Package 'rCAT'

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Title Conservation Assessment Tools

Version 0.1.6

Depends R (>= 3.3.0)

Suggests rgeos, rgbif (>= 0.9.2), knitr,rmarkdown, R.rsp,testthat,spelling

Description A set of tools and functions to help with species conservation assessments (Red List threat assessments). Includes Extent of occurrence, Area of Occupancy, Minimum Enclosing Rectangle, a geographic Projection Wizard and Species batch processing.

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Imports pracma (>= 1.9.5), rgdal (>= 1.2-5), sp (>= 1.2-3), grDevices (>= 3.3.2)

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`AOORating` *IUCN rating based from AOO Area*

Description

Calculates IUCN rating based on Area of occupancy (AOO) Area in km2

Usage

```
AOORating(AOOArea, abb)
```

Arguments

`AOOArea`	Area in km2
`abb`	TRUE or FALSE , TRUE = 2 letter code, FALSE = full text (see value), default = TRUE

Value

Text one of CR, EN, VU, NT, LC or Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern

Note

Any negative values are assumpted to be positive. Near Threatened is set at 3,000 km2, follow example in IUCN Guidelines version 11. 2014

Author(s)

Justin Moat. J.Moat@kew.org

References

Bachman, S., Moat, J., Hill, A.W., de Torre, J., Scott, B., 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. Zookeys 126, 117–26. doi:10.3897/zookeys.150.2109

Moat, J., Bachman, S., n.d. GeoCAT Geospatial Conservation Assessment Tool [WWW Document]. URL http://geocat.kew.org/

IUCN, 2012. IUCN Red List Categories and Criteria, 2nd ed. IUCN, Gland, Switzerland.

IUCN Standards and Petitions Subcommittee, 2014. Guidelines for Using the IUCN Red List Categories and Criteria. Version 11.

IUCN Standards and Petitions Subcommittee, 2016. Guidelines for Using the IUCN Red List Categories and Criteria. Version 12.

Joppa, L.N., Butchart, S.H.M., Hoffmann, M., Bachman, S.P., Akçakaya, H.R., Moat, J.F., Böhm, M., Holland, R.A., Newton, A., Polidoro, B., Hughes, A., 2016. Impact of alternative metrics on estimates of extent of occurrence for extinction risk assessment. Conserv. Biol. 30, 362–370. doi:10.1111/cobi.12591

See Also

AOOsimp for AOO calculations

Examples

```
AOOArea <- 25
AOORtext <- EOORating(AOOArea,FALSE)
```

`AOOsimp` *Area of Occupancy (AOO)*

Description

Calculates the number of ocupied cells for Area of Occupancy from a set of points (x,y), usually in metres, with orgin 0,0

Usage

```
AOOsimp(thepoints, cellsize)
```

Arguments

`thepoints`	set of points in metres i.e. c(x,y)
`cellsize`	size of cell (length) in metres

Details

calculates a very simple AOO area from a set of points

Value

integer number of unique cells as an integer

Author(s)

Justin Moat. J.Moat@kew.org

References

Bachman, S., Moat, J., Hill, A.W., de Torre, J., Scott, B., 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. Zookeys 126, 117–26. doi:10.3897/zookeys.150.2109

Moat, J., Bachman, S., n.d. GeoCAT Geospatial Conservation Assessment Tool. URL http://geocat.kew.org/

See Also

AOORating for AOO Ratings,

Examples

```
x <- runif (20,0,10)
y <- runif (20,0,10)
df <- data.frame(x,y)
AOOsimp (df,2)
```

---

cart2ll *Cartesian (x,y,z) to Geographic coordinates*

Description

calculates the latitude and longtitude cordinates in radians from Cartesian coordinates (x,y,z)

Usage

```
cart2ll(x, y, z)
```

Arguments

x	East to West coordinate in metres
y	South to North coordinate in metres
z	height coordinate in metres

Value

dataframe of latitude,longtitude

Author(s)

Justin Moat. J.Moat@kew.org

ConBatch *Batch process, preliminary conservation assessments*

Description

Combines all of routines in rCAT to process multiple species for AOO, EOO etc.

