

Alligator Production Probability Model (GATORPI v. 2.1.0)

User's Guide



Photograph by Leonard Pearlstine, Everglades National Park

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Model Description

The Alligator Production Probability model is a Joint Ecosystem Modeling (JEM) collaboration that can be used to assess the effects of Everglades' restoration scenarios on alligator (*Alligator mississippiensis*) production suitability.

Key objectives of this project include the following:

- develop a spatially-explicit alligator production model whose spatial domain will include the freshwater marshes within the Florida Everglades Water Conservation Areas and Everglades National Park;
- develop the model in collaboration with other scientists and facilitate code sharing to encourage the long-term development and use of the model;
- develop a model that can be used to readily evaluate Everglades restoration scenarios from hydrologic input provided by models such as the Regional System Model (RSM) and the South Florida Water Management Model (SFWMM);
- develop a model that provides nesting and production suitability and input to the USGS alligator population growth model; and
- develop a flexible modeling framework so that existing model parameters can be readily modified and new model parameters can be incorporated.

Principle contributors to development of the Alligator Production Probability model to date are (Listed in alphabetical order)

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This document describes installing and using the Alligator Production Probability model. Please refer to the Ecological and Design Documentation available at www.simglades.org for the model's rationale and methodology.

Software Requirements

Java JRE 1.6 or greater is required.

Installation

There is no installer for this application. Simply unzip the directory to the desired location.

Inputs

Input files Summary

File	File Type	Time resolution	Units	Description
Water Depths	NetCDF	Daily	mm	Raster temporal data of daily water depths. Typically at 400x400 or 500x500 meter resolution.
Salinity (optional)	NetCDF	Daily	ppt	Raster temporal data of daily surface water salinities. Typically at 400x400 or 500x500 meter resolution.
Habitat	NetCDF	Static	categorical	Raster static data of habitat and canals. Typically at 50x50 meter resolution.
Alligator Holes	Text (csv)	Static	na	UTM coordinate location of alligator holes within the model's domain.
Tree Island Zones	NetCDF	Static	categorical	Raster layer of tree islands zones. Typically at 400x400 or 500x500 meter resolution.
Tree Island Heights	Text (csv)	Static	mm	Table of mean tree island ground heights above the marsh surface for each zone in the Tree Island Zones raster layer.
Parameters	Text (xml)	na	na	Contains the path and filenames of input and output files and all the user-modifiable parameters used in the simulation.

Daily Water Depths

Any daily water depths raster dataset can be used; however, for Everglades restoration planning, the input water depth files are 500m resolution orthogonal interpolations of the gridded South Florida Water Management Model (SFWMM, 2 mile native resolution) or the Regional Simulation Model (RSM, variable mesh resolution). Everglades research may also use Everglades Depth Estimation Network (EDEN) time series, the M3ENP hydrologic model (Florida International University / Everglades National Park) or the USGS TIME/BISECT. All of these models are 400m resolution orthogonal grids.

Interpolations are generated using a Delaunay Triangulation approach with the **SpecificRSMconverter** application created by JEM (jem.gov). Although RSM is in the application's name, it can also be used for interpolating orthogonal datasets including the SFWMM. For more information about Delaunay Triangulation, see the reports at <http://www.cloudacus.com/simglades/WaDER.php>.

Water depth units must be millimeters.

Salinity

This layer is optional. Any daily salinity raster dataset can be used, however, for Everglades restoration planning, the only currently available salinity input is the USGS TIME/BISECT model at 400 m resolution. The salinity raster does not have to match the full extent of the output grid. Wherever the model domain is outside of the salinity domain, salinity is assumed to be zero. This allows coastal modeling of salinity effects without requiring the input model to include interior areas well beyond any salinities in the water column.

Habitat

The input habitat raster dataset must be at 50 m resolution and contain the following classes:

Class Value	Class
-99	Excluded: background and non-habitat
-1	Canals
1	Marsh
2	Marsh/ Upland Edge

Marsh/ Upland edge is upland habitat immediately adjacent to marsh habitat. Cells immediately adjacent to marsh grid cells include cells at a diagonal to a marsh cell.

Tree Islands

Two input files are used to characterize tree island heights for the model. A raster categorical data layer at 500 x 500 m resolution defines zones over which a constant mean tree island height is assumed

(Figure 1). A text file that must be called “treelslandHeights.csv” and must be located in the ./input folder contains the mean tree island heights for each zone. The file contains a header in the first row, followed by the data in the subsequent rows. Each row has at least 3 columns. The first column is typically an ID number or name, but the application does not use the column. The second column is the zone number. Zone numbers must match the zone values in the raster file and each zone in the raster file must have a listing in the text file. The third column is the mean tree island height in millimeters of the zone. Additional columns will be ignored. All columns must be separated by commas.

