Package 'ecoval'

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Type Package

Title Procedures for Ecological Assessment of Surface Waters

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Description Functions for evaluating and visualizing ecological assessment procedures for surface waters containing physical, chemical and biological assessments in the form of value functions.

License GPL-3

Depends R (>= 3.5.0), utility, rivernet, jpeg, fs

LazyData true

NeedsCompilation no

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Contents

`ecoval-package` *Procedures for the Ecological Assessment of Surface Waters*

Description

Functions for evaluating and visualizing ecological assessment procedures for surface waters.

Functions to generate branches (modules) of the assessment value function:

Swiss river assessment program and individual modules (MSK, https://modul-stufen-konzept.ch):

`msk.create`,
`msk.morphol.1998.create`,

msk.hydrol.2011.create,
msk.physapp.2007.create,
msk.nutrients.2010.create,
msk.diatoms.2007.create,
msk.invertebrates.2010.create,
msk.fish.2004.create,
msk.macrophytes.2017.create.

Additional modules in the evaluation state:

val.pesticides.create,
val.micropoll.create,
val.heavymetals.create,
val.spear.create,

val.invertebrates.create,

Integrative assessment value function considering modules of the Swiss assessment program and modules at the evaluation stage:

ecoval.river.create,

Moduls of the Swiss lake assessment program (see https://modul-stufen-konzept.ch):

lake.morphol.2016.create,

Node names, attribute names and identifiers for attribute levels (if not numeric) can be translated into different languages. See:

ecoval.dict,
ecoval.translate,
ecoval.dictionaries.default,

Details

Package:	ecoval
Type:	Package
Version:	1.2.10
Date:	2025-11-19
License:	GPL-3
Depends:	utility, rivernet, jpeg

Author(s)

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Maintainer: Nele Schuwirth <nele.schuwirth@eawag.ch>

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007.

https://modul-stufen-konzept.ch

See Also

utility.

Examples

```
# creation of individual modules:

morphol <- msk.morphol.1998.create()
plot(morphol)

hydrol <- msk.hydrol.2011.create()
plot(hydrol)

physapp <- msk.physapp.2007.create()
plot(physapp)

nutrients <- msk.nutrients.2010.create()
plot(nutrients)

micropoll <- val.micropoll.create()
plot(micropoll)

heavymetals <- val.heavymetals.create()
plot(heavymetals)
```

```
spear <- val.spear.create()
plot(spear)

diatoms <- msk.diatoms.2007.create()
plot(diatoms)

invertebrates <- msk.invertebrates.2010.create()
plot(invertebrates)

fish <- msk.fish.2004.create()
plot(fish)

# creation of three versions of assessment programs:

msk <- msk.create(language="EnglishNodes",col="blue")
plot(msk)
plot(msk,with.attrib=FALSE)

ecoval <- ecoval.river.create(language="EnglishNodes",col="red")
plot(ecoval)
plot(ecoval,with.attrib=FALSE)

beetles_richness <- utility.endnode.parfun1d.create(name.node   = "richness",
                                                    name.attrib = "gb_richness",
                                                    range       = c(0,1),
                                                    name.fun    = "utility.fun.exp",
                                                    par         = c(2,0,1),
                                                    utility     = FALSE)
beetles_concordance <- utility.endnode.parfun1d.create(name.node   = "concordance",
                                                       name.attrib = "gb_concordance",
                                                       range       = c(0,1),
                                                       name.fun    = "utility.fun.exp",
                                                       par         = c(1,0,1),
                                                       utility     = FALSE)
beetles <-utility.aggregation.create(name.node = "ground beetles",
                                     nodes    = list(beetles_richness,beetles_concordance),
                                        name.fun  = "utility.aggregate.add",
                                        par       = c(0.5,0.5))

ecoval2 <- ecoval.river.create(phys     = list(msk.morphol.1998.create),
                               chem     = list(msk.nutrients.2010.create,
                                               val.pesticides.create,
                                               val.heavymetals.create),
                               biol     = list(msk.invertebrates.2010.create,
                                               msk.fish.2004.create,
                                               beetles),
                               language = "EnglishNodes")
plot(ecoval2)
plot(ecoval2,with.attrib=FALSE)
```

---

ecoval.dict *Extracts a Single Dictionary from a Table of Dictionaries*

Description

Extracts a dictionary column from a matrix or data frame of dictionaries (translated words) with the languages provided by the column names and the words in the original language provided in the first column.

Usage

```
ecoval.dict(language,dictionaries=NA)
```

Arguments

`language`	A single word specifying the desired language.
`dictionaries`	Matrix or data frame of dictionaries with the languages provided by the column names and the original words provided in the first column. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.

Value

Vector of translated words labelled by the words in the original language.

See Also

`ecoval.translate`.

`ecoval.dictionaries.default` *Default Dictionaries for Nodes, Attributes and Attribute Levels*

Description

Default dictionaries for nodes, attributes and attribute levels.

`ecoval.plotsymbols` *Plot valuations of different sub-objectives as pie charts.*

Description

A function to add a plot with valuations of different sub-objectives as a pie chart to an existing plot e.g. with the river network.

Usage

```
ecoval.plotsymbols(nodes,x,y,r,u,
                   square     = F,
                   labels     = NA,
                   col        = utility.calc.colors(),
                   pos.legend = NA,
                   cex.nodes  = 1)
```

Arguments

nodes	Nodes of a value function, which should be plotted as pie chart.
x	Vector with x-coordinates for the pie charts.
y	Vector with y-coordinates for the pie charts.
r	Radius of the pie chart.
u	Dataframe or matrix with values between 0 and 1 corresponding to the valuation of the nodes with rows for the different pie charts and columns for each node. The column names have to be identical to the nodes.
square	Logical value, if true the diagram is plotted as square, if false as pie chart.
labels	Labels for the pie charts that are plotted close to the chart.
col	Colour-coding that transforms the numerical values of u into a color. Default is a plot-function from the utility package "utility.calc.colors()" with the following color-classes: 0-0.2 red, 0.2-0.4 orange, 0.4-0.6 yellow, 0.6-0.8 green, 0.8-1 blue.
pos.legend	Vector with x and y-coordinates of the legend.
cex.nodes	A numerical value giving the amount by which plotting text of the legend and the labels should be magnified relative to the default.

References

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Baumann P., Langhans S.D. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Synthese der Beurteilungen auf Stufe F (flaechendeckend). Umwelt-Vollzug Nr. Bundesamt fuer Umwelt, Bern: 47 S.

https://modul-stufen-konzept.ch

See Also

utility, rivernet.