Usage

```
ConBatch(taxa, lat, long, cellsize, project2gether)
```

Arguments

taxa	field which defines a list of species or taxa
lat	field which defines the latitude set of points
long	field which defines the longtitude set of points
cellsize	cell length in metres used to for AOO projection N.B. IUCN recommend 2000 m (ie 2 km)
project2gether	TRUE or FALSE, TRUE all data is projected together using the centre of all latitudes and longtitudes. FALSE each species is projected separately. Default = FALSE

Details

This function expects a list of taxa and latitudes and longitudes.ie

species_w	85.388000	84.33100
species_w	-45.467000	88.41500
species_w	-34.339000	-149.52600
species_x	-29.620000	79.11900
species_x	33.409000	-33.94700
species_x	64.692000	-149.18900
species_y	2.308000	-140.21900
species_y	41.452000	-3.65600
species_y	-30.475000	-129.99600

etc

Value

dataframe with; taxa ,Number of points, Area of the enclosing recetangle, EOO Area in km2, AOO area in km2, EOO IUCN category, AOO IUCN category

	taxa	NOP	MER	EOOkm2	AOO2km	EOOcat	AOOcat
1	species x	14	918562.259811711	585915.607417865	14	LC	EN
2	species y	124	1717224.64389286	634149.482670821	124	LC	EN
3	species z	61	22622717.2314339	17839113.1220552	61	LC	EN
4	species w	1130	509390660.388499	506445176.073246	1130	LC	VU

Note

Has a switch to either project all data as a whole or each taxa separately. I would suggest you use this switch if data is all from a simlar area (i.e. all from one country/region)

Author(s)

Justin Moat. J.Moat@kew.org

References

Bachman, S., Moat, J., Hill, A.W., de Torre, J., Scott, B., 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. Zookeys 126, 117–26. doi:10.3897/zookeys.150.2109

Moat, J. F. 2007. Conservation assessment tools extension for ArcView 3.x, version 1.2. Retrieved from http://www.kew.org/gis/projects/cats/catsdoc.pdf

Moat, J., Bachman, S.,(2017) GeoCAT Geospatial Conservation Assessment Tool [WWW Document]. URL http://geocat.kew.org/

Joppa, L.N., Butchart, S.H.M., Hoffmann, M., Bachman, S.P., Akçakaya, H.R., Moat, J.F., Böhm, M., Holland, R.A., Newton, A., Polidoro, B., Hughes, A., 2016. Impact of alternative metrics on estimates of extent of occurrence for extinction risk assessment. Conserv. Biol. 30, 362–370. doi:10.1111/cobi.12591

See Also

`MER` for Minimum Enclosing Rectangle calculations, `EOOarea` for EOO calculations, `EOORating` for EOO Ratings, `AOOsimp` for AOO calculations, `AOORating` for AOO Ratings,

Examples

```
lat <- runif (200,-24,-12)
long <- runif (200,43,51)
spa <- rep('aa',50)
spb <- rep('bb',150)
mydata <- data.frame(species=c(spa,spb),lat,long)
resultsdf <- ConBatch(mydata$species,mydata$lat,mydata$long,2000,FALSE)
```

deg2rad *Degrees to radians*

Description

Calculates radians from degrees or degrees from radians

Usage

```
deg2rad(deg)
```

Arguments

deg	number in degrees

Value

number

Author(s)

Justin Moat. J.Moat@kew.org

Examples

```
a <- 30
deg2rad(a)
```

EOOarea *Extent of Occurance (EOO) Area*

Description

Calculates the Extent of Occurance from a set of points (x,y)

Usage

```
EOOarea(thepoints)
```

Arguments

thepoints	dataframe of points i.e. c(x,y)

Details

calculates the EOO area of a set of popints'

Value

float_value area of EOO polygon

Note

area returned is in x,y units, but negative as polygon is constructed anticlockwise

Author(s)

