Package 'EPGMr'

October 12, 2022

Type Package

Title Implementation of the Everglades Phosphorus Gradient Model

Version 1.0.0

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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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Repository CRAN

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R topics documented:

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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)
```

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