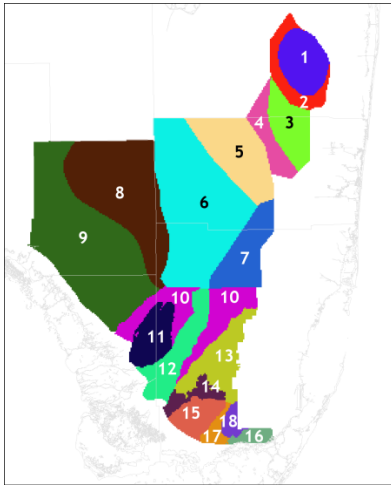


Figure 1. Example tree islands zone layer.

Example treelslandHeights.csv:

```
ID,Zone,Height(mm)
LNWR,1,0.39
LNWR,2,0.39
WCA2,3,0.5
WCA2,4,0.5
WCA3,5,0.45
WCA3,6,0.45
```



Additional columns could contain useful information for future reference such as citations for the listed height values. The additional columns will be ignored by the model.

Alligator Holes

A text file listing alligator hole locations must be located in the ./input folder and must be called “gatorHoles.csv”. The file contains a header in the first row, followed by the data in the subsequent

rows. Each row has at least 3 columns. The first column is typically an ID number or name, but the application does not use the column. The second and third columns must be the alligator hole's UTM x coordinate, and the colony's UTM y coordinate in that order. Additional columns will be ignored. All columns must be separated by commas.

Example gatorHoles.csv file:

```
Hole_ID,Easting,Northing,Place,Confidence
1,575556.188,2935812,Lox,low
2,575611.3,2934755.5,Lox,high
3,575864.4,2934289,Lox,high
4,575749.25,2934049.25,Lox,low
5,575475.8,2934183,Lox,high
6,575209.063,2934030.75,Lox,low
7,575441.9,2934211.8,Lox,high
8,574959.3,2934122,Lox,high
9,576000.875,2931916.75,Lox,low
```



This example retains additional, potentially useful information about the alligator holes in the last 2 columns, but this information is not used by the model. Retaining additional information can be helpful if the user desires to edit the location data at a later time.

Parameters

User changeable parameters must be located in the top folder and must be called "parameters.xml".

There are 8 modeling parameters that describe the output file and are user-changeable.

start	Start date of the simulation.
end	End date of the simulation.
ymax	Number of rows in the output file.
xmax	Number of columns in the output file.
size	Spatial resolution in meters. This value should always be 500 in the current model.
easting	Left UTM x coordinate (centroid of the left-most column)
northing	Top UTM y coordinate (centroid of the top-most row)
output name	Path and filename of the output NetCDF file.

The path and filename of 4 of the input files, habitat, salinity, zones, and depth, are also specified in the parameters.xml file. The path and filename of the alligator holes file and the tree island heights file can also be changed , but are not required to be present in the parameters.xml file.

Example of a parameters.xml file:

```
<?xml version="1.0" encoding="UTF-8" standalone="no"?>
<!--
Source: Alligator Model
Version: 2.0.0.305
Created On: Mon Mar 25 14:21:05 EDT 2013
Author: l pearlstine
-->
<parameters model="Alligator Model" version="1.0.0.305">
  <parameter easting="463400.0" end="1996-08-31" northing="2790200.0"
    size="500.0" start="1991-04-16" type="sim" xmax="229" ymax="324">Alligator_output.nc</parameter>
  <parameter name="habitat_area" type="layer">inputs/gator_habitat_canals.nc</parameter>
  <parameter name="salinity" type="layer">inputs/existingsalin.nc</parameter>
  <parameter name="zones" type="layer">inputs/areazones.nc</parameter>
  <parameter name="depth" type="layer">inputs/1991-2011_Depth_mm.nc</parameter>
  <parameter name="gator_holes" type="csvlayer">inputs/gatorHoles.csv</parameter>
  <parameter name="tree_island_heights" type="csvlayer">inputs/treeIslandHeights.csv</parameter>
</parameters>
```

Outputs

Output is to a NetCDF file with multiple spatial variables.

