

# Package ‘ecochange’

October 13, 2020

**Type** Package

**Title** Integrating Ecological Remote Sensing Data to Derive EBV Metrics

**Version** 1.3

**Date** 2020-10-06

**Maintainer** Wilson Lara Henao <wilarhen@temple.edu>

## Description

Essential Biodiversity Variables (EBV) are state variables with dimensions on time, space, and biological organization that can document biodiversity change. Freely available remote sensing products (RSP) are downloaded and integrated with data for national or regional domains to derive EBV metrics related to horizontal ecosystem extent, forest fragmentation, species distribution ranges, among others. To process the spatial data, the users must provide at least a region of interest (polygon or geographic administrative unit). Downloadable RSP include Global Surface Water (Peckel et al., 2016) <doi:10.1038/nature20584>, Forest Change (Hansen et al., 2013) <doi:10.1126/science.1244693>, and Continuous Tree Cover data (Sexton et al., 2013) <doi:10.1080/17538947.2013.786146>.

**License** GPL-3

**Depends** R (>= 3.5.0), raster, rgeos

## Imports

readr,rgdal,parallel,curl,gdalUtils,ggplot2,graphics,rvest,stats,landscapemetrics,sp,tibble,utils,xml2,dplyr,sf,R.utils,htrr,ge

**Encoding** latin1

**LazyData** TRUE

**NeedsCompilation** no

**Author** Wilson Lara Henao [aut, cre],  
Victor Gutierrez-Velez [aut]

**Repository** CRAN

**Date/Publication** 2020-10-13 15:00:02 UTC

## R topics documented:

barplot.EBVstats	2
deforest	3

EBVstats . . . . .	5
gaugeIndicator . . . . .	6
getGADM . . . . .	7
getrsp . . . . .	9
getWRS . . . . .	10
listGP . . . . .	11
plot.Indicator . . . . .	12
plotebv . . . . .	13
rsp2ebv . . . . .	14
sampleIndicator . . . . .	16

<b>Index</b>	<b>19</b>
--------------	-----------

---

barplot.EBVstats	<i>barplot EBV Stats</i>
------------------	--------------------------

---

## Description

A barplot of [EBVstats](#) is printed.

## Usage

```
## S3 method for class 'EBVstats'
barplot(height,
        ...)
```

## Arguments

height	tibble of EBVstats.
...	Additional arguments in <a href="#">barplot</a> .

## Value

Plot of EBVstats.

## Author(s)

Wilson Lara Henao <[wilarhen@temple.edu](mailto:wilarhen@temple.edu)> [aut, cre], Victor Gutierrez-Velez [aut]

## Examples

```
## Warnings from GDAL/PROJ are suppressed.

## Brick with structural Essential Biodiversity Variables covering the
## extent of a location in the northern Amazon basin (Colombia):

path. <- system.file('amazon.grd', package = 'ecochange')
amazon <- suppressWarnings(brick(path.))
```

```

## Tree-cover layers in the 'amazon' brick are both formatted and
## deforested:

suppressWarnings(
  def <- deforest(amazon, names(amazon)[grepl('TC', names(amazon))],
                 ebv.vals = 0:100,
                 remnant.areas = TRUE, keep.ebv = TRUE, mc.cores = 2)
)

## Deforestation Statistics:

defstats <- EBVstats(def)

## Barplot:

barplot(defstats)

```

---

deforest

*Deforest EBV*


---

## Description

This function can extract/subtract deforested areas from essential biodiversity variables (ebv) while focusing the analysis on a predefined area of occupancy.

## Usage

```

deforest(stk, ebv, loss = "lossyear",
         aoo, ebv.vals, loss.vals,
         incremental = TRUE,
         remnant.areas = TRUE,
         keep.ebv = FALSE,
         mc.cores = round(detectCores() *
                          0.6, 0))

```

## Arguments

stk	Raster*. Stack of ebv such as that produced by <a href="#">rsp2ebv</a> containing a 'lossyear' layer.
ebv	character. Name of the target layers in stk.
loss	character. Name of the 'lossyear' layer. Only for the case that it has a different name in stk. Default 'lossyear'.
aoo	character. Name of an optional binary raster in stk used to focus the analysis on a specific Area of Occupancy.
ebv.vals	numeric. Cell values in ebv. If missing then the whole range of values is processed

loss.vals	numeric. Cell values in loss. If missing then the function try to extract the values from the target layers in ebv. Otherwise the whole range of values in loss is processed.
incremental	logical. Develop incremental instead of discrete masking along the ebv.vals. Default TRUE.
remnant.areas	logical. Extract from ebv remnant areas instead of deforested areas . Default TRUE.
keep.ebv	logical. Keep in the extracted areas the corresponding cell values in ebv. Default FALSE produces binary masks: c(0,1).
mc.cores	numeric. The number of cores. Default uses around 60 percent CPU capacity.

