Package 'EPGMr'

May 5, 2020

Type Package

Title Implementation of the Everglades Phosphorus Gradient Model

Version 1.0.0

Date 2020-04-30

URL https://github.com/swampthingpaul/EPGMr

Description Everglades Phosphorus Gradient Model predicts variations in water-column P concentration, peat accretion rate, and soil P concentration along a horizontal gradient imposed by an external phosphorus load and sheet-flow conditions. Potential biological responses are expressed in terms of marsh surface area exceeding threshold criteria for water-column and soil phosphorus concentrations. More information of the model can be found at <http://www.wwwalker.net/epgm/>.

License GPL-3

Depends R (>= 3.6)

Imports grDevices, graphics, stats, utils

Suggests knitr, rmarkdown

Encoding UTF-8

LazyLoad yes

LazyData yes

RoxygenNote 7.0.2

NeedsCompilation no

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R topics documented:

casedat	*casedat*

Description

Data

Usage

casedat

Format

This data is from Walker and Kadlec, "A Model for Simulating Phosphorus Concentrations in Waters & Soils Downstream of Everglades Stormwater Treatment Areas", prepared for US Dept of the Interior, August 1996.

- case.number Index value unique for each case
- STA.Name The name of the Stormwater Treatment Area (STA) where this data originated.
- Receiving.Area The area which this STA discharges.
- Start.Discharge The year which this particular STA began discharge operations.
- STA.outflow.TPconc Outflow total phosphorus concentration (in ug L-1; mirograms per liter) for this STA.
- STA.outflow.vol Annual outflow discharge volume (in x1000 Acre-Feet Year-1) for this STA.
- FlowPath.width The width of the downstream flow path (in kilometers).
- Hydroperiod Average hydroperiod (time above ground surface) of the downstream system (in percent).
- Soil.Depth Depth of soil (in centimeters).
- Soil.BulkDensity.initial The initial bulk density prior to dicharge of the soil downstream of the system (in g cm-3).
- Soil.TPConc.initial The initial total phosphorus concentration of soil prior to discharge downstream of the system (in mg kg-1).
- Vertical.soilTPGradient.initial The soil total phosphorus concentration gradient prior to dischage downstream of the system (in mg cm-3 cm-1).
- Soil.BulkDensity.final The final bulk density after dischage of the soil downstream of the system (in g cm-3).
- PSettlingRate The phosphorus settling rate estimated from steady-state conditions (m Year-1).
- P.AtmoDep Phosphorus atmospheric depostition loading rate (in mg m-2 Year-1).
- Rainfall Annual accumulated rainfall estimate (m Year-1).
- ET Annual evapotranspiration estimate (m Year-1).

Source

<http://www.wwwalker.net/epgm/>

EPGMProfile   *Distance Profile*

Description

This function runs the EPGM model for a specific simulated period. The model is based primarily upon data collected in the early 1990's along the phosphorus gradient in WCA-2A. Substantial additional data collected since then in WCA-2A and other locations indicate a need to recalibrate the model and potentially revise its structure. Recent data suggest, for example, that the relationship between cattail density and soil P needs recalibration and that actual soil P thresholds for biological impacts are probably lower than reflected in the original calibrations. There are also issues relating to interpretation of and potential anomalies in the historical soil P calibration data attributed to variations in soil core collection method and definition of the soil/water interface (inclusion vs. exclusion of floc layer). There are also indications in the recent data of biologically-mediated vertical transport and/or mixing that are not reflected in the current model structure.

Usage

```
EPGMProfile(
  case.no = NA,
  Start.Discharge = NA,
  STA.outflow.TPconc = NA,
  STA.outflow.vol = NA,
  FlowPath.width = NA,
  Hydroperiod = NA,
  Soil.Depth = NA,
  Soil.BulkDensity.initial = NA,
  Soil.TPConc.initial = NA,
  Vertical.SoilTPGradient.initial = NA,
  Soil.BulkDensity.final = NA,
  PSettlingRate = NA,
  P.AtmoDep = NA,
  Rainfall = NA,
  ET = NA,
  Yr.Display = 30,
  Max.Yrs = 200,
  Max.Dist = 15,
  Dist.increment.km = 0.1,
  plot.profile = TRUE,
  raw.output = FALSE,
  results.table = TRUE,
  summary.distance = c(0, 0.5, 1, 2, 4, 8, 10)
)
```