Examples

```
plot(1, type="n",axes=FALSE,ann=FALSE,xlim=c(0, 10),ylim=c(0, 10))
u1 <- matrix(data=c(0.1,0.5,1,0.3,0.4,0.7),nrow=2,
             dimnames=list(c(NA,NA),c("morphology","hydrology","nutrients")))

ecoval.plotsymbols(nodes      = c("morphology","hydrology","nutrients"),
                   x          = c(1,2),
                   y          = c(7,8.5),
                   r          = 0.5,
                   u          = u1,
                   col        = utility.calc.colors(),
                   pos.legend = c(7,8.5),
                   cex.nodes  = 1)

u2 <- matrix(data=c(0.1,0.25,0.75,0.6),nrow=1,
             dimnames=list(NA,c("fish","algae","invertebrates","macrophytes")))

ecoval.plotsymbols(nodes      = c("fish","algae","invertebrates","macrophytes"),
                   x          = 1.5,
                   y          = 3,
                   r          = 0.5,
                   u          = u2,
                   square     = TRUE,
                   col        = utility.calc.colors(),
                   pos.legend = c(7,3),
                   cex.nodes  = 1)
```

`ecoval.river.create` *Creates a Value Function for Ecological River Assessment*

Description

Creates a value function for ecological river assessment based on physical, chemical and biological sub-objectives.

Usage

```
ecoval.river.create(phys = list(msk.morphol.1998.create,
                                msk.physapp.2007.create),
                    physagg      = "utility.aggregate.addmin",
                    physpar      = numeric(0),
                    chem         = list(msk.nutrients.2010.create,
                                        val.micropoll.create,
                                        val.heavymetals.create),
                    chemagg      = "utility.aggregate.addmin",
                    chempar      = numeric(0),
                    biol         = list(msk.diatoms.2007.create,
                                        val.invertebrates.create,
```

```
                        msk.fish.2004.create),
biolagg      = "utility.aggregate.addmin",
biolpar      = numeric(0),
ecolagg      = "utility.aggregate.addmin",
ecolpar      = numeric(0),
language     = "English",
dictionaries = NA,
col          = "black")
```

Arguments

phys	List containing either functions to create branches of the value function or already branches of value functions corresponding to physical sub-objectives. These branches (produced by the function or given directly) must be in the form of a value function definition as provided by the package utility.
physagg	Name of the function to be used for aggregating the value function branches specified in the argument phys.
physpar	Vector of parameters (often weights) provided to the aggregation function (provided by the argument physagg).
chem	List containing either functions to create branches of the value function or already branches of value functions corresponding to chemical sub-objectives. These branches (produced by the function or given directly) must be in the form of a value function definition as provided by the package utility.
chemagg	Name of the function to be used for aggregating the value function branches specified in the argument chem.
chempar	Vector of parameters (often weights) provided to the aggregation function (provided by the argument chemagg).
biol	List containing either functions to create branches of the value function or already branches of value functions corresponding to biological sub-objectives. These branches (produced by the function or given directly) must be in the form of a value function definition as provided by the package utility.
biolagg	Name of the function to be used for aggregating the value function branches specified in the argument biol.
biolpar	Vector of parameters (often weights) provided to the aggregation function (provided by the argument biolagg).
ecolagg	Name of the function to be used to aggregate the physical, chemical, and biological values.
ecolpar	Parameter vector passed to the function specified under ecolpar.
language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.
col	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

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See Also

utility.

Examples

```
ecol <- ecoval.river.create()
plot(ecol)
ecol.german <- ecoval.river.create(language="Deutsch")
plot(ecol.german)
```

---

ecoval.translate *Translates a Word Given a Dictionary*

Description

Translates a word given as the first argument using a dictionary provided as the second argument of the function. The dictionary consists of a character vector of translated words labelled by the words in the original language. If no translation is found, the given word in the original language is returned.

Usage

```
ecoval.translate(word,dictionary)
```

Arguments

word	A single word to be translated.
dictionary	Vector of translated words labelled by the words in the original language.

Value

The function returns the translated word.

See Also

ecoval.dict.

Examples

```
ecoval.translate("x",c(x="X",y="Y",z="Z"))
```

---

lake.morphol.2016.aggregate.val.spatial

Aggregate valuations along a single spatial dimension.

Description

Aggregate valuations of different lake shore sections along a single spatial dimension according to an arbitrarily defined grid.

Usage

```
lake.morphol.2016.aggregate.val.spatial(u,breakpoints)
```

Arguments

u	Data frame with calculated values for nodes (columns) and different shore sections (rows). The row labels are assumed to contain the spatial information as a string in the format `id | start - end` where `id` is the id of the lake, `start` is the start coordinate of the section along the shore line, and `end` is the end coordinate along the shore line. The first part, `id |` , is optional and can be omitted if the data is from a unique length measurement (of a single lake). Single spaces between the items are required. Note that this format is produced automatically when reading attributes with the function lake.morphol.2016.read.attrib and is then transferred to the values file when evaluating the value function.
breakpoints	For a single lake id, a vector of breakpoints that define the intervals to which the values are aggregated. For multiple lakes, a list of such vectors with as many elements and in the same order as the lake ids in the data frame provided with the argument `u`.

Details

Aggregation is done by length-weighted averaging of the values at each level of the objectives hierarchy. Note that this leads to an valuation result that is not compatible with the original value function (valuations of end nodes and aggregated nodes) across the objective hierarchy. Nevertheless, this seems to be the most meaningful aggregation as we cannot average discrete, non-numeric attributes and then re-calculate the corresponding values.

Value

A data frame of the same format as the argument u with the aggregated values.

Author(s)

Peter Reichert <peter.reichert@eawag.ch>

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

https://modul-stufen-konzept.ch

Niederberger, K., Rey, P., Reichert, P., Schlosser, J., Helg, U., Haertel-Borer, S., Binderheim, E. Methoden zur Untersuchung und Beurteilung der Seen. Modul: Oekomorphologie Seeufer. Bundesamt fuer Umwelt, Bern. Umwelt-Vollzug Nr. 1632. 73 S. 2016. http://www.bafu.admin.ch/uv-1632-d

Schlosser, J.A., Haertel-Borer, S., Liechti, P., Reichert, P. Konzept fuer die Untersuchung und Beurteilung der Seen in der Schweiz. Anleitung zur Entwicklung und Anwendung von Beurteilungsmethoden. Bundesamt fuer Umwelt, Bern. Umwelt-Wissen Nr. 1326. 38 S. 2013. http://www.bafu.admin.ch/uw-1326-d

See Also

lake.morphol.2016.create, lake.morphol.2016.read.attrib, lake.morphol.2016.plot.val.spatial.