### Value

RasterBrick.

### Author(s)

Wilson Lara Henao <wilarhen@temple.edu> [aut, cre], Victor Gutierrez-Velez [aut]

### References

- Jetz, W., McGeoch, M. A., Guralnick, R., Ferrier, S., Beck, J., Costello, M. J., ... & Meyer, C. (2019). Essential biodiversity variables for mapping and monitoring species populations. *Nature Ecology & Evolution*, 3(4), 539-551.
- Pekel, J. F., Cottam, A., Gorelick, N., & Belward, A. S. (2016). High-resolution mapping of global surface water and its long-term changes. *Nature*, 540(7633), 418-422.
- Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. *science*, 342(6160), 850-853.
- Sexton, J. O., Song, X. P., Feng, M., Noojipady, P., Anand, A., Huang, C., ... & Townshend, J. R. (2013). Global, 30-m resolution continuous fields of tree cover: Landsat-based rescaling of MODIS vegetation continuous fields with lidar-based estimates of error. *International Journal of Digital Earth*, 6(5), 427-448.

### Examples

```
## Warnings from GDAL/PROJ are suppressed.

## Brick with structural Essential Biodiversity Variables covering the
## extent of a location in the northern Amazon basin (Colombia):
path. <- system.file('amazon.grd',package = 'ecochange')
amazon <- suppressWarnings(brick(path.))

## Tree-cover layers in the 'amazon' brick are both formatted and
## deforested:
suppressWarnings(
  def <- deforest(amazon, names(amazon)[grepl('TC', names(amazon))],
```

```

        ebv.vals = 0:100,
        remnant.areas = TRUE, keep.ebv = TRUE, mc.cores = 2)
    )

    ## Function 'plotebv' allows comparing rasters using a common scale bar:
    suppressWarnings(
      plotebv(def)
    )

```

---

 EBVstats

*EBV Stats*


---

## Description

This function is a wrapper of `cellStats` to compute statistics of essential biodiversity variables.

## Usage

```
EBVstats(ccp, stats,
         ...)
```

## Arguments

<code>ccp</code>	RasterStack or NULL. If NULL then NULL is returned.
<code>stats</code>	character. vector of stats defined in <code>cellStats</code> . If missing then six summary statistics, including 'mean', 'sd', 'min', 'max', are computed.
<code>...</code>	Additional arguments in <code>cellStats</code>

## Value

list of EBVstats.

## Author(s)

Wilson Lara Henao <wilarhen@temple.edu> [aut, cre], Victor Gutierrez-Velez [aut]

## Examples

```

## Warnings from GDAL/PROJ are suppressed.

## Brick with structural Essential Biodiversity Variables covering the
## extent of a location in the northern Amazon basin (Colombia):

path. <- system.file('amazon.grd',package = 'ecochange')
amazon <- suppressWarnings(brick(path.))

## Tree-cover layers in the 'amazon' brick are both formatted and
## deforested:

```

```

suppressWarnings(
  def <- deforest(amazon, names(amazon)[grepl('TC', names(amazon))],
    ebv.vals = 0:100,
    remnant.areas = TRUE, keep.ebv = TRUE, mc.cores = 2)
)

## Deforestation Statistics:

defstats <- suppressWarnings(EBVstats(def))

## barplot method:

barplot(defstats)

```

---

gaugeIndicator

*Gauge Indicator*


---

## Description

This function processes stacks of essential biodiversity variables (ebv stacks) to gauge indicators related to horizontal ecosystem extent, degradation, fragmentation, among others. To sample the indicators in fixed-size grids across ebv stacks see [sampleIndicator](#).

