# Package 'FedData'

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**Type** Package

**Title** Functions to Automate Downloading Geospatial Data Available from Several Federated Data Sources

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**Description** Functions to automate downloading geospatial data available from several federated data sources (mainly sources maintained by the US Federal government). Currently, the package allows for retrieval of five datasets: The National Elevation Dataset digital elevation models (1 and 1/3 arc-second; USGS); The National Hydrography Dataset (USGS); The Soil Survey Geographic (SSURGO) database from the National Cooperative Soil Survey (NCSS), which is led by the Natural Resources Conservation Service (NRCS) under the USDA; the Global Historical Climatology Network (GHCN), coordinated by National Climatic Data Center at NOAA; and the International Tree Ring Data Bank. Additional data sources are in the works, including global DEM resources (ETOPO1, ETOPO5, ETOPO30, SRTM), global soils (HWSD), MODIS satellite data products, the National Atlas (US), Natural Earth, PRISM, and WorldClim.

**License** GPL-3

**Depends** sp, raster, rgdal, rgeos, igraph, Hmisc, data.table

## R topics documented:

## FedData-package *Scripts to automate downloading geospatial data available from the several federated data sources*

### Description

This package contains scripts to automate downloading geospatial data available from the several federated data sources (mainly sources maintained by the US Federal government). Currently, the package allows for retrieval of five datasets:

- The National Elevation Dataset digital elevation models (1 and 1/3 arc-second; USGS)
- The National Hydrography Dataset (USGS)
- The Soil Survey Geographic (SSURGO) database from the National Cooperative Soil Survey (NCSS), which is led by the Natural Resources Conservation Service (NRCS) under the USDA, and
- The Global Historical Climatology Network (GHCN), coordinated by National Climatic Data Center at NOAA.
- The International Tree Ring Data Bank (ITRDB), coordinated by National Climatic Data Center at NOAA.

Additional data sources are in the works, including global DEM resources (ETOPO1, ETOPO5, ETOPO30, SRTM), global soils (HWSD), MODIS satellite data products, the National Atlas (US), Natural Earth, PRISM, and WorldClim.

### Details

| | |
|---|---|
| Package: | FedData |
| Type: | FedData |
| Version: | 1.1 |
| Date: | 2015-03-19 |
| License: | GPL-3 |

This package is designed with the large-scale GIS use-case in mind: cases where the use of dynamic web-services is impractical due to the scale (spatial and/or temporal) of analysis. It functions primarily as a means of downloading tiled or otherwise spaticially-defined datasets; additionally, it can preprocess those datasets by extracting data within an area of interest (AoI), defined spatially. It relies heavily on the **sp**, **raster**, and **rgdal** packages, and requires three command line tools be installed by the user (and accesible through `system` calls in *R*): wget (for downloading with timestamping), `GDAL` (for manipulating raster and vector spatial data), and mdbtools (for extracting data from access databases).

There are three general types of methods available for each dataset (and others for particular datasets):

get...: High-level function that allows the user to define an AoI ("template") and returns the dataset cropped/mask

extract...: Mid-level functions that automate extraction of tabular data from databases (such as the SSURGO soils tab

download...: Low-level functions that automate downloading of raw tabular and spatial data from databases. Downloadi

Additionally, most functions can be forced to "start fresh" in downloading or processing data by specifying `force.redo=TRUE` in the function call.

## Author(s)

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## References

Gesch, D.B. (2007) The National Elevation Dataset, in Maune, D., ed., *Digital Elevation Model Technologies and Applications: The DEM Users Manual.* 2nd Edition. American Society for Photogrammetry and Remote Sensing, Bethesda, Maryland.

Gesch, D., Oimoen, M., Greenlee, S., Nelson, C., Steuck, M., and Tyler, D. (2002) The National Elevation Dataset. *Photogrammetric Engineering and Remote Sensing* 68(1):5–11.

Grissino-Mayer HD, Fritts HC. (1997) The International Tree-Ring Data Bank: An enhanced global database serving the global scientific community. *The Holocene* 7(2):235–238.