Arguments

`case.no`	Case number from the pre-loaded example data (values ranges from 1 to 12)
`Start.Discharge`	
	The year which this particular STA began discharge operations.
`STA.outflow.TPconc`	
	Outflow total phosphorus concentration (in ug L-1; micrograms per liter) for this STA.
`STA.outflow.vol`	
	Annual outflow discharge volume (in x1000 Acre-Feet Year-1) for this STA.
`FlowPath.width`	The width of the downstream flow path (in kilometers).
`Hydroperiod`	Average hydroperiod (time above ground surface) of the downstream system (in percent).
`Soil.Depth`	Depth of soil (in centimeters).
`Soil.BulkDensity.initial`	
	The initial bulk density prior to dicharge of the soil downstream of the system (in g cm-3).
`Soil.TPConc.initial`	
	The initial total phosphorus concentration of soil prior to discharge downstream of the system (in mg kg-1).
`Vertical.SoilTPGradient.initial`	
	The soil total phosphorus concentration gradient prior to dischage downstream of the system (in mg cm-3 cm-1).
`Soil.BulkDensity.final`	
	The final bulk density after dischage of the soil downstream of the system (in g cm-3).
`PSettlingRate`	The phosphorus settling rate estimated from steady-state conditions (m Year-1).
`P.AtmoDep`	Phosphorus atmospheric depostition loading rate (in mg m-2 Year-1).
`Rainfall`	Annual accumulated rainfall estimate (m Year-1).
`ET`	Annual evapotranspiration estimate (m Year-1).
`Yr.Display`	Output displays results for this time (years)
`Max.Yrs`	Maximum number of years simulated
`Max.Dist`	Maximum ditance plotted, default is 50 km
`Dist.increment.km`	
	Distance increment modeled
`plot.profile`	If TRUE base plot will be generate with water column distance, soil distance and cattail distance profiles.
`raw.output`	If TRUE a `data.frame` will be printed with all calculations used to estimate various parameters.Default is set to FALSE.
`results.table`	if TRUE summary results table will be printed in the console. Default is set to TRUE.
`summary.distance`	
	Default is `c(0,0.5,1,2,4,8,10)` but can be changed. Values determine what distances will be included in the summary table.

Details

As described in the original documentation, the model is designed to simulate marsh enrichment (responses to increasing P load), not recovery (responses to decreasing in load).

Value

This function computes and plots the distance profile along the gradient based on input values

Examples

```
EPGMProfile(case.no=11)

EPGMProfile(NA,1991,38,526,15.3,50,10,0.05,257,-0.004,0.04,15.2,45,1.3,1.4)
```

EPGMThreshold   *Threshold Evaluation*

Description

This function evaluates results of the EPGM model over a simulated period relative to ecological or regulatory thresholds.

Usage

```
EPGMThreshold(
  time.dat,
  WaterColumn.Thresholds = c(10, 15, 20),
  Soil.Thresholds = c(500, 600, 1000),
  cattail.Thresholds = c(5, 20, 90),
  plot.exceed = TRUE,
  raw.area.output = FALSE,
  results.area.table = TRUE
)
```

Arguments

time.dat   a data.frame, the raw output from EPGMTime (when raw.time.output=TRUE).

WaterColumn.Thresholds
                  a list of three water column total phosphorus thresholds to evaluate time output.

Soil.Thresholds
                  a list of three soil total phosphorus thresholds to evaluate time output.

cattail.Thresholds
                  a list of three cattail density thresholds to evaluate time output.

plot.exceed   If TRUE base plot will be generate with water column, soil and cattail area exceeded plots.

raw.area.output

> If TRUE a data.frame will be printed with all area exceedances calculated for each time step.Default is set to FALSE.

results.area.table

> If TRUE a summary results table will be printed in the console. Default is set to TRUE.

Details

As described in the original documentation, the model is designed to simulate marsh enrichment (responses to increasing P load), not recovery (responses to decreasing in load).