---

lake.morphol.2016.create

Creates a Value Function for Lake Shore Morphology

Description

Creates a value function for lake shore morphology based on the Swiss concept for lake assessment.

Usage

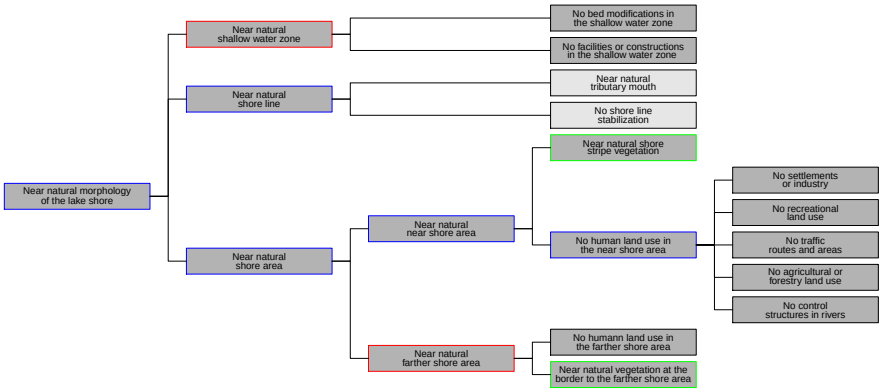
```
lake.morphol.2016.create(language     = "English",
                         dictionaries = NA,
                         col          = NA)
```

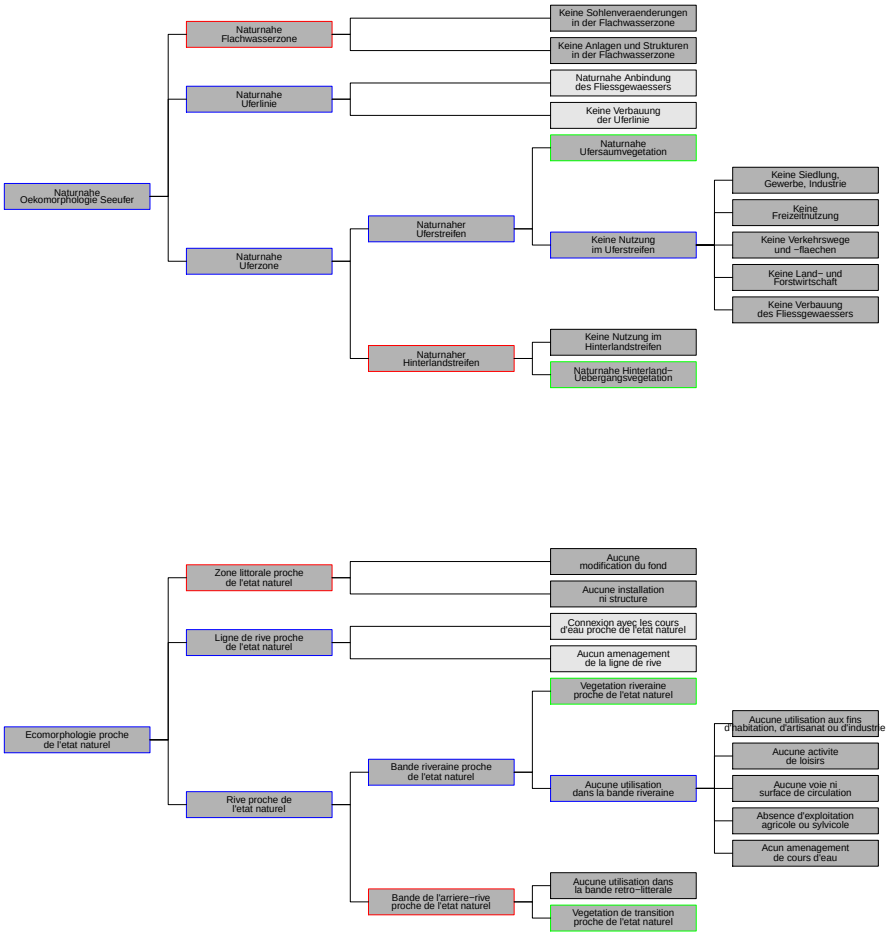
Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.
col	Color of bounding boxes in objectives hierarchy.

Details

The following figures show the objectives hierarchy for lake shore morpholgy assessment in English, German and French, as produced by the plot commands shown below:





Value

The function returns the value function as a class `utility`.

Author(s)

Peter Reichert <peter.reichert@eawag.ch>

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

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Niederberger, K., Rey, P., Reichert, P., Schlosser, J., Helg, U., Haertel-Borer, S., Binderheim, E. Methoden zur Untersuchung und Beurteilung der Seen. Modul: Oekomorphologie Seeufer. Bundesamt fuer Umwelt, Bern. Umwelt-Vollzug Nr. 1632. 73 S. 2016. http://www.bafu.admin.ch/uv-1632-d

Schlosser, J.A., Haertel-Borer, S., Liechti, P., Reichert, P. Konzept fuer die Untersuchung und Beurteilung der Seen in der Schweiz. Anleitung zur Entwicklung und Anwendung von Beurteilungsmethoden. Bundesamt fuer Umwelt, Bern. Umwelt-Wissen Nr. 1326. 38 S. 2013. http://www.bafu.admin.ch/uw-1326-d

See Also

lake.morphol.2016.read.attrib, lake.morphol.2016.plot.val.spatial, lake.morphol.2016.aggregate.val.spa

Examples

```
morphol <- lake.morphol.2016.create()
plot(morphol,two.lines=TRUE)
morphol.german <- lake.morphol.2016.create("Deutsch")
plot(morphol.german,two.lines=TRUE)
morphol.french <- lake.morphol.2016.create("Francais")
plot(morphol.french,two.lines=TRUE)
```

---

lake.morphol.2016.plot.val.spatial

Plots valuations along a single spatial dimension.

Description

Plots valuations of different lake shore sections as a line along a single spatial dimension.