## Usage

```
gaugeIndicator(pol, ind = "lsm_l_tafc",
  ...)
```

## Arguments

pol	RasterStack. ebv stack such as that produced by <a href="#">rsp2ebv</a> .
ind	character. An ebv metric. 'lsm_l_tafc' computes total forest-cover areas (ha). See <a href="#">calculate_lsm</a> to compute other metrics. Default ('lsm_l_tafc').
...	additional arguments in <a href="#">calculate_lsm</a> .

## Details

Coordinate system of the spatial units should be UTM. Metrics other than 'lsm\_l\_tafc' are calculated implementing [calculate\\_lsm](#).

## Value

tibble.

## Author(s)

Wilson Lara Henao <[wilarhen@temple.edu](mailto:wilarhen@temple.edu)> [aut, cre], Victor Gutierrez-Velez [aut]

## References

Hesselbarth, M. H., Sciaini, M., With, K. A., Wiegand, K., & Nowosad, J. (2019). landscapemetrics: an open source R tool to calculate landscape metrics. *Ecography*, 42(10), 1648-1657.

O'Connor, B., Secades, C., Penner, J., Sonnenschein, R., Skidmore, A., Burgess, N. D., & Hutton, J. M. (2015). Earth observation as a tool for tracking progress towards the Aichi Biodiversity Targets. *Remote sensing in ecology and conservation*, 1(1), 19-28.

Skidmore, A. K., & Pettorelli, N. (2015). Agree on biodiversity metrics to track from space: Ecologists and space agencies must forge a global monitoring strategy. *Nature*, 523(7561), 403-406.

## Examples

```
## Warnings from GDAL/PROJ are suppressed.

## Brick with structural Essential Biodiversity Variables covering the
## extent of a location in the northern Amazon basin (Colombia):

path. <- system.file('amazon.grd',package = 'ecochange')
amazon <- suppressWarnings(brick(path.))

## Tree-cover layers in the 'amazon' brick are both formatted and
## deforested:
suppressWarnings(
  def <- deforest(amazon, names(amazon)[grepl('TC', names(amazon))],
                 ebv.vals = 0:100,
                 remnant.areas = TRUE, keep.ebv = TRUE, mc.cores = 2)
)

## Binary layers of Forest and non-forest areas (keep.ebv = FALSE):

suppressWarnings(
  def_bin <- deforest(amazon, names(amazon)[grepl('TC', names(amazon))],
                    ebv.vals = 0:100,
                    remnant.areas = TRUE, keep.ebv = FALSE, mc.cores = 2)
)

## Areas for both the binary and the continuous forest layers:

defareas <- suppressWarnings(gaugeIndicator(def_bin, ind = 'lsm_c_ca'))
defclasses <- suppressWarnings(gaugeIndicator(def, ind = 'lsm_c_ca'))

## plot.gaugeIndicator method:

plot(defareas)
plot(defclasses)
```

**Description**

This function is a wrapper of `getData` used to import levels in Geographic Administrative Departments and Municipalities (GADM).

**Usage**

```
getGADM(unit.nm = NULL,  
        level = 2, country = "COL",  
        path = tempdir())
```

**Arguments**

<code>unit.nm</code>	character or NULL. Name of an administrative unit (e.g. municipality), or the name of such an unit plus its corresponding higher-level unit (e.g. department/state). If NULL then a list of unit names is printed.
<code>level</code>	numeric. A number between zero and two, indicating any of the levels of administrative subdivisions in GADM (0=country, 1=first level of subdivision, and 2=second level of subdivision).
<code>country</code>	character. ISO code specifying a country. Default 'COL'
<code>path</code>	character. Path name indicating where the unit will be stored. Default <code>tempdir()</code> .

**Value**

SpatialPolygonsDataFrame or character vector of GADM units..

**Author(s)**

Wilson Lara Henao <[wilarhen@temple.edu](mailto:wilarhen@temple.edu)> [aut, cre], Victor Gutierrez-Velez [aut]

**References**

<https://gadm.org/>

**Examples**

```
## Printing municipalities of Colombia:  
  
muni <- getGADM()  
head(muni)
```



---

getrsp *Get remote sensing product*

---

### Description

This function processes the extent of a predefined region of interest (polygon geometry or GADM unit) to download remote sensing products (RSP). Downloadable RSP include Global Surface Water, Forest Change, and Continuous Tree Cover data. See [listGP](#).

