

# Package ‘redlistr’

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**Title** Tools for the IUCN Red List of Ecosystems and Species

**Version** 1.0.2

**Description** A toolbox created by members of the International Union for Conservation of Nature (IUCN) Red List of Ecosystems Committee for Scientific Standards. Primarily, it is a set of tools suitable for calculating the metrics required for making assessments of species and ecosystems against the IUCN Red List of Threatened Species and the IUCN Red List of Ecosystems categories and criteria. See the IUCN website for detailed guidelines, the criteria, publications and other information.

**URL** <https://github.com/red-list-ecosystem/redlistr>

**BugReports** <https://github.com/red-list-ecosystem/redlistr/issues>

**Imports** grDevices, methods, plyr, rgeos

**Depends** R (>= 3.3.0), raster (>= 2.5-8), sp (>= 1.2-4)

**Suggests** devtools, knitr, rgdal, rmarkdown, testthat

**License** GPL (>= 3) | file LICENSE

**LazyData** true

**RoxygenNote** 6.0.1

**VignetteBuilder** knitr

**NeedsCompilation** no

**Author** Calvin Lee [cre, aut] (<<https://orcid.org/0000-0001-8277-8614>>),  
Nicholas Murray [aut] (<<https://orcid.org/0000-0002-4008-3053>>)

**Maintainer** Calvin Lee <[calvinkflee@gmail.com](mailto:calvinkflee@gmail.com)>

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createGrid	<i>Create empty Area of Occupancy (AOO) Grid.</i>
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**Description**

createGrid produces empty grid which can be used as the basis to help compute AOO.

**Usage**

```
createGrid(input.data, grid.size)
```

**Arguments**

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid.size	A number specifying the width of the desired grid square (in same units as your coordinate reference system)

**Value**

A regular grid raster with extent input.data and grid size grid.size. Each grid square has a unique identification number.

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

**References**

Bland, L.M., Keith, D.A., Miller, R.M., Murray, N.J. and Rodriguez, J.P. (eds.) 2016. Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. Gland, Switzerland: IUCN. ix + 94pp. Available at the following web site: <https://iucnr1e.org/>

**See Also**

Other AOO functions: [getA00Silent](#), [getA00](#), [makeA00Grid](#)

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extrapolateEstimate    *Extrapolate Estimate*

---

**Description**

extrapolateEstimate uses rates of decline from getDeclineStats to extrapolate estimates to a given time

**Usage**

```
extrapolateEstimate(A.t1, year.t1, nYears, ARD = NA, PRD = NA, ARC = NA)
```

**Arguments**

A.t1	Area at time t1
year.t1	Year of time t1
nYears	Number of years since t1 for prediction. Use negative values for backcasting
ARD	Absolute rate of decline
PRD	Proportional rate of decline
ARC	Annual rate of change

**Value**

A dataframe with the forecast year, and a combination of:

- Values as extrapolated with absolute rate of decline (ARD)
- Values as extrapolated with proportional rate of decline (PRD)
- Values as extrapolated with annual rate of change (ARC)

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

**References**

Bland, L.M., Keith, D.A., Miller, R.M., Murray, N.J. and Rodriguez, J.P. (eds.) 2016. Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. Gland, Switzerland: IUCN. ix + 94pp. Available at the following web site: <https://iucnr1e.org/>

**See Also**

Other change\_functions: [futureAreaEstimate](#), [sequentialExtrapolate](#)

**Examples**

```
a.r1 <- 23.55
a.r2 <- 15.79
decline.stats <- getDeclineStats(a.r1, a.r2, year.t1 = 1990, year.t2 = 2012,
                               methods = 'PRD')
a.2040.PRD <- extrapolateEstimate(a.r1, a.r2, year.t1 = 1990, nYears = 50,
                                 PRD = decline.stats$PRD)
```

---

futureAreaEstimate      *Future Area Estimate*

---

**Description**

futureAreaEstimate is now deprecated, please use extrapolateEstimate instead

**Usage**

```
futureAreaEstimate(A.t1, year.t1, nYears, ARD = NA, PRD = NA, ARC = NA)
```

**Arguments**

A.t1	Area at time t1
year.t1	Year of time t1
nYears	Number of years since t1 for area prediction
ARD	Absolute rate of decline
PRD	Proportional rate of decline
ARC	Annual rate of change

**Value**

A dataframe with the forecast year, and a combination of:

- Future area as estimated with absolute rate of decline (ARD)
- Future area as estimated with proportional rate of decline (PRD)
- Future area as estimated with annual rate of change (ARC)

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

## References

Bland, L.M., Keith, D.A., Miller, R.M., Murray, N.J. and Rodriguez, J.P. (eds.) 2016. Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. Gland, Switzerland: IUCN. ix + 94pp. Available at the following web site: <https://iucnrle.org/>

## See Also

Other change\_functions: [extrapolateEstimate](#), [sequentialExtrapolate](#)

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getAOO *Compute Area of Occupancy (AOO)*

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## Description

getAOO determines the number of area of occupancy (AOO) grid cells occupied by a species or ecosystem. It includes capability for specifying whether at least one percent of the grid cell needs to be occupied before it is counted in the AOO. This functionality is important for assessing the IUCN Red List of Ecosystems Criteria B.

## Usage

```
getAOO(input.data, grid.size, min.percent.rule = FALSE, percent = 1)
```

## Arguments

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid.size	A number specifying the width of the desired grid square (in same units as your coordinate reference system)
min.percent.rule	Logical. If TRUE, a minimum area threshold must be passed before a grid is counted as an AOO grid.
percent	Numeric. The minimum percent to be applied as a threshold for the min.percent.rule

## Value

The number of grid cells occupied by the ecosystem or species

## Author(s)

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

## References

Bland, L.M., Keith, D.A., Miller, R.M., Murray, N.J. and Rodriguez, J.P. (eds.) 2016. Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. Gland, Switzerland: IUCN. ix + 94pp. Available at the following web site: <https://iucnrle.org/>

**See Also**

Other AOO functions: [createGrid](#), [getAOSilent](#), [makeA00Grid](#)

**Examples**

```
crs.UTM55S <- '+proj=utm +zone=55 +south +ellps=WGS84 +datum=WGS84 +units=m +no_defs'
r1 <- raster(iffelse((volcano<130), NA, 1), crs = crs.UTM55S)
extent(r1) <- extent(0, 6100, 0, 8700)
A00 <- getA00(r1, 10000, min.percent.rule = TRUE, percent = 1)
```

---

getAOSilent

*Alternate function for getting AOO (with custom grid)*

---

**Description**

getAOSilent is identical to getA00, but allows the custom input of the grid parameter. Used for gridUncertainty.

**Usage**

```
getAOSilent(input.data, grid, min.percent.rule = FALSE, percent = 1)
```

**Arguments**

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid	Custom grid to be used to calculate AOO. Usually the output of gridUncertainty
min.percent.rule	Logical. If TRUE one percent of the grid cell must be occupied before it is counted in the AOO.
percent	Numeric. The minimum percent to be applied as a threshold for the min.percent.rule

**Value**

Value. The AOO calculated with the input distribution and grid.

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

**See Also**

Other AOO functions: [createGrid](#), [getA00](#), [makeA00Grid](#)

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getArea	<i>Calculates the Area of a Raster.</i>
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## Description

getArea reports the area of a RasterLayer object using the pixel counting method, or the area of a SpatialPolygons object using rgeos::gArea

## Usage

```
getArea(x, value.to.count)
```

## Arguments

x Either a RasterLayer or SpatialPolygons object. For a RasterLayer, no data value should be NA

value.to.count Optional. Value of the cells in a RasterLayer to be counted

## Value

The total area of the cells of interest in km2

## Author(s)

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

## See Also

Other Change functions: [getAreaLoss](#), [getDeclineStats](#)

## Examples

```
crs.UTM55S <- '+proj=utm +zone=55 +south +ellps=WGS84 +datum=WGS84 +units=m +no_defs'
r1 <- raster(ifelset(volcano<130), NA, 1), crs = crs.UTM55S)
extent(r1) <- extent(0, 6100, 0, 8700)
a.r1 <- getArea(r1) # area of all non-NA cells in r1
```

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getAreaE00	<i>Calculates area of the created EOO polygon.</i>
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---

**Description**

getAreaE00 calculates the area of the EOO polygon generated from makeE00 the provided data

**Usage**

```
getAreaE00(E00.polygon)
```

**Arguments**

E00.polygon     An object of class SpatialPolygons, usually the output from makeE00.