Menne, M., Durre, I., Korzeniewski, B., McNeal, S., Thomas, K., Yin, X., Anthony, S., Ray, R., Vose, R., B.E.Gleason, and Houston, T. (2012) *Global Historical Climatology Network-Daily (GHCN-Daily), Version 3.* `http://doi.org/10.7289/V5D21VHZ`.

Soil Survey Staff, Natural Resources Conservation Service, United States Department of Agriculture. Soil Survey Geographic (SSURGO) Database. Available online at `http://sdmdataaccess.nrcs.usda.gov/`.

## Examples

```
## Not run:
install.packages("FedData")
library(FedData)

# Get a random contiguous USA county for testing
wgetDownload(
  "http://dds.cr.usgs.gov/pub/data/nationalatlas/countyp010g.shp_nt00934.tar.gz"
  ,destdir=getwd())

untar("./countyp010g.shp_nt00934.tar.gz")
county <- rgdal::readOGR(".","countyp010g")
county <- county[!(county$STATE
county <- county[sample(1:length(county),1),]

# Get the NED (USA ONLY)
# Returns a raster
NED <- getNED(template=county,
  label=paste(county$STATE,'_',county$NAME, sep=''), res='1')

# Get the daily GHCN data (GLOBAL)
# Returns a list: the first element is the spatial locations of stations,
# and the second is a list of the stations and their daily data
GHCN.prcp <- getGHCNDaily(template=county,
  label=paste(county$STATE,'_',county$NAME, sep=''),
  elements=c('prcp'),
  standardize=F)

GHCN.temp <- getGHCNDaily(template=county,
  label=paste(county$STATE,'_',county$NAME, sep=''),
  elements=c('tmin','tmax'),
  standardize=T)

# Get the NHD (USA ONLY)
NHD <- getNHD(template=county,
  label=paste(county$STATE,'_',county$NAME, sep=''))

# Get the NRCS SSURGO data (USA ONLY)
SSURGO <- getSSURGO(template=county,
  label=paste(county$STATE,'_',county$NAME, sep=''))

# Get the ITRDB data
ITRDB <- getITRDB(template=county,
  label=paste(county$STATE,'_',county$NAME, sep=''))


## End(Not run)
```

## downloadGHCNDailyStation

*Download the daily data for a GHCN weather station.*

### Description

Download the daily data for a GHCN weather station.

### Usage

```
downloadGHCNDailyStation(ID, raw.dir, force.redo = F)
```

### Arguments

`ID` A character string giving the station ID.

`raw.dir` A character string indicating where raw downloaded files should be put.

`force.redo` If this weather station has been downloaded before, should it be updated? Defaults to FALSE.

### Value

A character string representing the full local path of the GHCN station data.

---

## `downloadHUC4` *Download a zipped directory containing a shapefile of the HUC4 subregions of the NHD.*

---

### Description

Download a zipped directory containing a shapefile of the HUC4 subregions of the NHD.

### Usage

```
downloadHUC4(raw.dir)
```

### Arguments

| | |
|---|---|
| `raw.dir` | A character string indicating where raw downloaded files should be put. |

### Value

A character string representing the full local path of the HUC4 zipped directory.

---

## `downloadITRDB` *Download the latest version of the ITRDB.*

---

### Description

Downloads and parses the latest zipped (numbered) version of the ITRDB. This function includes improvements to the `read.crn` function from the **dplR** library. The principle changes are better parsing of metadata, and support for the Schweingruber-type Tucson format. Chronologies that are unable to be read are reported to the user.

### Usage

```
downloadITRDB(raw.dir = "./RAW/ITRDB/", force.redo = FALSE)
```

### Arguments

| | |
|---|---|
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. Defaults to "./RAW/ITRDB/". |
| `force.redo` | If a download already exists, should a new one be created? Defaults to FALSE. |

### Value

A data.table containing all of the ITRDB data.

## `downloadNEDTile` *Download a zipped tile from the 1 (~30 meter) or 1/3 (~10 meter) arc-second National Elevation Dataset.*

### Description

Tiles are specified by a resolution, northing, and westing; northing and westing refer to the northwest corner of each NED tile, in degrees; tiles are 1x1 degree. Tiles are downloaded in zipped ESRI ArcGrid format. `downloadNED` returns the path to the downloaded zip file.