### Usage

```
getrsp(roi = NULL, ...,
       lyrs = NULL, path,
       verify.web = FALSE,
       mc.cores = round(detectCores() *
                        0.6, 0))
```

### Arguments

roi	SpatialPolygonsDataFrame; or character; or NULL. Region of interest. This can be whether 1) a polygon geometry; or 2) the name of a GADM unit (see <a href="#">getGADM</a> ); or 3) a NULL value. Default NULL makes the function to print a list of GADM units.
...	If roi is a GADM unit then additional arguments in <a href="#">getGADM</a> .
lyrs	character. Remote sensing products. Default NULL makes the function to print a list of Downloadable RSPs, see <a href="#">listGP</a> .
path	character. Path name indicating where the variables will be stored. Default uses a folder named as 'ecochange' located in a current temporary directory.
verify.web	logical. Verify in the web whether the URLs used to download the rsp are available. See <a href="#">getOption('webs')</a> . Default FALSE.
mc.cores	numeric. The number of cores. Default uses around 60 percent of the cores.

### Details

Downloads of Continuous Tree Cover data require user authentication through the NASA Earth data Login. To obtain a NASA Earth data Login account, please visit: <https://urs.earthdata.nasa.gov/users/new>.

### Value

Path names of the remote sensing products just retrieved, or character lists suggesting GADM units/Global Products that can be used to download rsp (see NULL defaults in arguments 'roi' and 'lyrs').

### Author(s)

Wilson Lara Henao <[wilarhen@temple.edu](mailto:wilarhen@temple.edu)> [aut, cre], Victor Gutierrez-Velez [aut]

## References

- Pekel, J. F., Cottam, A., Gorelick, N., & Belward, A. S. (2016). High-resolution mapping of global surface water and its long-term changes. *Nature*, 540(7633), 418-422.
- Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. *science*, 342(6160), 850-853.
- Sexton, J. O., Song, X. P., Feng, M., Noojipady, P., Anand, A., Huang, C., ... & Townshend, J. R. (2013). Global, 30-m resolution continuous fields of tree cover: Landsat-based rescaling of MODIS vegetation continuous fields with lidar-based estimates of error. *International Journal of Digital Earth*, 6(5), 427-448.

## Examples

```
## Warnings from GDAL/PROJ are suppressed.

## A Global Surface Water layer ('seasonality') covering the extent of a
## Colombian municipality Cartagena del Chair i is retrieved:
  load(system.file('cchaira_roi.RData',package = 'ecochange'))

suppressWarnings(
  rsp_cchaira <- getrsp(roi = cchaira_roi,
    lyrs = 'seasonality', mc.cores = 2, path = tempdir())
)
file.exists(rsp_cchaira) #TRUE
```

---

getWRS

*Get WRS*

---

## Description

This function processes regions of interest (a polygon geometry or GADM unit) to find corresponding Landsat Path/Row World Reference System (WRS) polygons. This function is internally implemented by [getrsp](#)

## Usage

```
getWRS(roi = NULL, path = tempdir(),
  ...)
```

## Arguments

**roi** SpatialPolygonsDataFrame; or character; or NULL. Region of interest. This can be whether 1) a polygon geometry; or 2) the name of a GADM unit (see [getGADM](#)); or 3) a NULL value. Default NULL makes the function to print a list of GADM units.

path character. Path name indicating where the WRS data are processed.  
 ... Additional arguments in [getGADM](#).

**Value**

SpatialPolygonsDataFrame, or set of GADM units.

**Author(s)**

Wilson Lara Henao <[wilarhen@temple.edu](mailto:wilarhen@temple.edu)> [aut, cre], Victor Gutierrez-Velez [aut]

**Examples**

```
load(system.file('cchaira_roi.RData', package = 'ecochange'))

wrs_cchaira <- suppressWarnings(getWRS(cchaira_roi))
plot(wrs_cchaira)
```

---

listGP	<i>List of global products</i>
--------	--------------------------------

---

**Description**

This function prints a list of remote sensing products that can be downloaded with [getrsp](#).