Usage

```
lake.morphol.2016.plot.val.spatial(u,
                                   uref      = NA,
                                   nodes     = NA,
                                   main      = "",
                           col     = c("red","orange","yellow","green","blue"),
                                   gridlines = FALSE,
                                   ...)
```

Arguments

u	Data frame with calculated values for nodes (columns) and different shore sections (rows). The row labels are assumed to contain the spatial information as a string in the format `id | start - end` where `id` is the id of the lake, `start` is the start coordinate of the section along the shore line, and `end` is the end coordinate along the shore line. The first part, `id |` , is optional and can be omitted if the data is from a unique length measurement (of a single lake). Single spaces between the items are required. Note that this format is produced automatically when reading attributes with the function `lake.morphol.2016.read.attrib` and is then transferred to the values file when evaluating the value function.
uref	(optional) a second value table to compared with the one provided with the argument `u`. This can represent a different aggregation scheme or the effect of a rehabilitation measure.
nodes	(optional) a vector of node names to be plotted (in the order provided here). Default is to plot all nodes.
main	(optional) a header written to the top of the plot combined with the lake id if one was provided (see discussion of argument `u`).
col	(optional) an optional color coding for the lines to be plotted.
gridlines	(optional) a logical variable to specify whether gridlines should mark the start and end points of the sections.
...	(optional) further plot parameters are forwarded to the plot command (e.g `lwd` for line width).

Value

The function returns a data frame with start and end of the reaches in the first two columns and the attribute levels in subsequent columns.

Author(s)

Peter Reichert <peter.reichert@eawag.ch>

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

https://modul-stufen-konzept.ch

Niederberger, K., Rey, P., Reichert, P., Schlosser, J., Helg, U., Haertel-Borer, S., Binderheim, E. Methoden zur Untersuchung und Beurteilung der Seen. Modul: Oekomorphologie Seeufer. Bundesamt fuer Umwelt, Bern. Umwelt-Vollzug Nr. 1632. 73 S. 2016. http://www.bafu.admin.ch/uv-1632-d

Schlosser, J.A., Haertel-Borer, S., Liechti, P., Reichert, P. Konzept fuer die Untersuchung und Beurteilung der Seen in der Schweiz. Anleitung zur Entwicklung und Anwendung von Beurteilungsmethoden. Bundesamt fuer Umwelt, Bern. Umwelt-Wissen Nr. 1326. 38 S. 2013. http://www.bafu.admin.ch/uw-1326-d

See Also

lake.morphol.2016.create, lake.morphol.2016.read.attrib, lake.morphol.2016.aggregate.val.spatial.

---

lake.morphol.2016.read.attrib

Reads attributes with different segmentation.

Description

Reads individual attributes with different segmentation and combines them to a data frame with unified segmentation.

Usage

```
lake.morphol.2016.read.attrib(directory    = ".",
                              language     = "English",
                              dictionaries = NA,
                              attrib.names = NA,
                              col.names    = NA)
```

Arguments

`directory`	(optional) Directory from which the files are read. The directory must contain the data files, one file per attribute. The file names must start with the attribute names as given by the argument `attrib.names` and they must contain the columns as specified by the argument `col.names`. The file format must be comma-separated text with the first row containing the headers as specified by the argument `col.names` and subsequent rows the corresponding data. The files may contain additional columns that will be ignored.
`language`	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
`dictionaries`	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.
`attrib.names`	(optional) Names of the attributes. These should match first characters of the names of the files that provide the corresponding data. NA indicates that the attribute names are taken from the dictionary. Order of the names is E01, E02, B02, B01, C06, C01, C02, C03, C04, C05, D01, D02.
`col.names`	(optional) Names of the columns to be read from the individual attribute files. The first three elements must be present and represent the columns containing the start and end point of the reach (one dimenstional length measure along the shoreline) and the corresponding attribute level. The fourth element represents an optional id to distinguish different lakes or shoreline measures (for the same id, the lenght measure used to characterize start and end of a reach must be unique). This element can be missing or NA; both indicates a unique lenght measure across all records. Further column names can be provided and are interpreted as comments. These are merged to a single string when compiling the output data frame. `col.names = NA` indicates that the names form the dictionary are used.

Value

The function returns a data frame with start and end of the reaches in the first two columns and the attribute levels in subsequent columns.

Author(s)

Peter Reichert <peter.reichert@eawag.ch>

References

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https://modul-stufen-konzept.ch

Niederberger, K., Rey, P., Reichert, P., Schlosser, J., Helg, U., Haertel-Borer, S., Binderheim, E. Methoden zur Untersuchung und Beurteilung der Seen. Modul: Oekomorphologie Seeufer. Bundesamt fuer Umwelt, Bern. Umwelt-Vollzug Nr. 1632. 73 S. 2016. http://www.bafu.admin.ch/uv-1632-d

Schlosser, J.A., Haertel-Borer, S., Liechti, P., Reichert, P. Konzept fuer die Untersuchung und Beurteilung der Seen in der Schweiz. Anleitung zur Entwicklung und Anwendung von Beurteilungsmethoden. Bundesamt fuer Umwelt, Bern. Umwelt-Wissen Nr. 1326. 38 S. 2013. http://www.bafu.admin.ch/uw-1326-d

See Also

lake.morphol.2016.create, lake.morphol.2016.plot.val.spatial, lake.morphol.2016.aggregate.val.spatial.

`msk.create` *Creates a Value Function for Ecological River Assessment*

Description

Creates a value function for ecological river assessment based on the Swiss modular concept for stream assessment, level I (Regional survey).

Usage

```
msk.create(language         = "English",
           dictionaries     = NA,
           col              = "black",
           modify.nutrients = F)
```

Arguments

`language`	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.

`dictionaries` Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.

`col` Color of bounding boxes in objectives hierarchy.

`modify.nutrients` A logical value indicating whether to use a modified version of the value functions for NO2 and NH4 or the original method in the nutrients branch.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

https://modul-stufen-konzept.ch

See Also

utility.

Examples

```
ecol <- msk.create()
plot(ecol)
ecol.german <- msk.create(language="Deutsch")
plot(ecol.german)
```

`msk.diatoms.2007.create` *Creates a Value Function for River Diatoms*

Description

Creates a value function for river diatoms based on the Swiss modular concept for stream assessment, level I (Regional survey) from 2007.

Usage

```
msk.diatoms.2007.create(language     = "English",
                        dictionaries = NA,
                        col          = "black")
```

Arguments

`language`	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
`dictionaries`	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.
`col`	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22,

188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

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See Also

utility.

Examples

```
diatoms <- msk.diatoms.2007.create()
plot(diatoms)
diatoms.german <- msk.diatoms.2007.create("Deutsch")
plot(diatoms.german)
```

---

msk.fish.2004.create *Creates a Value Function for River Fish*

Description

Creates a value function for river fish based on the Swiss modular concept for stream assessment, level I (Regional survey) from 2004.