### Usage

```
downloadNEDTile(res = NULL, tileNorthing, tileWesting, raw.dir)
```

### Arguments

| | |
|---|---|
| `res` | A character string representing the desired resolution of the NED. "1" indicates the 1 arc-second NED, while "13" indicates the 1/3 arc-second dataset. Defaults to NULL. |
| `tileNorthing` | An integer representing the northing (latitude, in degrees north of the equator) of the northwest corner of the tile to be downloaded. |
| `tileWesting` | An integer representing the westing (longitude, in degrees west of the prime meridian) of the northwest corner of the tile to be downloaded. |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. Defaults to "./RAW/NED/". |

### Value

A character string representing the full local path of the downloaded directory.

## `downloadNHDSubregion` *Download a zipped NHD HUC4 subregion.*

### Description

HUC4 subregion are specified by a unique character string, best obtained using the `getHUC4` function. `downloadNHDSubregion` returns the path to the downloaded zip file.

### Usage

```
downloadNHDSubregion(area, raw.dir)
```

### Arguments

| | |
|---|---|
| `area` | A 4-character string indicating the HUC4 NHD subregion to download. |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. |

### Value

A character string representing the full local path of the downloaded zip file.

---

`downloadSSURGOInventory`
*Download a zipped directory containing a shapefile of the SSURGO study areas.*

---

## Description

Download a zipped directory containing a shapefile of the SSURGO study areas.

## Usage

```
downloadSSURGOInventory(raw.dir)
```

## Arguments

| | |
|---|---|
| `raw.dir` | A character string indicating where raw downloaded files should be put. |

## Value

A character string representing the full local path of the SSURGO study areas zipped directory.

---

`downloadSSURGOStudyArea`
*Download a zipped directory containing the spatial and tabular data for a SSURGO study area.*

---

## Description

`downloadSSURGOStudyArea` first tries to download data including a state-specific Access template, then the general US template.

## Usage

```
downloadSSURGOStudyArea(area, date, raw.dir)
```

## Arguments

| | |
|---|---|
| `area` | A character string indicating the SSURGO study area to be downloaded. |
| `date` | A character string indicating the date of the most recent update to the SSURGO area for these data. This information may be gleaned from the SSURGO Inventory (`getSSURGOInventory`). |
| `raw.dir` | A character string indicating where raw downloaded files should be put. |

## Value

A character string representing the full local path of the SSURGO study areas zipped directory.

## `extractSSURGOData` *Extract data from a SSURGO databse pertaining to a set of mapunits.*

### Description

`extractSSURGOData` creates a directed graph of the joins in a SSURGO tabular dataset, and then iterates through the tables, only retaining data pertinant to a set of mapunits.

### Usage

```
extractSSURGOData(tables, mapunits)
```

### Arguments

| | |
|---|---|
| `tables` | A list of SSURGO tabular data. |
| `mapunits` | A `SpatialPolygonsDataFrame` of mapunits (likely dropped from SSURGO spatial data) defining which mapunits to retain. |

### Value

A list of extracted SSURGO tabular data.

## `getGHCNDaily` *Download and crop the Global Historical Climate Network-Daily data.*

### Description

`getGHCNDaily` returns a named list of length 2:

1. "spatial": A `SpatialPointsDataFrame` of the locations of GHCN weather stations in the template, and
2. "tabular": A named list of `data.frame`s with the daily weather data for each station. The name of each list item is the station ID.