**Value**

The area of the E00.polygon in km2

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

**See Also**

Other EOO functions: [makeE00](#)

**Examples**

```
crs.UTM55S <- '+proj=utm +zone=55 +south +ellps=WGS84 +datum=WGS84 +units=m +no_defs'
r1 <- raster(iffelse((volcano<130), NA, 1), crs = crs.UTM55S)
extent(r1) <- extent(0, 6100, 0, 8700)
E00.polygon <- makeE00(r1)
E00.area <- getAreaE00(E00.polygon)
```

---

getAreaLoss	<i>Area change between two inputs in km2</i>
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**Description**

getAreaLoss reports the difference in area between two inputs. These can be RasterLayers, SpatialPolygons, or numbers. Any combinations of these inputs are valid. If using number as input, ensure it is measured in km2

**Usage**

```
getAreaLoss(x, y)
```



**Arguments**

x	RasterLayer or SpatialPolygons object of distribution or Numeric representing area in km2
y	RasterLayer or SpatialPolygons object of distribution or Numeric representing area in km2

**Value**

Returns the difference in area of the two inputs in km2

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

**See Also**

Other Change functions: [getArea](#), [getDeclineStats](#)

**Examples**

```
crs.UTM55S <- '+proj=utm +zone=55 +south +ellps=WGS84 +datum=WGS84 +units=m +no_defs'
r1 <- raster(ifelse((volcano<130), NA, 1), crs = crs.UTM55S)
extent(r1) <- extent(0, 6100, 0, 8700)
r2 <- raster(ifelse((volcano<145), NA, 1), crs = crs.UTM55S)
extent(r2) <- extent(0, 6100, 0, 8700)
a.dif <- getAreaLoss(r1, r2) # distribution rasters
```

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getDeclineStats      *Change statistics.*

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**Description**

getDeclineStats calculates the Proportional Rate of Decline (PRD), Absolute Rate of Decline (ARD) and Annual Rate of Change (ARC), given two areas at two points in time. Also provides the total area difference. Inputs are usually the results from getArea.

**Usage**

```
getDeclineStats(A.t1, A.t2, year.t1, year.t2, methods)
```

**Arguments**

A.t1	Area at time t1
A.t2	Area at time t2
year.t1	Year of time t1
year.t2	Year of time t2
methods	Method(s) used to calculate rate of decline. Either 'PRD', 'ARD', and/or 'ARC'. See vignette to see a more detailed explanation for each of them.

**Value**

A dataframe with absolute differences between the two inputs, and a selection of:

- Proportional Rate of Decline (PRD)
- Absolute Rate of Decline (ARD)
- Annual Rate of Change (ARC)

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

**References**

Bland, L.M., Keith, D.A., Miller, R.M., Murray, N.J. and Rodriguez, J.P. (eds.) 2016. Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. Gland, Switzerland: IUCN. ix + 94pp. Available at the following web site: <https://iucnrle.org/>  
Puyravaud, J.-P. 2003. Standardizing the calculation of the annual rate of deforestation. Forest Ecology and Management, 177, 593-596.

**See Also**

Other Change functions: [getAreaLoss](#), [getArea](#)

**Examples**

```
a.r1 <- 23.55
a.r2 <- 15.79
decline.stats <- getDeclineStats(a.r1, a.r2, year.t1 = 1990, year.t2 = 2012,
                                methods = c('ARD', 'ARC'))
```

---

gridUncertainty	<i>Function to compute AOO with grid uncertainty systematically with stopping rule</i>
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---

**Description**

gridUncertainty determines the number of area of occupancy (AOO) grid cells occupied by a species or ecosystem systematically. It will only stop when the AOO calculated does not improve (decrease) after a set number of split scenarios.

**Usage**

```
gridUncertainty(input.data, grid.size, n.AOO.improvement,
                min.percent.rule = FALSE, percent = 1)
```

**Arguments**

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid.size	A number specifying the width of the desired grid square (in same units as your coordinate reference system)
n.AOO.improvement	Specifies the minimum number of rounds the calculated AOO is not improved before stopping the function.
min.percent.rule	Logical. If TRUE, a minimum area threshold must be passed before a grid is counted as an AOO grid.
percent	Numeric. The minimum percent to be applied as a threshold for the min.percent.rule.