Usage

```
msk.fish.2004.create(language     = "English",
                     dictionaries = NA,
                     col          = "black")
```

Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.
col	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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See Also

utility.

Examples

```
fish <- msk.fish.2004.create()
plot(fish)
fish.german <- msk.fish.2004.create("Deutsch")
plot(fish.german)
```

`msk.hydrol.2011.aggregate`

Aggregation function of the hydrology module of the Swiss modular concept for stream assessment, level I (Regional survey) from 2011.

Description

Aggregates the values of the 9 sub-objectives at the second-highest aggregation level of the hydrology module of the Swiss River Assessment Program MSK (2011).

Usage

```
msk.hydrol.2011.aggregate(u,
                          par = NA)
```

Arguments

u	Numerical vector of length 9 containing the values that quantify the degree of fulfillment of the 9 sub-objettives.
par	Argument added for consistency with the other aggregation procedures. No parameters are needed.

Value

The function returns the aggregated value.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

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See Also

msk.hydrol.2011.create, utility.

Examples

```
hydrol <- msk.hydrol.2011.create()
plot(hydrol)
hydrol.german <- msk.hydrol.2011.create("Deutsch")
plot(hydrol.german)
```

`msk.hydrol.2011.create`

Creates a Value Function for River Hydrology

Description

Creates a value function for river hydrology based on the Swiss modular concept for stream assessment, level I (Regional survey) from 2011.

Usage

```
msk.hydrol.2011.create(language     = "English",
                       dictionaries = NA,
                       col          = "black")
```

Arguments

`language`	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
`dictionaries`	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.
`col`	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

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See Also

utility.

Examples

```
hydrol <- msk.hydrol.2011.create()
plot(hydrol)
hydrol.german <- msk.hydrol.2011.create("Deutsch")
plot(hydrol.german)
```

---

msk.invertebrates.2010.create

Creates a Value Function for River Invertebrates

Description

Creates a value function for river invertebrates based on the Swiss modular concept for stream assessment, level I (Regional survey) from 2010.

Usage

```
msk.invertebrates.2010.create(language     = "English",
                              dictionaries = NA,
                              col          = "black",
                              modify       = FALSE)
```

Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.

col	Color of bounding boxes in objectives hierarchy.
modify	Use the biological indicators Makroindex and IBGN in addition to IBCH. Default is False.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

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Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

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Stucki P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser - Makrozoobenthos Stufe F. Bundesamt fuer Umwelt, Bern. Umwelt-Vollzug Nr. 1026: 61 S. 2010. http://www.bafu.admin.ch/uv-1026-d

Indice Biologique Global Normalise IBGN, NF-T90-350. Guide Technique. Agences de l'Eau, 2000. https://hal.science/hal-00490432/document

See Also

utility.

Examples

```
invertebrates <- msk.invertebrates.2010.create()
plot(invertebrates)
invertebrates.german <- msk.invertebrates.2010.create("Deutsch")
plot(invertebrates.german)
```

`msk.macrophytes.2017.addminbonusmalus`
Aggregation technique for MSK module macrophytes

Description

Aggregation technique for MSK module macrophytes.

Usage

```
msk.macrophytes.2017.addminbonusmalus(u, par)
```

Arguments

u	numeric vector of values or utilities to be aggregated.
par	numeric vector with the following components (n is the number of elements to aggregate): par[1:n]: weights par[n+1]: weight of additive aggregation (weight of minimum aggregation is 1-par[n+1]) par[(n+2):(2*n+1)]: indicators -1: malus, +1 bonus, 0 addmin.

Value

The function returns the aggregated value or utility.

Author(s)

Peter Reichert <peter.reichert@eawag.ch>

`msk.macrophytes.2017.calc.types`
Function to calculate macrophyte river types for a given set of attributes.

Description

Function to calculate macrophyte river types for a given set of attributes.

Usage

```
msk.macrophytes.2017.calc.types(attrib,
                                sampsize     = 10000,
                                language     = "English",
                                dictionaries = NA)
```

Arguments

attrib	Data frame with river attributes.
sampsize	(optional) sample size for Monte Carlo calculation of probabilities of macrophyte river types (default is 10000).
language	(optional) language to be used to denote nodes, attributes and attribute levels. Must be a column name of the data frame provided by the argument dictionaries or of the default dictionaries data frame of the package if no data frame is provided under dictionaries.
dictionaries	(optional) data frame of dictionaries with the languages provided by the column names and the original keywords provided as the row names. If dictionaries is NA, the default dictionary ecoval.dictionaries.default is loaded.

Details

.

Value

The function returns a list with the following entries:
typedef: a list containing the details of the definition of macrophyte river types.
Important entries:
thresholds: nominal thresholds of the attributes used to classify rivers into macrophyte river types.
thresholds.indices: table of different combinations of lower and upper thresholds.
types: table of macrophyte river types corresponding to the combinations listed under thresholds.indices (three different levels of resolution: according to the river types scheme, used for valuation, and types for different growth forms).
thresholds.unc: definition of probability distributions used to characterize the uncertainty in the thresholds.
observations.unc: definition of probability distributions used to characterize the uncertainty in attributes.
attrib.types: data frame of attributes needed to calculate macrophyte river types. types.comb.obs: table of the row indices of the combinations according to typedef$thresholds.indices that corresponds to the observed river site attributes.
types.scheme.obs: table of the macrophyte river types according to the river types scheme that corresponds to the observed river site attributes.
types.fields.obs: table of the row and column indices of the river types scheme that corresponds to the observed river site attributes.

types.comb.probs: table of probabilities of the row indices of the combinations according to typedef$thresholds.indices that correspond to the river sites.
types.scheme.probs: table of probabilities of river types according to river types scheme that correspond to the river sites.
types.val.probs: table of probabilities of river types used for valuation that correspond to the river sites.
types.grfo.probs: table of probabilities of river growth form types that correspond to the river sites.
types.fields.probs: table of probabilities of row and column indices of the river types scheme

that correspond to the river sites.
`types.val.obs`: river types used for valuation.
`types.scheme.maxprob`: river types according to the river types scheme with maximum probability.
`types.val.maxprob`: river types used for valuation with maxiumum probability.
`types.table`: data frame of the most important results.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

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See Also

`msk.macrophytes.2017.create`, `utility`.

`msk.macrophytes.2017.create`
Creates a Value Function for River Macrophytes

Description

Creates a value function for river macrophytes based on the Swiss modular concept for stream assessment 2017.