### Usage

```
getGHCNDaily(template = NULL, label = NULL, elements = NULL,
  raw.dir = "./RAW/GHCN/", extraction.dir = "./EXTRACTIONS/GHCN/",
  standardize = F, force.redo = F)
```

### Arguments

| | |
|---|---|
| `template` | A Raster* or Spatial* object to serve as a template for cropping. |
| `label` | A character string naming the study area. |
| `elements` | A character vector of elemets to extract. Common elements include "tmin", "tmax", and "prcp". |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. Defaults to "./RAW/GHCN/". |

| | |
|---|---|
| `extraction.dir` | A character string indicating where the extracted and cropped GHCN shapefiles should be put. The directory will be created if missing. Defaults to "./EXTRACTIONS/GHCN/". |
| `standardize` | Select only common year/month/day? Defaults to FALSE. |
| `force.redo` | If an extraction for this template and label already exists, should a new one be created? Defaults to FALSE. |

## Value

A named list containing the "spatial" and "tabular" data.

---

## `getGHCNDailyStation` *Download and extract the daily data for a GHCN weather station.*

---

### Description

`getGHCNDailyStation` returns a named list of `data.frame`s, one for each `elements`. If `elements` is undefined, it returns all available weather tables for the station

### Usage

```
getGHCNDailyStation(ID, elements = NULL, raw.dir, standardize = F,
  force.redo = F)
```

### Arguments

| | |
|---|---|
| `ID` | A character string giving the station ID. |
| `elements` | A character vector of elemets to extract. Common elements include "tmin", "tmax", and "prcp". |
| `raw.dir` | A character string indicating where raw downloaded files should be put. |
| `standardize` | Select only common year/month/day? Defaults to FALSE. |
| `force.redo` | If this weather station has been downloaded before, should it be updated? Defaults to FALSE. |

### Value

A named list of `data.frame`s, one for each `elements`.

## `getGHCNInventory` *Download and crop the inventory of GHCN stations.*

### Description

`getGHCNInventory` returns a `SpatialPolygonsDataFrame` of the GHCN stations within the specified `template`. If template is not provided, returns the entire GHCN inventory.

### Usage

```
getGHCNInventory(template = NULL, elements = NULL, raw.dir)
```

### Arguments

| | |
|---|---|
| `template` | A Raster* or Spatial* object to serve as a template for cropping. |
| `elements` | A character vector of elemets to extract. Common elements include "tmin", "tmax", and "prcp". |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. |

### Details

Stations with multiple elements will have multiple points. This allows for easy mapping of stations by element availability.

### Value

A `SpatialPolygonsDataFrame` of the GHCN stations within the specified `template`

## `getHUC4` *Download and crop a shapefile of the HUC4 regions of the National Hydrography Dataset.*

### Description

`getHUC4` returns a `SpatialPolygonsDataFrame` of the HUC4 regions within the specified `template`. If template is not provided, returns the entire HUC4 dataset.

### Usage

```
getHUC4(template = NULL, raw.dir)
```

### Arguments

| | |
|---|---|
| `template` | A Raster* or Spatial* object to serve as a template for cropping. |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. |

### Value

A `SpatialPolygonsDataFrame` of the HUC4 regions within the specified `template`.

getITRDB *Download the latest version of the ITRDB, and extract given parameters.*

### Description

getITRDB returns a named list of length 3:

1. "metadata": A data.table or SpatialPointsDataFrame (if makeSpatial==TRUE) of the locations and names of extracted ITRDB chrononlogies,
2. "widths": A matrix of tree-ring widths/densities given user selection, and
3. "depths": A matrix of tree-ring sample depths.

### Usage

```
getITRDB(template = NULL, label = NULL, recon.years = NULL,
  calib.years = NULL, species = NULL, measurement.type = NULL,
  chronology.type = NULL, makeSpatial = F, raw.dir = "./RAW/ITRDB/",
  extraction.dir = "./EXTRACTIONS/ITRDB/", force.redo = FALSE)
```

### Arguments

template A Raster* or Spatial* object to serve as a template for selecting chronologies.

label A character string naming the study area.

recon.years A numeric vector of years over which reconstructions are needed; if missing, the union of all years in the available chronologies are given.

calib.years A numeric vector of all required years—chronologies without these years will be discarded; if missing, all available chronologies are given.

species A character vector of 4-letter tree species identifiers; if missing, all available chronologies are given.

measurement.type
A character vector of measurement type identifiers. Options include:

- "Total Ring Density"
- "Earlywood Width"
- "Earlywood Density"
- "Latewood Width"
- "Minimum Density"
- "Ring Width"
- "Latewood Density"
- "Maximum Density"
- "Latewood Percent"

if missing, all available chronologies are given.

chronology.type
A character vector of chronology type identifiers. Options include:

- "Low Pass Filter"
- "Residual"
- "Standard"

- "Re-Whitened Residual"
- "Measurements Only"

if missing, all available chronologies are given.

| | |
|---|---|
| makeSpatial | Should the metadata be presented as a SpatialPointsDataFrame? Defaults to FALSE. |
| raw.dir | A character string indicating where raw downloaded files should be put. The directory will be created if missing. Defaults to "./RAW/ITRDB/". |
| extraction.dir | A character string indicating where the extracted and cropped ITRDB dataset should be put. The directory will be created if missing. Defaults to "./EXTRACTIONS/ITRDB/". |
| force.redo | If an extraction already exists, should a new one be created? Defaults to FALSE. |

### Value

A named list containing the "metadata", "widths", and "depths" data.

## getNED *Download and crop the 1 (~30 meter) or 1/3 (~10 meter) arc-second National Elevation Dataset.*

### Description

getNED returns a RasterLayer of elevation data cropped to a given template study area.

### Usage

```
getNED(template, label, res = NULL, raw.dir = "./RAW/NED/",
  extraction.dir = "./EXTRACTIONS/NED/", force.redo = F)
```

### Arguments

| | |
|---|---|
| template | A Raster* or Spatial* object to serve as a template for cropping, and perhaps resolution. If a Raster* with a resolution that is less than 1/3 arc-second, getNED defaults to the 1/3 arc-second dataset. Otherwise, it defaults to the 1 arc-second dataset. |
| label | A character string naming the study area. |
| res | A character string representing the desired resolution of the NED. "1" indicates the 1 arc-second NED, while "13" indicates the 1/3 arc-second dataset. Defaults to NULL. |
| raw.dir | A character string indicating where raw downloaded files should be put. The directory will be created if missing. Defaults to "./RAW/NED/". |
| extraction.dir | A character string indicating where the extracted and cropped DEM should be put. The directory will be created if missing. Defaults to "./EXTRACTIONS/NED/". |
| force.redo | If an extraction for this template and label already exists, should a new one be created? |

### Value

A RasterLayer DEM cropped to the extent of the template.

---

getNEDTile *Download and crop tile from the 1 (~30 meter) or 1/3 (~10 meter) arc-second National Elevation Dataset.*

---

## Description

getNEDTile returns a RasterLayer cropped within the specified template. If template is not provided, returns the entire NED tile.

## Usage

```
getNEDTile(template = NULL, res, tileNorthing, tileWesting, raw.dir)
```

## Arguments

| | |
|---|---|
| template | A Raster* or Spatial* object to serve as a template for cropping. |
| res | A character string representing the desired resolution of the NED. "1" indicates the 1 arc-second NED, while "13" indicates the 1/3 arc-second dataset. Defaults to NULL. |
| tileNorthing | An integer representing the northing (latitude, in degrees north of the equator) of the northwest corner of the tile to be downloaded. |
| tileWesting | An integer representing the westing (longitude, in degrees west of the prime meridian) of the northwest corner of the tile to be downloaded. |
| raw.dir | A character string indicating where raw downloaded files should be put. The directory will be created if missing. Defaults to "./RAW/NED/". |

## Value

A RasterLayer cropped within the specified template.

---

getNHD *Download and crop the National Hydrography Dataset.*

---

## Description

getNHD returns a list of Spatial* objects extracted from the National Hydrography Dataset.

## Usage

```
getNHD(template, label, raw.dir = "./RAW/NHD/",
  extraction.dir = "./EXTRACTIONS/NHD/", force.redo = FALSE)
```

### Arguments

| | |
|---|---|
| `template` | A Raster* or Spatial* object to serve as a template for cropping. |
| `label` | A character string naming the study area. |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. Defaults to "./RAW/NHD/". |
| `extraction.dir` | A character string indicating where the extracted and cropped NHD shapefiles should be put. The directory will be created if missing. Defaults to "./EXTRACTIONS/NHD/". |
| `force.redo` | If an extraction for this template and label already exists, should a new one be created? |

### Value

A list of Spatial* objects extracted from the National Hydrography Dataset.