**Value**

A list containing the following:

- Data frame of results showing the minimum AOO calculated for each shift scenario
- Single SpatialPolygonsDataFrame containing the AOO grid which would produce the minimum AOO calculated

**Author(s)**

Calvin Lee <calvinkflee@gmail.com>

**See Also**

Other gridUncertainty functions: [gridUncertaintyBase](#), [gridUncertaintyRandomManual](#), [gridUncertaintyRandom](#), [gridUncertaintyRestricted](#), [gridUncertaintySimulation](#)

**Examples**

```
crs.UTM55S <- '+proj=utm +zone=55 +south +ellps=WGS84 +datum=WGS84 +units=m +no_defs'
r1 <- raster(iffelse((volcano<130), NA, 1), crs = crs.UTM55S)
extent(r1) <- extent(0, 6100, 0, 8700)
x <- gridUncertainty(r1, grid.size = 10000, n.AOO.improvement = 5,
                    min.percent.rule = FALSE, percent = 1)
```

---

gridUncertaintyBase     *Base function to compute AOO with grid uncertainty systematically*

---

**Description**

gridUncertaintyBase helps determine the minimum number of area of occupancy (AOO) grid cells occupied by a species or ecosystem. It varies the location of the AOO grid by shifting in systematically in both x- and y- axes, adding a small amount of random movement (five percent of the grid.size) at each point. It then returns summary statistics for the range of AOOs calculated, and the RasterLayer(s) containing the grids with the minimum AOO. It is the base function which is used by gridUncertainty, gridUncertaintySimulation, and gridUncertaintyRestricted

**Usage**

```
gridUncertaintyBase(input.data, grid.size, splits, min.percent.rule = FALSE,
  percent = 1, restriction = FALSE, min.grids.shift)
```

**Arguments**

<code>input.data</code>	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
<code>grid.size</code>	A number specifying the width of the desired grid square (in same units as your coordinate reference system)
<code>splits</code>	Specifies the number of ways to split the grid in ONE axis.
<code>min.percent.rule</code>	Logical. If TRUE, a minimum area threshold must be passed before a grid is counted as an AOO grid.
<code>percent</code>	Numeric. The minimum percent to be applied as a threshold for the <code>min.percent.rule</code> .
<code>restriction</code>	Logical. If TRUE, allows user to specify areas to focus where grid search is done. Used in <code>gridUncertaintyRestricted</code> .
<code>min.grids.shift</code>	Dataframe object with two columns ( <code>x.shift</code> and <code>y.shift</code> ) specifying the coordinates to restrict the AOO grid placement.

**Value**

List containing the following:

- Vector of length `split*split` of calculated AOO for each shifted grid
- Data frame of summary statistics for the results create the AOO grid(s) which return the smallest AOO
- Data frame of the shift(s) required to create the AOO grid(s) with the smallest AOO

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

**See Also**

[createGrid](#) [getAOSilent](#)

Other `gridUncertainty` functions: [gridUncertaintyRandomManual](#), [gridUncertaintyRandom](#), [gridUncertaintyRestrict](#), [gridUncertaintySimulation](#), [gridUncertainty](#)

---

gridUncertaintyRandom *Function to compute AOO with grid uncertainty randomly with stop rule*

---

### Description

gridUncertaintyRandom helps determine the minimum number of area of occupancy (AOO) grid cells occupied by a species or ecosystem. It varies the location of the AOO grid by shifting in randomly in both x- and y- axes, returning summary statistics for the range of AOOs calculated, and the RasterLayer(s) containing the grids with the minimum AOO. It automatically stops when the AOO no longer improves after a specified number of rounds.

### Usage

```
gridUncertaintyRandom(input.data, grid.size, n.AOO.improvement,
  min.percent.rule = FALSE, percent = 1, max.n.rounds = 1000)
```

### Arguments

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid.size	A number specifying the width of the desired grid square (in same units as your coordinate reference system)
n.AOO.improvement	Specifies the minimum number of rounds the calculated AOO is not improved before stopping the function.
min.percent.rule	Logical. If TRUE, a minimum area threshold must be passed before a grid is counted as an AOO grid.
percent	Numeric. The minimum percent to be applied as a threshold for the min.percent.rule.
max.n.rounds	Specifies the maximum number of rounds to calculate AOOs. Generally unused except to limit computation time.