Usage

```
msk.macrophytes.2017.create(language     = "English",
                            dictionaries = NA,
                            col          = "black")
```

Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.
col	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

Author(s)

Christian Michel <christian.michel@eawag.ch> and Peter Reichert <peter.reichert@eawag.ch>

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.read.compile.evaluate,
msk.macrophytes.2017.calc.types,
msk.macrophytes.2017.doc.site,
msk.macrophytes.2017.doc.typology,
msk.macrophytes.2017.doc.vegetation,
msk.macrophytes.2017.doc.valuation,
msk.macrophytes.2017.plot.typedef,
msk.macrophytes.2017.plot.types.scheme,
msk.macrophytes.2017.plot.types.grfo,
msk.macrophytes.2017.plot.hierarchy,

utility.

Examples

```
macrophytes <- msk.macrophytes.2017.create()
plot(macrophytes,two.lines=TRUE)
macrophytes.german <- msk.macrophytes.2017.create("Deutsch")
plot(macrophytes.german,two.lines=TRUE)
```

---

msk.macrophytes.2017.doc.site

Function to write site documentation.

Description

Function to write site documentation.

Usage

```
msk.macrophytes.2017.doc.site(res,row.no,pic.folder)
```

Arguments

res	results as provided by one of the functions msk.macrophytes.2017.calc.types or msk.macrophytes.2017.read.compile.evaluate.
row.no	row index of site to be plotted.
pic.folder	folder of site picture to be added to the site documentation.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.create, utility.

`msk.macrophytes.2017.doc.typology`

Function to write documentation of probabilities of macrophyte river types at a given site.

Description

Function to write documentation of probabilities of macrophyte river types at a given site.

Usage

```
msk.macrophytes.2017.doc.typology(res,row.no)
```

Arguments

res	results as provided by one of the functions msk.macrophytes.2017.calc.types or msk.macrophytes.2017.read.compile.evaluate.
row.no	row index of site to be plotted.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.create, utility.

`msk.macrophytes.2017.doc.valuation`

Function to write documentation of macrophytes valuation at a given site.

Description

Function to write documentation of macrophytes valuation at a given site.

Usage

```
msk.macrophytes.2017.doc.valuation(res,row.no)
```

Arguments

res	results as provided by the functions msk.macrophytes.2017.read.compile.evaluate.
row.no	row index of site to be plotted.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

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Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.create, utility.

`msk.macrophytes.2017.doc.vegetation`

Function to write documentation of vegetation at a given site.

Description

Function to write documentation of vegetation at a given site.

Usage

```
msk.macrophytes.2017.doc.vegetation(res,row.no)
```

Arguments

res	results as provided by the functions msk.macrophytes.2017.read.compile.evaluate.
row.no	row index of site to be plotted.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.create, utility.

`msk.macrophytes.2017.plot.hierarchy`

Function to plot the objectives hierarchy of the macrophyte assessment colored according the valuation.

Description

Function to plot the objectives hierarchy of the macrophyte assessment colored according the valuation.

Usage

```
msk.macrophytes.2017.plot.hierarchy(res,i,final=TRUE,...)
```

Arguments

res	results as provided by one of the functions msk.macrophytes.2017.calc.types or msk.macrophytes.2017.read.compile.evaluate.
i	row index of site to be plotted.
final	logical variable indicating whether to plot the final valuation or the valuation before plausibilization.
...	additional arguments are passed to the function plot.

Value

.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.create, utility.

`msk.macrophytes.2017.plot.typedef`
Function to visualize the uncertainties of the macrophyte river types definition.

Description

Function to visualize the uncertainties of the macrophyte river types definition.

Usage

```
msk.macrophytes.2017.plot.typedef(res.calc.types,max.x=NA,max.y=NA,...)
```

Arguments

`res.calc.types`	results as provided by one of the functions `msk.macrophytes.2017.calc.types` or `msk.macrophytes.2017.read.compile.evaluate`.
`max.x`	named vector of maxima for the extent of the x-axes of the plots (check names of variables from the plot with omitting this argument).
`max.y`	named vector of maxima for the extent of the y-axes of the plots (check names of variables from the plot with omitting this argument).
`...`	additional arguments are passed to the function `plot`.

Value

.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22,

188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.create, utility.

`msk.macrophytes.2017.plot.types.grfo`

Function to plot the probabilities of all macrophytes river types aggregated to growth form classes.

Description

Function to plot the probabilities of all macrophytes river types aggregated to growth form classes.

Usage

```
msk.macrophytes.2017.plot.types.grfo(res.calc.types,i,...)
```

Arguments

`res.calc.types`	results as provided by one of the functions `msk.macrophytes.2017.calc.types` or `msk.macrophytes.2017.read.compile.evaluate`.
`i`	row index of site to be plotted.
`...`	additional arguments are passed to the function `barplot`.

Value

.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013.

doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.create, utility.

`msk.macrophytes.2017.plot.types.scheme`

Function to plot the probabilities of all river types according to the type definition scheme.

Description

Function to plot the probabilities of all river types according to the type definition scheme.

Usage

```
msk.macrophytes.2017.plot.types.scheme(res.calc.types,i,cex=1,cex.labels=1,...)
```

Arguments

res.calc.types	results as provided by one of the functions msk.macrophytes.2017.calc.types or msk.macrophytes.2017.read.compile.evaluate.
i	row index of site to be plotted.
cex	scaling factor for font.
cex.labels	scaling factor for font of labels.
...	additional arguments are passed to the function plot.

Value

.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

msk.macrophytes.2017.create, utility.

`msk.macrophytes.2017.read.compile.evaluate`

Function to read and compile data for macrophyte and calculate river types and valuation.

Description

Function to read and compile data for macrophyte and calculate river types and valuation.

Usage

```
msk.macrophytes.2017.read.compile.evaluate(file.site,
                                           pic.folder        = ".",
                                           file.species      = NA,
                                           file.typeplaus    = NA,
                                           sampling.protocol = "v2018",
                                           sampsize          = 10000,
```

```
file.res          = NA,
file.doc          = NA,
file.taxa.used    = NA,
file.taxa.removed = NA,
file.check.msg    = NA,
sep               = "\t",
sep.in            = NA,
sep.out           = NA,
language          = "English",
dictionaries      = NA)
```

Arguments

file.site	name of text file with site characteristics.
pic.folder	(optional) name of folder to search for site pictures (pictures found will be displayed).
file.species	(optional) name of text file with species observations.
file.typeplaus	(optional) name of text file with plausibilized river types.
sampling.protocol	(optional) sampling protocol ("v2018" or "v2009").
sampsize	(optional) sample size for Monte Carlo calculation of probabilities of macrophyte river types (default is 10000).
file.res	Name of text file for results.
file.doc	Name of text file for documentation of sites.
file.taxa.used	(optional) name of text file for taxa used for assessment.
file.taxa.removed	(optional) name of text file for taxa that were removed because of insufficient determination or because they are not on the taxa list.
file.check.msg	(optional) name of text file for warnings and error messages from compilation of species data.
sep	Column separator for input and output text files (see also arguments sep.in and sep.out below).
sep.in	Column separator for input files (only needed if different for input and output files; default is the argument sep above).
sep.out	Column separator for output files (only needed if different for input and output files; default is the argument sep above).
language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.