Justin Moat. J.Moat@kew.org

References

Bachman, S., Moat, J., Hill, A.W., de Torre, J., Scott, B., 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. Zookeys 126, 117–26. doi:10.3897/zookeys.150.2109

Moat, J., Bachman, S., n.d. GeoCAT Geospatial Conservation Assessment Tool [WWW Document]. URL http://geocat.kew.org/

Joppa, L.N., Butchart, S.H.M., Hoffmann, M., Bachman, S.P., Akçakaya, H.R., Moat, J.F., Böhm, M., Holland, R.A., Newton, A., Polidoro, B., Hughes, A., 2016. Impact of alternative metrics on estimates of extent of occurrence for extinction risk assessment. Conserv. Biol. 30, 362–370. doi:10.1111/cobi.12591

See Also

EOORating for EOO Ratings

Examples

```
x <- runif (20,0,10)
y <- runif (20,0,10)
df <- data.frame(x,y)
EOOarea (df)
```

EOORating *IUCN rating based from EOO Area*

Description

Calculates IUCN rating based on Extent of Occurance (EOO) Area in km2

Usage

```
EOORating(EOOArea, abb)
```

Arguments

EOOArea	Area in km2
abb	TRUE or FALSE , TRUE = 2 letter code, FALSE = full text (see value), default = TRUE

Details

Calculates IUCN rating from EOO

Value

Text one of CR, EN, VU, NT, LC or Critically Endangered, Endangered, Vulnerable, Near Threatened, Least Concern

Note

Any negative values are assumpted to be positive. Near Threatened is set at 30,000 km2, follow example in IUCN petition 2014

Author(s)

Justin Moat. J.Moat@kew.org

References

Bachman, S., Moat, J., Hill, A.W., de Torre, J., Scott, B., 2011. Supporting Red List threat assessments with GeoCAT: geospatial conservation assessment tool. Zookeys 126, 117–26. doi:10.3897/zookeys.150.2109

Moat, J., Bachman, S., n.d. GeoCAT Geospatial Conservation Assessment Tool [WWW Document]. URL http://geocat.kew.org/

IUCN, 2012. IUCN RED LIST CATEGORIES AND CRITERIA, 2nd ed. IUCN, Gland, Switzerland.

IUCN Standards and Petitions Subcommittee, 2014. Guidelines for Using the IUCN Red List Categories and Criteria. Version 11.

IUCN Standards and Petitions Subcommittee, 2016. Guidelines for Using the IUCN Red List Categories and Criteria. Version 12.

Joppa, L.N., Butchart, S.H.M., Hoffmann, M., Bachman, S.P., Akçakaya, H.R., Moat, J.F., Böhm, M., Holland, R.A., Newton, A., Polidoro, B., Hughes, A., 2016. Impact of alternative metrics on estimates of extent of occurrence for extinction risk assessment. Conserv. Biol. 30, 362–370. doi:10.1111/cobi.12591

See Also

EOOarea for EOO calculations

Examples

```
EOOArea <- 25
EOORtext <- EOORating(EOOArea,TRUE)
```

ll2cart *Geographic coordinates to cartesian (x,y,z)*

Description

Calculates the Cartesian cordinates (x,y,z) from lat long in radians

Usage

```
ll2cart(latr, longr)
```

Arguments

latr	latitude point in radians
longr	longtitude point in radians

Value

dataframe of x,y,z

Author(s)

Justin Moat. J.Moat@kew.org

References

Descartes, R., 1637. Discours de la methode. A Leyde, De l'imprimerie de I. Maire, Paris.