**Usage**

```
listGP(layer = TRUE,
        Algorithm = TRUE,
        author = TRUE, funs = FALSE,
        api.code = FALSE)
```

**Arguments**

layer character. Add column 'layer' to the data.  
 Algorithm character. Add column 'Algorithm' to the data.  
 author character. Add column 'author' to the data.  
 funs character. Add column 'funs' to the data.  
 api.code character. Add column 'api.code' to the data.

**Value**

tibble.

**Author(s)**

Wilson Lara Henao <[wilarhen@temple.edu](mailto:wilarhen@temple.edu)> [aut, cre], Victor Gutierrez-Velez [aut]

## References

- Pekel, J. F., Cottam, A., Gorelick, N., & Belward, A. S. (2016). High-resolution mapping of global surface water and its long-term changes. *Nature*, 540(7633), 418-422.
- Hansen, M. C., Potapov, P. V., Moore, R., Hancher, M., Turubanova, S. A., Tyukavina, A., ... & Kommareddy, A. (2013). High-resolution global maps of 21st-century forest cover change. *science*, 342(6160), 850-853.
- Sexton, J. O., Song, X. P., Feng, M., Noojipady, P., Anand, A., Huang, C., ... & Townshend, J. R. (2013). Global, 30-m resolution continuous fields of tree cover: Landsat-based rescaling of MODIS vegetation continuous fields with lidar-based estimates of error. *International Journal of Digital Earth*, 6(5), 427-448.

## Examples

```
lst <- listGP()
```

---

plot.Indicator	<i>Plot indicator</i>
----------------	-----------------------

---

## Description

A plot of `gaugeIndicator` is printed.

## Usage

```
## S3 method for class 'Indicator'
plot(x, ...)
```

## Arguments

`x` [tibble](#). Data set of indicators such as that produced by `gaugeIndicator`.

`...` Further arguments in [aes](#).

## Author(s)

Wilson Lara Henao <wilarhen@temple.edu> [aut, cre], Victor Gutierrez-Velez [aut]

## Examples

```
## Warnings from GDAL/PROJ are suppressed.

## Brick with structural Essential Biodiversity Variables covering the
## extent of a location in the northern Amazon basin (Colombia):

path. <- system.file('amazon.grd', package = 'ecochange')
amazon <- suppressWarnings(brick(path.))
```

```

## Tree-cover layers in the 'amazon' brick are both formatted and
## deforested:
suppressWarnings(
  def <- deforest(amazon, names(amazon)[grepl('TC', names(amazon))],
                 ebv.vals = 0:100,
                 remnant.areas = TRUE, keep.ebv = TRUE, mc.cores = 2)
)

## Binary layers of Forest and non-forest areas (keep.ebv = FALSE):
suppressWarnings(
  def_bin <- deforest(amazon, names(amazon)[grepl('TC', names(amazon))],
                    ebv.vals = 0:100,
                    remnant.areas = TRUE, keep.ebv = FALSE, mc.cores = 2)
)

## Areas for both the binary and the continuous forest layers:

defareas <- suppressWarnings(gaugeIndicator(def_bin, ind = 'lsm_c_ca'))
defclasses <- suppressWarnings(gaugeIndicator(def, ind = 'lsm_c_ca'))

## Plot the indicators:

plot(defareas)
plot(defclasses)

```

---

plotebv

*Plot EBV*


---

## Description

This function prints levelplots of Essential Biodiversity Variables using a common spatial scale bar. The function is helpful to compare EBV indicators.

## Usage

```
plotebv(ebv, ...)
```

## Arguments

```
ebv          Raster*. Raster Object.
...          
```

## Value

```
levelplot.
```

## Author(s)

Wilson Lara Henao <wilarhen@temple.edu> [aut, cre], Victor Gutierrez-Velez [aut]

## Examples

```
## Warnings from GDAL/PROJ are suppressed.

## Brick with structural Essential Biodiversity Variables covering the
## extent of a location in the northern Amazon basin (Colombia):

path. <- system.file('amazon.grd',package = 'ecochange')
amazon <- suppressWarnings(brick(path.))

## Tree-cover layers in the 'amazon' brick are both formatted and
## deforested:

suppressWarnings(
  def <- deforest(amazon, names(amazon)[grep1('TC', names(amazon))],
                 ebv.vals = 0:100,
                 remnant.areas = TRUE, keep.ebv = TRUE, mc.cores = 2)
)

## Plot:
suppressWarnings(
  plotebv(def)
)
```

---

 rsp2ebv

*Remote Sensing Product to EBV*


---

## Description

This function processes regions of interest (polygon geometry or GADM unit) to integrate dissimilar remote sensing products (RSP) into Essential biodiversity variables.