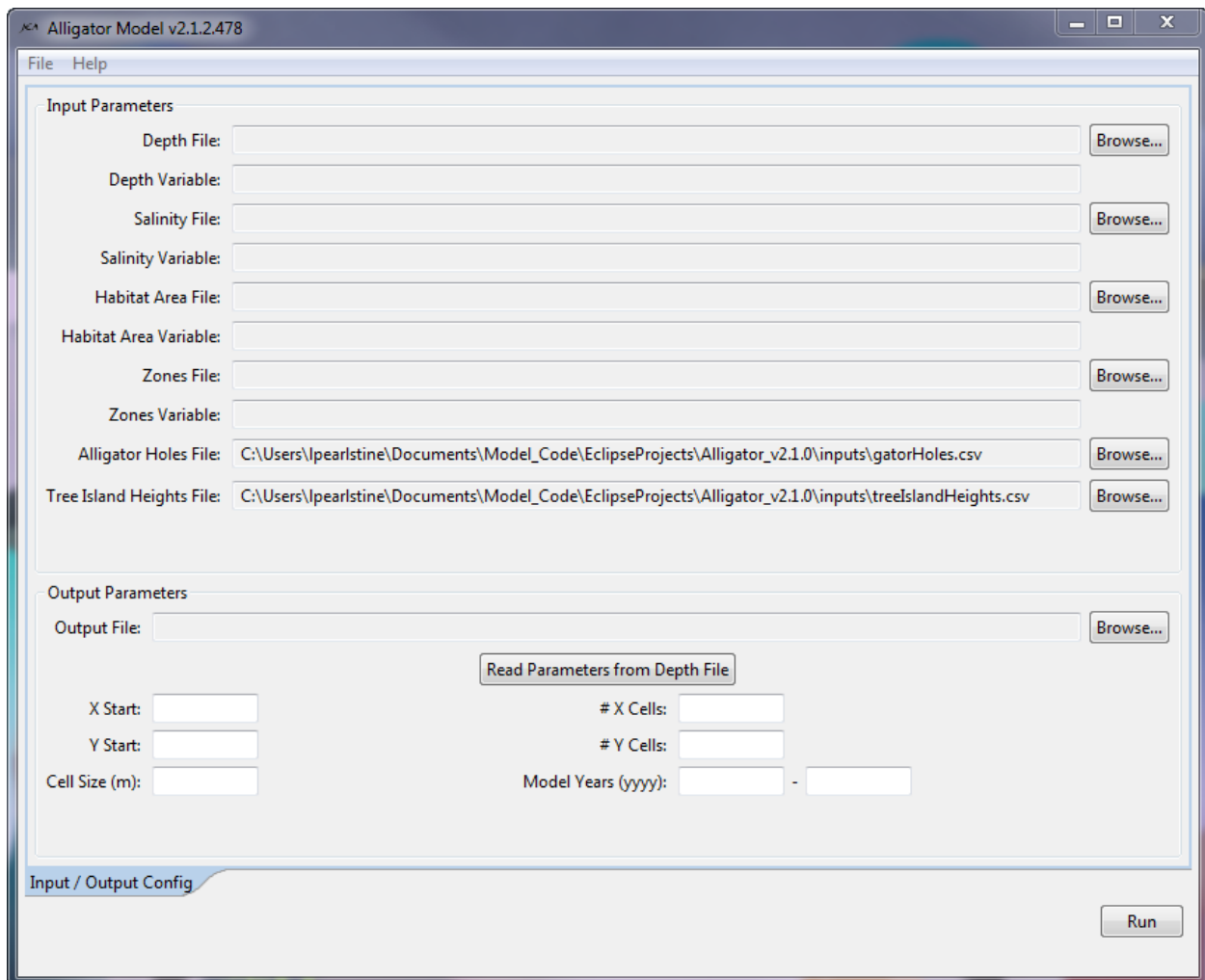
Output		Description
1.	Habitat Area	Suitability for area of habitat within the grid cell.
2.	Tree Island Height	Average height of tree island ground surface above marsh surface
3.	Sum Alligator Holes	Number of alligator holes in the grid cell.
4.	Percent Edge Habitat	Proportion of edge habitat in the grid cell.
5.	Breeding Potential	Suitability for breeding potential.
6.	Courtship and Mating	Suitability for courtship and mating.
7.	Nest Building	Suitability for nest building.
8.	Nest Flooding	Probability of flooding during egg incubation.
9.	Habitat Suitability	Overall alligator production suitability
10.	BP Wet/Dry	Proportion of days during breeding when too wet or dry.

11.	CM Depth	Average water depth during courtship and mating.
12.	NB Depth	Average water depth during nest building.
13.	NF Depth Max	max water depth during egg incubation.

Running the Alligator Production Probability Model

User Interface

Version 2 of the Alligator Model introduces a new graphical user interface (GUI) to aid in parameterizing the model.



A parameters file can be used to populate the contents of the user interface fields. You may also use the "Browse" button next to any particular entry to choose or change the selected input or output file.

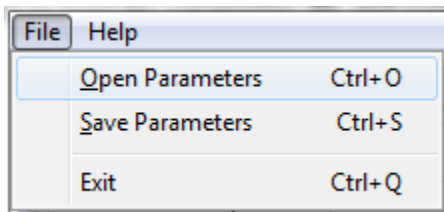
When a new depth input file is selected, the output grid parameters and model years selections can either be specified manually or updated from the depth file by clicking the "Read Parameters from Depth File" button for your convenience.

After you have parameterized the model from the interface, click the "Run" button. The model will begin processing and display its current status to you.

Note: clicking cancel on the progress dialog may take several minutes since the model must complete the next time step before cancelling.

Using a Parameters File

Edit the parameters.xml file as needed and save in the main Alligator application directory. Use the "File" > "Open Parameters" menu option to load the parameters file and populate the GUI fields.



"Open Parameters" menu item.

Creating a Parameters File

If you have fully parameterized the model from the interface, you can save a new parameters file by using the "File" > "Save Parameters" menu entry. This file can be loaded later via the "Open Parameters" menu entry.