Examples

```
lat <- runif (200,-24,-12)
long <- runif (200,43,51)
thepoints <- data.frame(lat,long)
llrad <- deg2rad(thepoints)
cartp <- ll2cart(llrad$lat,llrad$long)
```

MER *Minimum Enclosing Rectangle (MER)*

Description

Calculates the minimum enclosing rectangle (MER) from a set of points (x,y)

Usage

```
MER(thepoints)
```

Arguments

thepoints	dataframe of points ie c(x,y)

Details

calculates the MER of a set of numbers'

Value

list of 4 doubles = xmin,xmax,ymin,ymax

Author(s)

Justin Moat. J.Moat@kew.org

Examples

```
x <- runif (20,0,10)
y <- runif (20,0,10)
df <- data.frame(x,y)
MER (df)
```

Mode *Mode of a test of points*

Description

Calculates the mode (the value that occurs most often) of a set of data - note the capital M

Usage

```
Mode(x)
```

Arguments

x	set of numbers

Details

calculates the mode of a set of numbers'

Value

number

Note

Orginally from http://stackoverflow.com/questions/2547402/standard-library-function-in-r-for-finding-the-mode

Author(s)

Justin Moat. J.Moat@kew.org

Examples

```
a <- c(5,5,5,6,7,8,9)
Mode(a)
```

`pro2sph` *Cartesian coordinate projection*

Description

calculates Cartesian (x,y,z), projected from the centre of the sphere to the earth surface, returns cartesian (x,y,z) used to calculate "true" centre of set of lat longs

Usage

```
pro2sph(x, y, z)
```

Arguments

x	East to West coordinate in metres
y	South to North coordinate in metres
z	height coordinate in metres

Value

x,y,z

Note

http://stackoverflow.com/questions/9604132/how-to-project-a-point-on-to-a-sphere

Author(s)

Justin Moat. J.Moat@kew.org

References

Descartes, R., 1637. Discours de la methode. A Leyde, De l'imprimerie de I. Maire, Paris.

rad2deg *Radians to Degrees*

Description

Calculates radians from degrees or degrees from radians

Usage

```
rad2deg(rad)
```

Arguments

rad	number in radians

Value

number

Author(s)

Justin Moat. J.Moat@kew.org

Examples

```
b <- 0.392699
rad2deg(b)
```

simProjWiz *Simple Projection Wizard*

Description

Projects any set of lat long points to a "suitable" area projection, based on it's "true centre of gravity"

Usage

```
simProjWiz(thepoints, thecentre)
```

Arguments

thepoints	set of points in latitude and longtitude ie c(lat,long)
thecentre	one point ie c(lat,long)

Details

Simple equal area projection wizard

Value

set of points in metres (x,y)

Note

Based around a simple continental projection, using two sets of projections equal area cylindrical = Cylindrical equal-area = 8287 equal area azimuthal for polar (above 70) = Lambert azimuthal equal-area

note these are not cartographically pleasing projections, they are just so we can get the data into something simple for areal analysis See below for a more cartographically pleasing projection engine

Šavric, B., Jenny, B., Jenny, H., 2016. Projection Wizard – An Online Map Projection Selection Tool. Cartogr. J. 53, 1–9. doi:10.1080/00087041.2015.1131938

Author(s)

Justin Moat. J.Moat@kew.org

References

Šavric, B., Jenny, B., Jenny, H., 2016. Projection Wizard – An Online Map Projection Selection Tool. Cartogr. J. 53, 1–9. doi:10.1080/00087041.2015.1131938

Snyder, J.P., 1987. Map projections: A working manual, Professional Paper. Washington, D.C.

Examples

```
lat <- runif (200,-24,-12)
long <- runif (200,43,51)
ll <- data.frame(lat,long)
cp <- trueCOGll(ll)
pointsprojected <- simProjWiz(ll,cp)
```

---

trueCOGll *True centre of gravity from a set of Lat longs*

Description

Calculates the "true" centre of gravity (weighted) from a set of lat longs, using cartesian geometry

Usage

```
trueCOGll(thepoints)
```

Arguments

thepoints	set of points c(lat,long)

Value

a point (lat,long) from centre

Author(s)

Justin Moat. J.Moat@kew.org

References

Descartes, R., 1637. Discours de la methode. A Leyde, De l'imprimerie de I. Maire, Paris.

Examples

```
lat <- runif (200,-24,-12)
long <- runif (200,43,51)
ll <- data.frame(lat,long)
cp <- trueCOGll(ll)
```

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