Value

This function computes and plots the distance profile along the gradient based on input values

Examples

```
example<-EPGMTime(case.no=11,raw.time.output=TRUE)
EPGMThreshold(example)

#END
```

EPGMTime   *Time Profile*

Description

This function runs the EPGM model over a simulated period. The model is based primarily upon data collected in the early 1990's along the phosphorus gradient in WCA-2A. Substantial additional data collected since then in WCA-2A and other locations indicate a need to recalibrate the model and potentially revise its structure. Recent data suggest, for example, that the relationship between cattail density and soil P needs recalibration and that actual soil P thresholds for biological impacts are probably lower than reflected in the original calibrations. There are also issues relating to interpretation of and potential anomalies in the historical soil P calibration data attributed to variations in soil core collection method and definition of the soil/water interface (inclusion vs. exclusion of floc layer). There are also indications in the recent data of biologically-mediated vertical transport and/or mixing that are not reflected in the current model structure.

Usage

```
EPGMTime(
  case.no = NA,
  Start.Discharge = NA,
  STA.outflow.TPconc = NA,
  STA.outflow.vol = NA,
  FlowPath.width = NA,
  Hydroperiod = NA,
```

```
    Soil.Depth = NA,
    Soil.BulkDensity.initial = NA,
    Soil.TPConc.initial = NA,
    Vertical.SoilTPGradient.initial = NA,
    Soil.BulkDensity.final = NA,
    PSettlingRate = NA,
    P.AtmoDep = NA,
    Rainfall = NA,
    ET = NA,
    Dist.Display = 12,
    Dist.slice = c(0, 0.5, 1, 2, 5, 10),
    Max.Yrs = 200,
    Max.Dist = 15,
    Time.increment.yr = 5,
    Dist.increment.km = 0.1,
    plot.profile = TRUE,
    raw.time.output = FALSE,
    results.time.table = TRUE
)
```

Arguments

case.no   Case number from the pre-loaded example data (values ranges from 1 to 12)

Start.Discharge

The year which this particular STA began discharge operations.

STA.outflow.TPconc

Outflow total phosphorus concentration (in ug L-1; micrograms per liter) for this STA.

STA.outflow.vol

Annual outflow discharge volume (in x1000 Acre-Feet Year-1) for this STA.

FlowPath.width   The width of the downstream flow path (in kilometers).

Hydroperiod   Average hydroperiod (time above ground surface) of the downstream system (in percent).

Soil.Depth   Depth of soil (in centimeters).

Soil.BulkDensity.initial

The initial bulk density prior to dicharge of the soil downstream of the system (in g cm-3).

Soil.TPConc.initial

The initial total phosphorus concentration of soil prior to discharge downstream of the system (in mg kg-1).

Vertical.SoilTPGradient.initial

The soil total phosphorus concentration gradient prior to dischage downstream of the system (in mg cm-3 cm-1).

Soil.BulkDensity.final

The final bulk density after dischage of the soil downstream of the system (in g cm-3).

PSettlingRate	The phosphorus settling rate estimated from steady-state conditions (m Year-1).
P.AtmoDep	Phosphorus atmospheric depostition loading rate (in mg m-2 Year-1).
Rainfall	Annual accumulated rainfall estimate (m Year-1).
ET	Annual evapotranspiration estimate (m Year-1).
Dist.Display	Output display result for this distance
Dist.slice	A list of distances to disply parameters in a time series plot if `plot.profile` is TRUE.
Max.Yrs	Maximum number of years simulated
Max.Dist	Maximum ditance plotted, default is 50 km
Time.increment.yr	
	Year increment to be modeled
Dist.increment.km	
	Distance increment modeled
plot.profile	If TRUE base plot will be generate with water column distance, soil distance and cattail distance profiles.
raw.time.output	
	If TRUE a `data.frame` will be printed with all calculations used to estimate various parameters.Default is set to FALSE.
results.time.table	
	If TRUE a summary results table will be printed in the console. Default is set to TRUE.

Details

As described in the original documentation, the model is designed to simulate marsh enrichment (responses to increasing P load), not recovery (responses to decreasing in load).

Value

This function computes and plots the distance profile along the gradient based on input values

Examples

```
EPGMTime(case.no=11)
```

Index