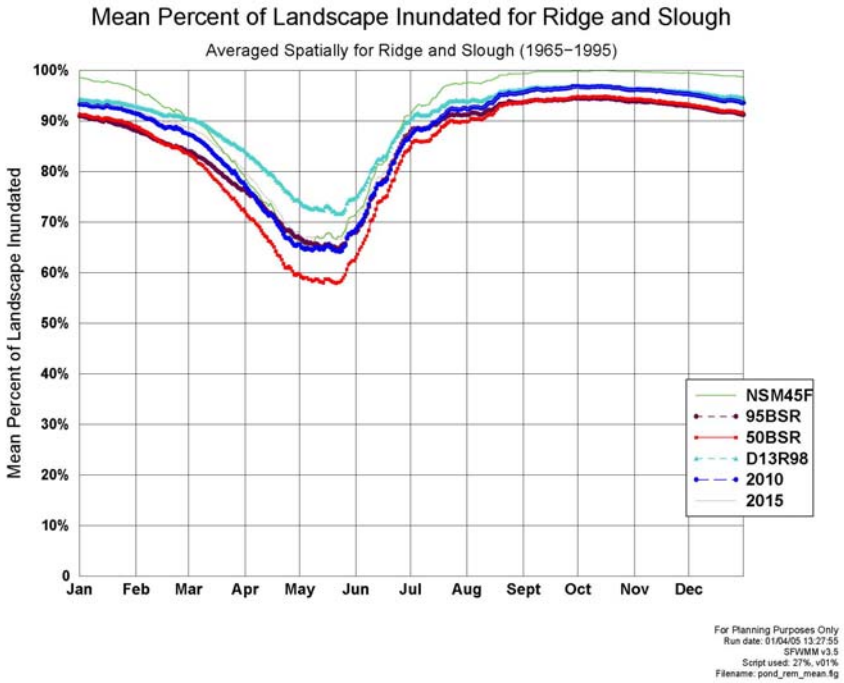

Figure 3.3.2. Comparisons of average daily pond counts for the ridge and slough landscape.

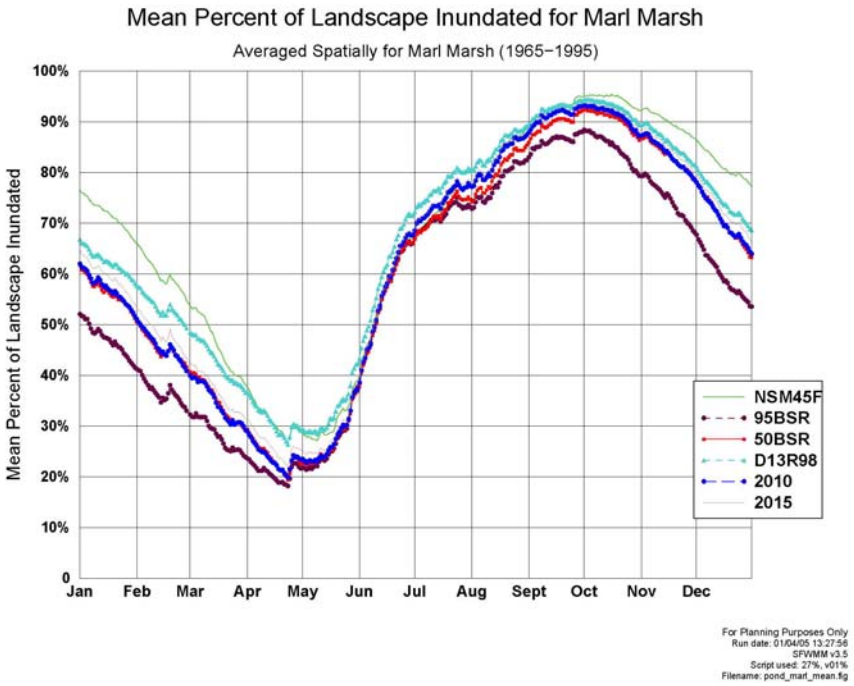

Figure 3.3.3. Comparisons of average daily pond counts for the marl prairie landscape.

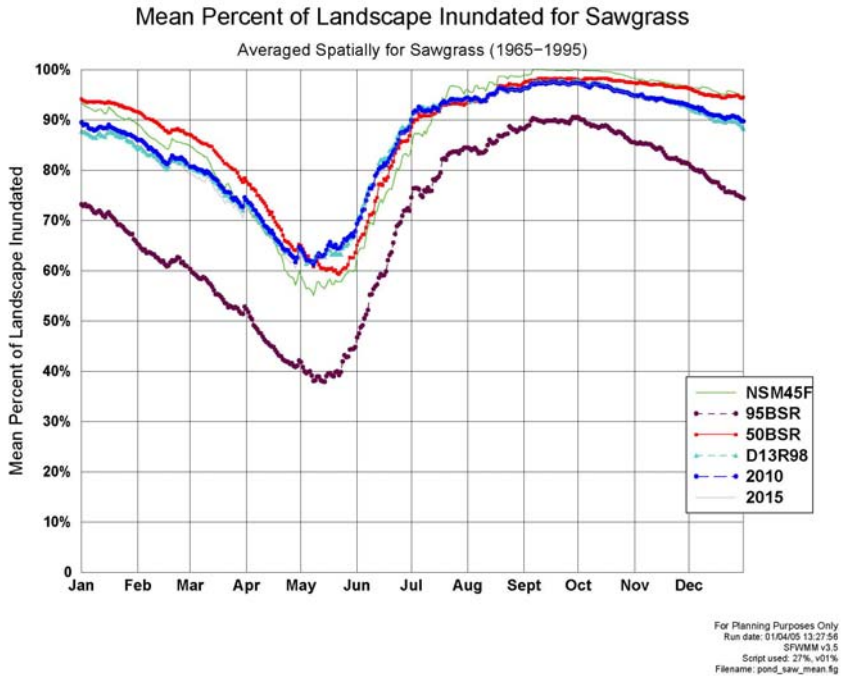

Figure 3.3.4. Comparisons of average daily pond counts for the sawgrass landscape.

How will we track whether the interim goals established for this indicator have been achieved?

The establishment of a network of water level recorders distributed throughout the natural areas of South Florida is a primary goal of the CERP Monitoring and Assessment Plan (RECOVER 2004). A database of the average daily water levels from each of these recorders will be produced, and can be used in a geographic information system (GIS) application to generate water surface elevation maps covering the region. These water surface elevation maps can then be combined with topographic data to generate regional maps of water depth. The percentage of each landscape type that is shown to be inundated on these water depth maps will then be determined. This information can then be used to determine whether or not the landscape is inundated at the spatial extent and for the duration of time predicted by the SFWMM. In order to provide a more complete analysis of inundation in terms of interannual variability, the regional model will be used to simulate the projects as they were actually constructed. Inundation will be recalculated to further determine the extent to which the CERP is meeting expectations.

What additional work is needed to improve the prediction methods for this interim goal?

This interim goal will be revised as the regional hydrologic models are improved.

References

RECOVER. 2004. CERP Monitoring and Assessment Plan: Part 1, Monitoring and Supporting Research. Restoration Coordination and Verification Team (RECOVER), c/o United States Army Corps of Engineers, Jacksonville District, Jacksonville, FL, and South Florida Water Management District, West Palm Beach, FL.