wetlandP version 1.1 – Read Me

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Quantifying phosphorus retention in restored riparian wetlands of the Lake Champlain Basin

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## About

This folder contains the wetlandP model (v. 1.1). The model is an ordinary differential equation model implemented in R (v. 4.0.0) and Rstudio (v. 1.2.1) or later. with the deSolve (v. 1.28) package (Soetaert et al. 2010). This document gives details on how the folder is organized and how to implement the model. The model relies on the packages within the tidyverse (Wickham 2019), for plotting, data manipulation and string editing.

The development versions of model are hosted on github @ <https://github.com/arhwiegman/wetlandP/model_versions/>

The stable versions model is also hosted uvm gitlab page. [insert link].

## Getting Started

To run the model, click on the wetlandP\_vX.X.Rproj file. This will open up Rstudio with the working directory set to wetlandP\_vX.X.

## File Structure

The working directory contains folders for model documentation, scripts, inputs, and outputs. The packrat folder contains libraries for model’s dependancies (e.g. deSolve). A current list of the working directory is given below.

## [1] "documentation" "inputs"   
## [3] "outputs" "packrat"   
## [5] "ReadMe.docx" "ReadMe.html"   
## [7] "ReadMe.Rmd" "scripts"   
## [9] "wetlandP\_documentation.html" "wetlandP\_documentation.nb.html"  
## [11] "wetlandP\_documentation.Rmd" "wetlandP\_documentation.tex"   
## [13] "wetlandP\_v1.1.Rproj"

### Documentation

Currently the most detailed documentation of the model is within the model scripts. Open the [wetlandP\_documentation](wetlandP_documentation.nb.html) notebook in your web browser for a summary of the model state variables and the assumptions governing their differential equations.

### Scripts

## [1] "fns" "functions.R" "initialize.R" "model.R"   
## [5] "parameters.R" "subroutines.R" "xecute.R"

The table below provides a description of each of the scripts used by the model.

|  |  |
| --- | --- |
| name | description |
| xecute.R | Loads source code, executes simulation and manages data outputs. This script must be run to implement the model. To run the file: in Rstudio with the xecute.R file open press cmd/crtl + shift + enter |
| parameters.R | The main way to manipulate outputs. This includes both nurmerical constants to be used in model calculations as well as model run specifications (e.g. static or dynamic, simulation time) see fn\_edit\_parameter\_values.R to change individual parameters for before a given run. |
| model.R | The high level script controling flow of subroutines in the wetlandP model. See subroutines for details of model calculations. |
| initialize.R | initializes the model state variables based on the parameter values and functions provided. |
| subroutines.R | a series of subroutines that calculate new values of variables in the model based on functions, parameters and variable values in the model environment. |
| functions.R | a high level script that sources other functions. |
| fns\_X.R | For detailed functions pertainin to X aspect of the model |

### Inputs

Inputs are data that are used to force or calibrate the model. Examples include water level data, weather station data, nutrient concentrations and so on. A calibration subroutine still needs to be added so the inputs folder is currently empty.

### Outputs

The model saves outputs with a prefix then the simulation then a timestamp. The model produces three types of output:

|  |  |  |
| --- | --- | --- |
| prefix | extension | description |
| “sim\_” | “.Rdata” | an image of the R environment objects saved upon execution of the model run. Use load("sim\_[run name].Rdata") in R to load the environment objects for the simulation. |
| “fig” | “.png” | time series plots of variables |
| outputs | “.csv” | a comma delimited data table of variable values along the time series the model run |

## Buildnotes

wetlandP\_v1.1

### Status (of this version)

1. The subroutines have been checked for mass balance and numerical stability. The model functions when water is above and below the soil surface during static simulations.
2. Model rate functions have been checked but metadata needs to be updated.

### Next steps (for future versions)

1. The model mass balance and stability needs to be verified for dynamic simulations
2. Subroutines for calibration need to be coded
3. Scenarios need to be coded
4. The model performance needs to be optimized for run speed

## References

Karline Soetaert, Thomas Petzoldt, R. Woodrow Setzer (2010). Solving Differential Equations in R: Package deSolve. Journal of Statistical Software, 33(9), 1–25. URL <http://www.jstatsoft.org/v33/i09/> DOI 10.18637/jss.v033.i09