

EverForecast—A Near-Term Forecasting Application for Ecological Decision Support

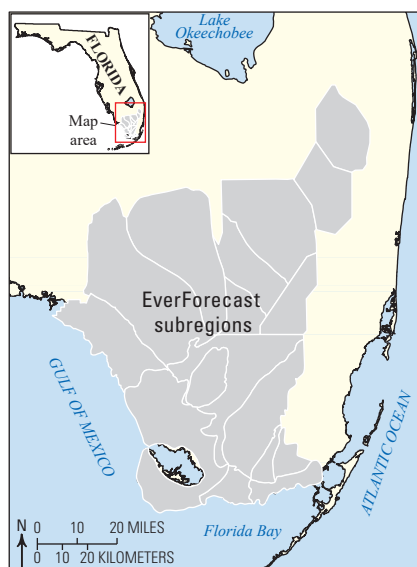


Why Is Everglades Decision Making Difficult?

The Greater Everglades is a vast, subtropical wetland ecosystem in South Florida that contains critical protected areas, harbors impressive biodiversity, and provides water resources for agricultural lands and one of the largest urban areas in the Nation. The region's protected areas are highly altered by the construction of canals and levees, putting threatened and endangered species at risk. Furthermore, species of concern have different spatial and temporal hydrologic preferences, requiring managers to make tough decisions about optimal ways to distribute the water within the natural areas.

What Is EverForecast?

Developed in collaboration between the U.S. Geological Survey and the National Park Service, the Everglades Forecasting application (EverForecast) helps decision makers identify management actions that balance the hydrologic needs of multiple species across the natural landscape. EverForecast provides 6-month forecasts of daily projected, spatially continuous water stage values across the region (fig. 1). It then runs these forecasts through a suite of ecological models and illustrates potential tradeoffs. Scientists and natural resource managers can use these forecasts to plan for near-term environmental change and make decisions according to their management priorities.



Base from U.S. Geological Survey digital data
Universal Transverse Mercator Zone 17N

Figure 1. Location of the EverForecast subregions within Florida.




How Does EverForecast Work?

To generate a forecast, EverForecast uses precipitation forecasts from the National Oceanic and Atmospheric Administration (NOAA) combined with historical water stage from the Everglades Depth Estimation Network (EDEN). A hydrologic

spatial position analysis produces a central tendency water stage forecast across the model domain of the Greater Everglades at a 400×400 -meter resolution. The central tendency represents the most probable daily water stage over the next 6 months.

Next, EverForecast generates 150 stochastic simulations, representing a range of possible future conditions, by combining the central tendency with historical water stage trends from the past 20 years. EverForecast defaults to using EDEN hydrology because it represents the historical distribution, but the model code contains the flexibility to use other hydrologic scenarios, which allows users to evaluate alternatives in water management operations.

To integrate with ecological models, we subtract the EDEN digital elevation model (DEM) from the simulations of water stage to calculate water depth. Water depth simulations are then run through a suite of models for the following species of concern in the Everglades:

-  Alligator (*Alligator mississippiensis*)
-  Florida applesnail (*Pomacea paludosa*)
-  Small fish
-  Wood stork (*Mycteria americana*)
-  White ibis (*Eudocimus albus*)
-  Roseate spoonbill (*Platalea ajaja*)
-  Glossy ibis (*Plegadis falcinellus*)
-  Little blue heron (*Egretta caerulea*)
-  Great blue heron (*Ardea herodias*)
-  Great egret (*Ardea alba*)
-  Everglades snail kite (*Rostrhamus sociabilis plumbeus*)
-  Cape Sable seaside sparrow (*Ammodramus maritima mirabilis*)

The simulations are sorted into hydrologic categories according to depth and recession rate, relative to the full forecast. EverForecast is run at the beginning of each month and summarized by hydrologic category and subregion, allowing users to explore forecasts of hydrology and expected suitability for an individual species or multiple species (fig. 2).

How Does EverForecast Help Decision Makers?

EverForecast offers managers the tools to examine optimal allocations of water across managed subregions in the Everglades by considering multiple species with conflicting needs and adds a unique way to support and improve current multispecies management efforts. By examining the modeled species responses to hydrologic scenarios, decision makers can explicitly see where and when tradeoffs occur and can balance wetland-dependent species' hydrologic needs across the natural landscape (fig. 3A–B).