## Usage

```
rsp2ebv(roi = NULL, ...,
        lyrs = NULL, path,
        sr, ofr = c(30, 30))
```

## Arguments

roi	SpatialPolygonsDataFrame; or character; or NULL. Region of interest. This can be whether 1) a polygon geometry; or 2) the name of a GADM unit (see <a href="#">getGADM</a> ); or 3) a NULL value. Default NULL makes the function to print a list of GADM units.
...	If roi is a GADM unit then additional arguments in <a href="#">getGADM</a> can be specified here.
lyrs	character. Remote sensing products, If NULL then a list of products is printed, see <a href="#">listGP</a> . Default NULL.

path	character. Path name indicating where the variables are stored. If it is missing then a folder named as 'ecochange' located in a current temporary directory is used.
sr	character. PROJ.4 description of the target coordinate reference system. If missing then the target layers are projected to metric system UTM.
ofr	numeric. c(xres,yres). Output file resolution (in target georeferenced units). Default c(30,30) m2.

### Details

This function implements 'gdalUtils' so it assumes the user has a working GDAL on their system. From the documentation: "If the 'gdalUtils\_gdalPath' option has been set (usually by 'gdal\_setInstallation'), the GDAL found in that path will be used. If nothing is found, 'gdal\_setInstallation' will be executed to attempt to find a working GDAL that has the right drivers as specified with the 'of' (output format) parameter", see example below.

### Value

RasterBrick of essential biodiversity variables (UTM crs), or character lists suggesting GADM units/Global Products that can be used to download rsp (see NULL defaults in arguments 'roi' and 'lyrs').

### Author(s)

Wilson Lara Henao <wilarhen@temple.edu> [aut, cre], Victor Gutierrez-Velez [aut]

### References

- Jetz, W., McGeoch, M. A., Guralnick, R., Ferrier, S., Beck, J., Costello, M. J., ... & Meyer, C. (2019). Essential biodiversity variables for mapping and monitoring species populations. *Nature Ecology & Evolution*, 3(4), 539-551.
- O'Connor, B., Secades, C., Penner, J., Sonnenschein, R., Skidmore, A., Burgess, N. D., & Hutton, J. M. (2015). Earth observation as a tool for tracking progress towards the Aichi Biodiversity Targets. *Remote sensing in ecology and conservation*, 1(1), 19-28.
- Skidmore, A. K., & Pettorelli, N. (2015). Agree on biodiversity metrics to track from space: Ecologists and space agencies must forge a global monitoring strategy. *Nature*, 523(7561), 403-406.

### Examples

```
## First, we'll check to make sure there is a valid GDAL
## installation (from 'gdalUtils'):

## \donttest{
## gdalUtils::gdal_setInstallation()
## valid_install <- !is.null(getOption("gdalUtils_gdalPath"))
## }

## Warnings from GDAL/PROJ are suppressed.
```

```

## A Global Surface Water layer ('seasonality') covering the extent of a
## Colombian municipality Cartagena del Chair i is formatted into an
## spatial EBV:
      load(system.file('cchaira_roi.RData',package = 'ecochange'))

suppressWarnings(
  rsp_cchaira <- getrsp(roi = cchaira_roi,
    lyrs = 'seasonality', mc.cores = 2, path = tempdir())
)

file.exists(rsp_cchaira) #TRUE

suppressWarnings(
  season_cchaira <- rsp2ebv(roi = cchaira_roi,
    lyrs = 'seasonality', path = tempdir())
)

suppressWarnings(
  plotebv(season_cchaira)
)

```

---

sampleIndicator

*Sample Indicator*


---

## Description

This function can divide Essential Biodiversity Variables into fixed-size grids and calculate biodiversity indicators in the grids. To compute indicators avoiding the grid sampling procedure see [gaugeIndicator](#)

## Usage

```

sampleIndicator(roi = NULL,
  ..., ind = "condent",
  min = 1, max = 100,
  classes = 5, side,
  perc. = 15, mc.cores = round(detectCores() *
    0.6, 0))

```

## Arguments

**roi** Raster\*; or SpatialPolygonsDataFrame; or character; or NULL. Raster object such as these produced by [rsp2ebv](#) and [deforest](#); or region of interest (roi). The roi can be whether 1) a polygon geometry; or 2) the name of a GADM unit (see [getGADM](#)); or 3) a NULL value. Default NULL makes the function to print a list of GADM units.