## `getNHDSubregion` *Download and crop data from a zipped HUC4 subregion of the National Hydrography Dataset.*

### Description

`getNHDSubregion` returns a list of `SpatialPolygonsDataFrames` of the layers of the HUC4 subregion, within the specified `template`. If template is not provided, returns the entire HUC4 subregion.

### Usage

```
getNHDSubregion(template = NULL, area, raw.dir)
```

### Arguments

| | |
|---|---|
| `template` | A Raster* or Spatial* object to serve as a template for cropping. |
| `area` | A 4-character string indicating the HUC4 NHD subregion to download and crop. |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. |

### Value

A `SpatialPolygonsDataFrame` of the HUC4 regions within the specified `template`.

## getSSURGO *Download and crop data from the NRCS SSURGO soils database.*

### Description

This is an efficient method for spatially merging several different soil survey areas as well as merging their tabular data.

### Usage

```
getSSURGO(template, label, raw.dir = "./RAW/SSURGO/",
  extraction.dir = "./EXTRACTIONS/SSURGO/", force.redo = FALSE)
```

### Arguments

| | |
|---|---|
| `template` | A Raster* or Spatial* object to serve as a template for cropping. |
| `label` | A character string naming the study area. |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. Defaults to "./RAW/SSURGO/". |
| `extraction.dir` | A character string indicating where the extracted and cropped SSURGO shapefiles should be put. The directory will be created if missing. Defaults to "./EXTRACTIONS/SSURGO/". |
| `force.redo` | If an extraction for this template and label already exists, should a new one be created? Defaults to FALSE. |

### Details

`getSSURGO` returns a named list of length 2:

1. "spatial": A `SpatialPolygonsDataFrame` of soil mapunits in the template, and
2. "tabular": A named list of `data.frame`s with the SSURGO tabular data.

### Value

A named list containing the "spatial" and "tabular" data.

## getSSURGOInventory *Download and crop a shapefile of the SSURGO study areas.*

### Description

`getSSURGOInventory` returns a `SpatialPolygonsDataFrame` of the SSURGO study areas within the specified `template`. If template is not provided, returns the entire SSURGO inventory of study areas.

### Usage

```
getSSURGOInventory(template = NULL, raw.dir)
```

### Arguments

| | |
|---|---|
| `template` | A Raster* or Spatial* object to serve as a template for cropping. |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. |

### Value

A `SpatialPolygonsDataFrame` of the SSURGO study areas within the specified `template`.

---

## `getSSURGOStudyArea` *Download and crop the spatial and tabular data for a SSURGO study area.*

---

### Description

`getSSURGOStudyArea` returns a named list of length 2:

1. "spatial": A `SpatialPolygonsDataFrame` of soil mapunits in the template, and
2. "tabular": A named list of `data.frame`s with the SSURGO tabular data.

### Usage

```
getSSURGOStudyArea(template = NULL, area, date, raw.dir)
```

### Arguments

| | |
|---|---|
| `template` | A Raster* or Spatial* object to serve as a template for cropping. If missing, whose study area is returned |
| `area` | A character string indicating the SSURGO study area to be downloaded. |
| `date` | A character string indicating the date of the most recent update to the SSURGO area for these data. This information may be gleaned from the SSURGO Inventory (`getSSURGOInventory`). |
| `raw.dir` | A character string indicating where raw downloaded files should be put. The directory will be created if missing. |

### Value

A `SpatialPolygonsDataFrame` of the SSURGO study areas within the specified `template`.

## pkgTest *Install and load a package.*

### Description

This is a convenience function that checks whether a package is installed, and if not, installs it.