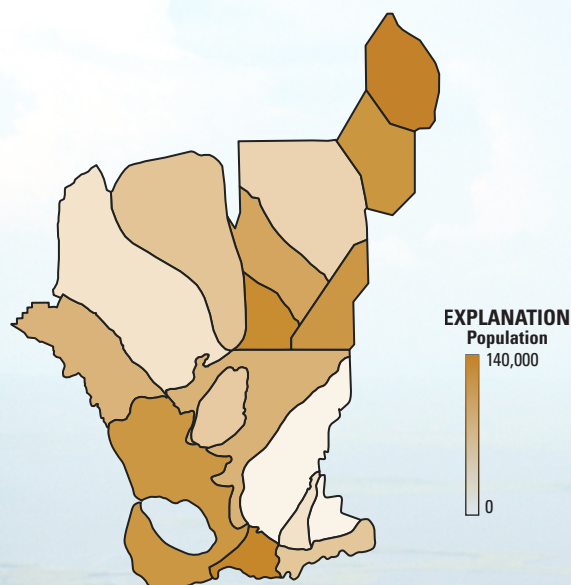


Figure 2. EverForecast output for an individual species model for one hydrologic category. The visualization shows the mean population of adult apple snails per model grid cell for October 1–15, 2020.

The use of near-term forecasting helps decision makers manage the transition from current conditions to future alternatives. With growing concern over the frequency and severity of episodic weather events, near-term forecasts of hydrologic conditions paired with integrated evaluation of ecological responses can guide real-time decision making to maintain ecological integrity in restoration planning. More detail on the forecasting methods are described in Pearlstine and others (2020).

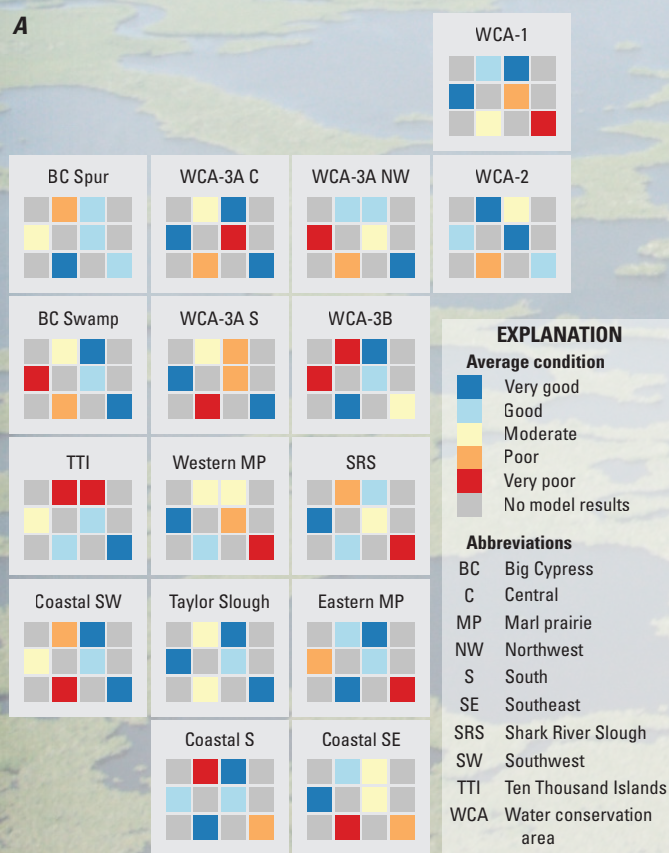
How Do I Access EverForecast?

Explore EverForecast at <https://jem.gov/everforecast>. Learn more about the species models at <https://jem.gov/modeling>.

Reference Cited

Pearlstine, L.G., Beerens, J.M., Reynolds, G., Haider, S.M., McKelvy, M., Suir, K., Romañach, S.S., and Nestler, J.H., 2020, Near-term spatial hydrologic forecasting in Everglades, USA for landscape planning and ecological forecasting: Environmental Modelling & Software, v. 132, article 104783, 13 p., accessed August 27, 2020, at <https://doi.org/10.1016/j.envsoft.2020.104783>.

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EXPLANATION		EXPLANATION	
Alpha code	Name	Alpha code	Name
CSSS	Cape Sable Seaside Sparrow	ROSP	Roseate spoonbill
GLIB	Glossy ibis	SNKI	Snail kite
GBHE	Great blue heron	WHIB	White ibis
GREG	Great egret	WOST	Wood stork
LBHE	Little blue heron		

Figure 3. EverForecast output for multiple species models for one hydrologic category. The visualization, A, shows the average condition of select species for each subregion, for October 1–15, 2020, and the square of species icons, B, serves as a key indicating which square represents which species.

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