Details

The tasks and ouput depends on the input provided. For `sampsize` = 0, only checking of the input files is done. For `sampsize` > 0, in addition, Monte Carlo simulation is done to get the probabilities of all river types. If the file `file.species` is provided (and `sampsize` > 0), in addition, the valuations of all sites are performed. If also the file `file.typeplaus` is provided, an additional valuation is calculated for the plausibilized river types. In addition to the list of outputs (see `Value`) the output is written to the text file `file.res` and to pdf site documentation files with names constructed from `file.doc` and the identifiers of the sites, if these file names are provided. In addition, diagnostics and error messages are written to the files `file.taxa.used`, `file.taxa.removed` and `file.check.msg`. See https://modul-stufen-konzept.ch for more details regarding the methodology.

Value

Named list of outputs dependent on tasks performed (see `Details`).

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

Kaenel, B., Michel, C., Reichert, P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser. Makrophyten - Stufe F (flaechendeckend) und Stufe S (systembezogen). Entwurf. Bundesamt fuer Umwelt, Bern. 119 S. 2017. https://modul-stufen-konzept.ch/

See Also

`msk.macrophytes.2017.create`, `utility`.

`msk.macrophytes.2017_ListTaxa`
Data frame containing the characteristics of the taxa to be considered for valuation.

Description

Data frame containing the characteristics of the taxa to be considered for valuation.

`msk.macrophytes.2017_RiverTypes_DefLimitsUnc`
Data frame containing the definition of uncertainty of attribute limits of river types.

Description

Data frame containing the definition of uncertainty of attribute limits of river types.

`msk.macrophytes.2017_RiverTypes_DefObsUnc`
Data frame containing the definition of observation uncertainty for river types.

Description

Data frame containing the definition of observation uncertainty for river types.

`msk.macrophytes.2017_RiverTypes_DefStruct`
Data frame containing the definition of the structure used for river types.

Description

Data frame containing the definition of the structure used for river types.

`msk.morphol.1998.aggregate` *Aggregation function of the highest node in the morphology module of the Swiss modular concept for stream assessment, level I (Regional survey) from 1998.*

Description

Aggregates the values of the 2 sub-objectives at the highest aggregation level of the morphology module of the Swiss River Assessment Program MSK (1998). If the river is covered, the value for morphology is zero, otherwise it has the value of the uncovered node.

Usage

```
msk.morphol.1998.aggregate(u,
                           par = NA)
```

Arguments

`u`	Numerical vector of length 2 containing the values that quantify the degree of fulfillment of the 2 sub-objettives.
`par`	Argument added for consistency with the other aggregation procedures. No parameters are needed.

Value

The function returns the aggregated value.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22,

188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

https://modul-stufen-konzept.ch

Huette, M. and Niederhauser P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser in der Schweiz: Oekomorphologie Stufe F. Mitteilungen zum Gewaesserschutz Nr. 27. Bundesamt fuer Umwelt, Wald und Landschaft, BUWAL, Bern. 1998. https://modul-stufen-konzept.ch/wp-content/uploads/2020/12/Modul-oekomorphologie-f_DE-2.pdf

See Also

msk.morphol.1998.create, utility.

Examples

```
morphol <- msk.morphol.1998.create()
plot(morphol)
morphol.german <- msk.morphol.1998.create("Deutsch")
plot(morphol.german)
```

---

msk.morphol.1998.create

Creates a Value Function for River Morphology

Description

Creates a value function for river morphology based on the Swiss modular concept for stream assessment, level I (Regional survey) from 1998.

Usage

```
msk.morphol.1998.create(language     = "English",
                        dictionaries = NA,
                        col          = "black")
```

Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.
col	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

Reichert, P., Schuwirth, N. and Langhans, S. Constructing, evaluating and visualizing value and utility functions for decision support, Environmental Modelling & Software 46, 283-291, 2013. doi:10.1016/j.envsoft.2013.01.017

Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

Reichert, P., Borsuk, M., Hostmann, M., Schweizer, S., Sporri, C., Tockner, K. and Truffer, B. Concepts of decision support for river rehabilitation, Environmental Modelling and Software 22, 188-201, 2007. doi:10.1016/j.envsoft.2005.07.017

https://modul-stufen-konzept.ch

Huette, M. and Niederhauser P. Methoden zur Untersuchung und Beurteilung der Fliessgewaesser in der Schweiz: Oekomorphologie Stufe F. Mitteilungen zum Gewaesserschutz Nr. 27. Bundesamt fuer Umwelt, Wald und Landschaft, BUWAL, Bern. 1998. https://modul-stufen-konzept.ch/wp-content/uploads/2020/12/Modul-oekomorphologie-f_DE-2.pdf

See Also

utility.

Examples

```
morphol <- msk.morphol.1998.create()
plot(morphol)
morphol.german <- msk.morphol.1998.create("Deutsch")
plot(morphol.german)
```

---

msk.nutrients.2010.create

Creates a Value Function for River Nutrients

Description

Creates a value function for river nutrients based on the Swiss modular concept for stream assessment, level I (Regional survey) from 2010.

Usage

```
msk.nutrients.2010.create(language     = "English",
                          dictionaries = NA,
                          col          = "black",
                          modify       = F)
```

Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.
col	Color of bounding boxes in objectives hierarchy.
modify	A logical value indicating whether to use a modified version of the value functions for NO2 and NH4 or the original method.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

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See Also

utility.

Examples

```
nutrients <- msk.nutrients.2010.create()
plot(nutrients)
nutrients.german <- msk.nutrients.2010.create("Deutsch")
plot(nutrients.german)
```

---

msk.physapp.2007.create

Creates a Value Function for River Physical Appearance

Description

Creates a value function for river physical appearance based on the Swiss modular concept for stream assessment, level I (Regional survey) from 2007.