### Usage

```
pkgTest(x)
```

### Arguments

| | |
|---|---|
| `x` | A character string representing the name of a package. |

## polygonFromExtent *Turn an extent object into a polygon*

### Description

Turn an extent object into a polygon

### Usage

```
polygonFromExtent(x, proj4string = NULL)
```

### Arguments

| | |
|---|---|
| `x` | An `extent` object, or an object from which an extent object can be retrieved. |
| `proj4string` | A PROJ.4 formatted string defining the required projection. If NULL, the function will attempt to get the projection from x using `projection` |

### Value

A SpatialPolygons object.

## read.crn — *Read a Tucson-format chronology file.*

### Description

This function includes improvements to the `read.crn` function from the **dplR** library. The principle changes are better parsing of metadata, and support for the Schweingruber-type Tucson format. Chronologies that are unable to be read are reported to the user. This function automatically recognizes Schweingruber-type files.

### Usage

```
read.crn(file)
```

### Arguments

| | |
|---|---|
| `file` | A character string path pointing to a `*.crn` file to be read. |

### Details

This wraps two other functions: `read.crn.metadata` `read.crn.data`.

### Value

A list containing the metadata and chronology.

## read.crn.data — *Read chronology data from a Tucson-format chronology file.*

### Description

This function includes improvements to the `read.crn` function from the **dplR** library. The principle changes are better parsing of metadata, and support for the Schweingruber-type Tucson format. Chronologies that are unable to be read are reported to the user. The user (or `read.crn`) must tell the function whether the file is a Schweingruber-type chronology.

### Usage

```
read.crn.data(file, SCHWEINGRUBER)
```

### Arguments

| | |
|---|---|
| `file` | A character string path pointing to a `*.crn` file to be read. |
| `SCHWEINGRUBER` | Is the file in the Schweingruber-type Tucson format? |

### Value

A data.frame containing the data, or if `SCHWEINGRUBER==T`, a list containing four types of data.

## read.crn.metadata *Read metadata from a Tucson-format chronology file.*

### Description

This function includes improvements to the `read.crn` function from the **dplR** library. The principle changes are better parsing of metadata, and support for the Schweingruber-type Tucson format. Chronologies that are unable to be read are reported to the user. The user (or `read.crn`) must tell the function whether the file is a Schweingruber-type chronology.

### Usage

```
read.crn.metadata(file, SCHWEINGRUBER)
```

### Arguments

| | |
|---|---|
| `file` | A character string path pointing to a `*.crn` file to be read. |
| `SCHWEINGRUBER` | Is the file in the Schweingruber-type Tucson format? |

### Details

Location information is converted to decimal degrees.

### Value

A data.frame containing the metadata.

## sequential.duplicated *Get a logical vector of which elements in a vector are sequentially duplicated.*

### Description

Get a logical vector of which elements in a vector are sequentially duplicated.

### Usage

```
sequential.duplicated(x, rows = F)
```

### Arguments

| | |
|---|---|
| `x` | An vector of any type, or, if `rows`, a matrix. |
| `rows` | Is x a matrix? |

### Value

A logical vector of the same length as x.

## SPDFfromPolygon *Turn an SpatialPolygons object into a SpatialPolygonsDataFrame.*

### Description

Turn an SpatialPolygons object into a SpatialPolygonsDataFrame.

### Usage

```
SPDFfromPolygon(x)
```

### Arguments

| | |
|---|---|
| x | An SpatialPolygons object. |

### Value

A SpatialPolygonsDataFrame object.

## substrRight *Get the rightmost "n" characters of a character string.*

### Description

Get the rightmost "n" characters of a character string.

### Usage

```
substrRight(x, n)
```

### Arguments

| | |
|---|---|
| x | A character string. |
| n | The number of characters to retrieve. |

### Value

A character string.

## `wgetDownload` *Use the* `wget` *command line tool to download a file.*

### Description

If both `timestamping` and `nc` are TRUE, timestamping behavior trumps nc.

### Usage

```
wgetDownload(url, destdir = getwd(), timestamping = T, nc = F)
```

### Arguments

| | |
|---|---|
| `url` | The location of a file. |
| `destdir` | Where the file should be downloaded to. |
| `timestamping` | Should only newer files be downloaded? |
| `nc` | Should files of the same type not be clobbered? |

### Value

A logical vector of the same length as x.

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