...	If roi is not a Raster* then additional arguments in <code>rsp2ebv</code> can be specified here.
ind	character. Indicator. This can be cohesion ('cohesion'), conditional entropy ('condent'), perimeter-area fractal dimension ('condent'), among other, see package <code>landscapemetrics</code> . Default computes conditional entropy 'condent'.
min	numeric. Minimum cell value in the layers. This value is used to subset the data before it is reclassified, see argument 'classes' below. Default 1
max	numeric. Maximum cell value in the layers. This value is used to subset the data before it is reclassified, see argument 'classes' below. Default 100
classes	numeric; or NULL. Number of classes between 1-30 used to reclassify the layers. Default 5. If NULL then the layers are not reclassified.
side	numeric. The side of the sampling grid (m). If this is not specified, the function tries to find the maximum side length that allows splitting the layer extents into n suitable grids.
perc.	numeric. Minimum percentage of features per grid. Grids with lower percentages than this value are set to NA.
mc.cores	numeric. The number of cores. Default uses 60 percent of the cores.

### Value

Raster\*.

### Author(s)

Wilson Lara Henao <wilarhen@temple.edu> [aut, cre], Victor Gutierrez-Velez [aut]

### References

- Hesselbarth, M. H., Sciaini, M., With, K. A., Wiegand, K., & Nowosad, J. (2019). `landscapemetrics`: an open source R tool to calculate landscape metrics. *Ecography*, 42(10), 1648-1657.
- O'Connor, B., Secades, C., Penner, J., Sonnenschein, R., Skidmore, A., Burgess, N. D., & Hutton, J. M. (2015). Earth observation as a tool for tracking progress towards the Aichi Biodiversity Targets. *Remote sensing in ecology and conservation*, 1(1), 19-28.
- Skidmore, A. K., & Pettorelli, N. (2015). Agree on biodiversity metrics to track from space: Ecologists and space agencies must forge a global monitoring strategy. *Nature*, 523(7561), 403-406.

### Examples

```
## Warnings from GDAL/PROJ are suppressed.

## Brick with structural Essential Biodiversity Variables covering the
## extent of a location in the northern Amazon basin (Colombia):

path. <- system.file('amazon.grd',package = 'ecochange')
amazon <- suppressWarnings(brick(path.))

## Tree-cover layers in the 'amazon' brick are both formatted and
```

```
## deforested:

suppressWarnings(
  def <- deforest(amazon, names(amazon)[grepl('TC', names(amazon))],
    ebv.vals = 0:100,
    remnant.areas = TRUE, keep.ebv = TRUE, mc.cores = 2)
)

## Conditional entropy is sampled along the deforested layers using
## cell sides of 300m:
suppressWarnings(
  condent <- sampleIndicator(def, side = 300, mc.cores = 2)
)
suppressWarnings(
  plotebv(condent)
)
```

# Index

`aes`, [12](#)

`barplot`, [2](#)

`barplot.EBVstats`, [2](#)

`calculate_lsm`, [6](#)

`cellStats`, [5](#)

`deforest`, [3](#), [16](#)

`EBVstats`, [2](#), [5](#)

`gaugeIndicator`, [6](#), [12](#), [16](#)

`getData`, [8](#)

`getGADM`, [7](#), [9–11](#), [14](#), [16](#)

`getrsp`, [9](#), [10](#), [11](#)

`getWRS`, [10](#)

`landscapemetrics`, [17](#)

`listGP`, [9](#), [11](#), [14](#)

`plot.Indicator`, [12](#)

`plotebv`, [13](#)

`rsp2ebv`, [3](#), [6](#), [14](#), [16](#), [17](#)

`sampleIndicator`, [6](#), [16](#)

`tibble`, [12](#)