### Value

List containing the following:

- Data frame of summary statistics for the results
- Data frame showing the distance shifted in x and y directions used to create the AOO grid(s) and their associated AOOs
- List of RasterLayer(s) containing the AOO grid(s) which return the smallest AOO

### Author(s)

Calvin Lee <calvinkflee@gmail.com>. Nicholas Murray <murr.nick@gmail.com>

**See Also**

[createGrid](#) [getA00Silent](#)

Other gridUncertainty functions: [gridUncertaintyBase](#), [gridUncertaintyRandomManual](#), [gridUncertaintyRestricted](#), [gridUncertaintySimulation](#), [gridUncertainty](#)

**Examples**

```
crs.UTM55S <- '+proj=utm +zone=55 +south +ellps=WGS84 +datum=WGS84 +units=m +no_defs'
r1 <- raster(ifelse((volcano<130), NA, 1), crs = crs.UTM55S)
extent(r1) <- extent(0, 6100, 0, 8700)
x <- gridUncertaintyRandom(r1, grid.size = 10000, n.A00.improvement = 50,
                           min.percent.rule = TRUE, percent = 1)
```

---

gridUncertaintyRandomManual

*Manual function to compute AOO with grid uncertainty randomly*

---

**Description**

gridUncertaintyRandomManual helps determine the minimum number of area of occupancy (AOO) grid cells occupied by a species or ecosystem. It varies the location of the AOO grid by shifting in randomly in both x- and y- axes, returning summary statistics for the range of AOOs calculated, and the RasterLayer(s) containing the grids with the minimum AOO. Requires manual input for the number of simulations to perform.

**Usage**

```
gridUncertaintyRandomManual(input.data, grid.size, n.sim = 10,
                             min.percent.rule = FALSE, percent = 1)
```

**Arguments**

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid.size	A number specifying the width of the desired grid square (in same units as your coordinate reference system)
n.sim	Specifies the number of random grids to be created and tested.
min.percent.rule	Logical. If TRUE, a minimum area threshold must be passed before a grid is counted as an AOO grid.
percent	Numeric. The minimum percent to be applied as a threshold for the min.percent.rule.

**Value**

List containing the following:

- Data frame of summary statistics for the results
- Data frame showing the distance shifted in x and y directions used to create the AOO grid(s) and their associated AOOs
- List of RasterLayer(s) containing the AOO grid(s) which return the smallest AOO

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

**See Also**

[createGrid](#) [getAOSilent](#)

Other gridUncertainty functions: [gridUncertaintyBase](#), [gridUncertaintyRandom](#), [gridUncertaintyRestricted](#), [gridUncertaintySimulation](#), [gridUncertainty](#)

---

gridUncertaintyRestricted

*Function to compute AOO with grid uncertainty systematically with stopping rule and restrictions*

---

**Description**

gridUncertaintyRestricted determines the number of area of occupancy (AOO) grid cells occupied by a species or ecosystem systematically. It will only stop when the AOO calculated does not improve (decrease) after a set number of split scenarios. The number of grids within each split is restricted to only include those which are already found nearby to ones already with the minimum AOO.

**Usage**

```
gridUncertaintyRestricted(input.data, grid.size, n.AOO.improvement,
  min.percent.rule = FALSE, percent = 1)
```

**Arguments**

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid.size	A number specifying the width of the desired grid square (in same units as your coordinate reference system)
n.AOO.improvement	Specifies the minimum number of rounds the calculated AOO is not improved before stopping the function.

min.percent.rule	Logical. If TRUE, a minimum area threshold must be passed before a grid is counted as an AOO grid.
percent	Numeric. The minimum percent to be applied as a threshold for the min.percent.rule.

**Value**

A list containing the following:

- Data frame of results showing the minimum AOO calculated for each shift scenario
- Single SpatialPolygonsDataFrame containing the AOO grid which would produce the minimum AOO calculated

**Author(s)**

Calvin Lee <calvinkflee@gmail.com>

**See Also**

Other gridUncertainty functions: [gridUncertaintyBase](#), [gridUncertaintyRandomManual](#), [gridUncertaintyRandom](#), [gridUncertaintySimulation](#), [gridUncertainty](#)

---

gridUncertaintySimulation

*Function to investigate behaviour of AOO under various split scenarios*

---

**Description**

gridUncertaintySimulation returns the maximum and minimum number of area of occupancy (AOO) grid cells occupied by a species or ecosystem in incremental splits using gridUncertaintyBase.

**Usage**

```
gridUncertaintySimulation(input.data, grid.size, simulations,
  min.percent.rule = FALSE, percent = 1)
```

**Arguments**

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid.size	A number specifying the width of the desired grid square (in same units as your coordinate reference system)
simulations	Specifies the maximum number of splits to be performed on the generated grid
min.percent.rule	Logical. If TRUE, a minimum area threshold must be passed before a grid is counted as an AOO grid.
percent	Numeric. The minimum percent to be applied as a threshold for the min.percent.rule.