Usage

```
msk.physapp.2007.create(language     = "English",
                        dictionaries = NA,
                        col          = "black")
```

Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.
col	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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See Also

utility.

Examples

```
physapp <- msk.physapp.2007.create()
plot(physapp)
physapp.german <- msk.physapp.2007.create("Deutsch")
plot(physapp.german)
```

---

val.heavymetals.create

Creates a Value Function for River Heavy Metal Concentrations

---

Description

Creates a value function for heavy metal concentrations in river sediments.

Usage

```
val.heavymetals.create(language     = "English",
                       dictionaries = NA,
                       col          = "black",
                       version      = "AWEL")
```

Arguments

`language`	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
`dictionaries`	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.
`col`	Color of bounding boxes in objectives hierarchy.
`version`	Option to choose between the version "AWEL", which uses an assessment of AWEL (2006) based on quality criteria of LAWA (1998), or the version "IKSR", which uses the assessment of the IKSR (2009).

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

Langhans, S.D., Reichert, P. and Schuwirth, N. The method matters: indicator aggregation in ecological river assessment. Ecological Indicators 45, 494-507, 2014. doi:10.1016/j.ecolind.2014.05.014

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Reichert, P., Langhans, S., Lienert, J. and Schuwirth, N. The conceptual foundation of environmental decision support. Journal of Environmental Management. 154, 316-332, 2015. doi:10.1016/j.jenvman.2015.01.053

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AWEL Amt fuer Abfall, Wasser, Energie und Luft, Kanton Zuerich, Statusbericht 2006: Wasserqualitaet der Seen, Fliessgewaesser und des Grundwassers im Kanton Zuerich.

LAWA (Laenderarbeitsgemeinschaft Wasser) 1998: Zielvorgaben zum Schutz oberirdischer Binnengewaesser. Band II: Ableitung und Erprobung von Zielvorgaben zum Schutz oberiridischer

Binnengewaesser fuer die Schwermetalle Blei, Cadmium, Chrom, Kupfer, Nickel, Quecksilber und Zink. Kulturbuchverlag Berlin GmbH, Berlin.

IKSR 2009. Bericht Nr. 175, Sedimentmanagementplan Rhein.

See Also

utility.

Examples

```
heavymetals <- val.heavymetals.create()
plot(heavymetals)
heavymetals.german <- val.heavymetals.create("Deutsch")
plot(heavymetals.german)
heavymetals.IKSR <- val.heavymetals.create(version="IKSR")
plot(heavymetals.IKSR,type="nodes")
```

---

val.invertebrates.create

Creates an Integrative Value Function for River Invertebrates

---

Description

Creates a value function for river invertebrates integrating macroinvertebrate indices for organic matter pollution and toxicity.

Usage

```
val.invertebrates.create(language     = "English",
                         dictionaries = NA,
                         col          = "black",
                         modify       = TRUE)
```

Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.
col	Color of bounding boxes in objectives hierarchy.
modify	Use the biological indicators Makroindex and IBGN in addition to IBCH. Default is TRUE.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

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See Also

utility.

Examples

```
invertebrates <- val.invertebrates.create()
plot(invertebrates)
invertebrates.german <- val.invertebrates.create("Deutsch")
plot(invertebrates.german)
```

`val.micropoll.create` *Creates a Value Function for River Micropollutants*

Description

Creates a value function for river micropollutants with episodic inputs (pesticides, often from diffuse sources) and continous inputs (mainly from point-sources). Micropollutants with continous inputs are assessed regarding their toxicity to different organism groups. Micropollutants with episodic inputs are grouped according to their mode of action while exposure patterns are taken into account.

Usage

```
val.micropoll.create(language     = "English",
                     dictionaries = NA,
                     col          = "black")
```

Arguments

`language`	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
`dictionaries`	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.
`col`	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

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Balsiger, Gewaesserbelastung durch Pestizide, Gas Wasser Abwasser 3/2007, 2007.

Chevre et al. 2006: Pestizide in Schweizer Oberflaechengewaessern. Wirkungsbasierte Qualitaetskriterien. Gas Wasser Abwasser 4/2006. S. 297-307, 2006

See Also

utility. val.pesticides.create.

Examples

```
micropoll <- val.micropoll.create()
plot(micropoll)
micropoll.german <- val.micropoll.create("Deutsch")
plot(micropoll.german)
```

---

val.pesticides.create *Creates a Value Function for River Pesticides*

Description

Creates a value function for river pesticides. Substances are grouped according to their mode of action and evaluation according to AWEL 2006 based on Chevre et al. 2006.

Usage

```
val.pesticides.create(language     = "English",
                      dictionaries = NA,
                      col          = "black")
```

Arguments

language	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
dictionaries	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary ecoval.dictionaries.default is loaded.
col	Color of bounding box.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

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Chevre et al. 2006: Pestizide in Schweizer Oberflaechengewaessern. Wirkungsbasierte Qualitaetskriterien. Gas Wasser Abwasser 4/2006. S. 297-307, 2006

See Also

utility.

Examples

```
pesticides <- val.pesticides.create()
plot(pesticides)
pesticides.german <- val.pesticides.create("Deutsch")
plot(pesticides.german)
```

`val.spear.create` *Creates a Value Function for River Spear Index*

Description

Creates a value function for the SPEARpesticides index in rivers.

Usage

```
val.spear.create(language     = "English",
                 dictionaries = NA,
                 col          = "black")
```

Arguments

`language`	Language to be used to denote nodes, attributes and attribute levels. Must be a column name of the table provided by the second argument.
`dictionaries`	Matrix of dictionaries with the languages provided by the column names and the original words provided as the row names. If dictionary is NA, the default dictionary `ecoval.dictionaries.default` is loaded.
`col`	Color of bounding boxes in objectives hierarchy.

Value

The function returns the value function as a class utility.

References

Langhans, S.D., Lienert, J., Schuwirth, N. and Reichert, P. How to make river assessments comparable: A demonstration for hydromorphology, Ecological Indicators 32, 264-275, 2013. doi:10.1016/j.ecolind.2013.03.027

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Beketov M.A., Foit K., Schafer R.B., Schriever C.A., Sacchi A., Capri E., Biggs J., Wells C. & Liess M. SPEAR indicates pesticide effects in streams - Comparative use of species- and family-level biomonitoring data. Environmental Pollution, 157, 1841-1848, 2009. doi:10.1016/j.envpol.2009.01.021

See Also

utility.

Examples

```
spear <- val.spear.create()
plot(spear)
spear.german <- val.spear.create("Deutsch")
plot(spear.german)
```

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