**Value**

Data frame of results showing the minimum and maximum AOO calculated for each grid shift scenario.

**Author(s)**

Calvin Lee <calvinkflee@gmail.com>

**See Also**

Other gridUncertainty functions: [gridUncertaintyBase](#), [gridUncertaintyRandomManual](#), [gridUncertaintyRandom](#), [gridUncertaintyRestricted](#), [gridUncertainty](#)

---

makeA00Grid	<i>Create Area of Occupancy (AOO) grid for an ecosystem or species distribution</i>
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**Description**

makeA00Grid creates grids for species presence based on the presented raster object. It includes capability for specifying whether a minimum percent of the grid cell needs to be occupied before it is counted in the AOO. This functionality is important for assessing the IUCN Red List of Ecosystems Criteria B.

**Usage**

```
makeA00Grid(input.data, grid.size, min.percent.rule = FALSE, percent = 1)
```

**Arguments**

input.data	Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.
grid.size	A number specifying the width of the desired grid square (in same units as your coordinate reference system)
min.percent.rule	Logical. If TRUE, a minimum area threshold must be passed before a grid is counted as an AOO grid.
percent	Numeric. The minimum percent to be applied as a threshold for the min.percent.rule

**Value**

A shapefile of grid cells occupied by an ecosystem or species

**Author(s)**

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

## References

Bland, L.M., Keith, D.A., Miller, R.M., Murray, N.J. and Rodriguez, J.P. (eds.) 2016. Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. Gland, Switzerland: IUCN. ix + 94pp. Available at the following web site: <https://iucnrle.org/>

## See Also

Other AOO functions: [createGrid](#), [getA00Silent](#), [getA00](#)

## Examples

```
crs.UTM55S <- '+proj=utm +zone=55 +south +ellps=WGS84 +datum=WGS84 +units=m +no_defs'
r1 <- raster(iffelse((volcano<130), NA, 1), crs = crs.UTM55S)
extent(r1) <- extent(0, 6100, 0, 8700)
A00_grid <- makeA00Grid(r1, 10000, min.percent.rule = TRUE, percent = 1)
```

---

makeEEO

*Creates Extent of occurrence (EEO) Polygon*

---

## Description

makeEEO creates a minimum convex polygon enclosing all occurrences of the provided data

## Usage

```
makeEEO(input.data)
```

## Arguments

`input.data` Object of an ecosystem or species distribution. Accepts either raster or spatial points formats. Please use a CRS with units measured in metres.

## Value

An object of class `SpatialPolygons` representing the EEO of `input.data`. Also inherits its CRS.

## Author(s)

Nicholas Murray <murr.nick@gmail.com>, Calvin Lee <calvinkflee@gmail.com>

## References

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## See Also

Other EEO functions: [getAreaEEO](#)

## Examples

```
crs.UTM55S <- '+proj=utm +zone=55 +south +ellps=WGS84 +datum=WGS84 +units=m +no_defs'  
r1 <- raster(ifelse((volcano<130), NA, 1), crs = crs.UTM55S)  
extent(r1) <- extent(0, 6100, 0, 8700)  
E00.polygon <- makeE00(r1)
```

---

sequentialExtrapolate *Sequential extrapolation estimate*

---

## Description

sequentialExtrapolate uses rates of decline from getDeclineStats and generates a sequence of estimates at regular time-steps. Useful for generating a sequence for plotting graphs.

## Usage

```
sequentialExtrapolate(A.t1, year.t1, nYears, ARD = NA, PRD = NA, ARC = NA)
```

## Arguments

A.t1	Area at time t1
year.t1	Year of time t1
nYears	Number of years since t1 for prediction. Use negative values for backcasting
ARD	Absolute rate of decline
PRD	Proportional rate of decline
ARC	Annual rate of change

## Value

A dataframe with the forecast year, and a combination of:

- Sequence of values as extrapolated with absolute rate of decline (ARD)
- Sequence of values as extrapolated with proportional rate of decline (PRD)
- Sequence of values as extrapolated with annual rate of change (ARC)

## Author(s)

Calvin Lee <calvinkflee@gmail.com>

## References

Bland, L.M., Keith, D.A., Miller, R.M., Murray, N.J. and Rodriguez, J.P. (eds.) 2016. Guidelines for the application of IUCN Red List of Ecosystems Categories and Criteria, Version 1.0. Gland, Switzerland: IUCN. ix + 94pp. Available at the following web site: <https://iucnrle.org/>



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