

# Package ‘rgdal’

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**Title** Bindings for the 'Geospatial' Data Abstraction Library

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**Depends** R (>= 3.5.0), methods, sp (>= 1.1-0)

**Imports** grDevices, graphics, stats, utils

**LinkingTo** sp

**Suggests** knitr, DBI, RSQLite, maptools, mapview, rmarkdown, curl,  
rgeos

**NeedsCompilation** yes

**Description** Provides bindings to the 'Geospatial' Data Abstraction Library ('GDAL') (>= 1.11.4) and access to projection/transformation operations from the 'PROJ' library. Please note that 'rgdal' will be retired by the end of 2023, plan transition to `sf/stars/terra` functions using 'GDAL' and 'PROJ' at your earliest convenience. Use is made of classes defined in the 'sp' package. Raster and vector map data can be imported into R, and raster and vector 'sp' objects exported. The 'GDAL' and 'PROJ' libraries are external to the package, and, when installing the package from source, must be correctly installed first; it is important that 'GDAL' < 3 be matched with 'PROJ' < 6. From 'rgdal' 1.5-8, installed with 'GDAL' >=3, 'PROJ' >=6 and 'sp' >= 1.4, coordinate reference systems use 'WKT2\_2019' strings, not 'PROJ' strings. 'Windows' and 'macOS' binaries (including 'GDAL', 'PROJ' and their dependencies) are provided on 'CRAN'.

**License** GPL (>= 2)

**URL** <http://rgdal.r-forge.r-project.org>, <https://gdal.org>,  
<https://proj.org>, <https://r-forge.r-project.org/projects/rgdal/>

**SystemRequirements** PROJ (>= 4.8.0, <https://proj.org/download.html>) and GDAL (>= 1.11.4, <https://gdal.org/download.html>), with versions either (A) PROJ < 6 and GDAL < 3 or (B) PROJ >= 6 and GDAL >= 3. For degraded PROJ 6 or 7 and GDAL < 3, use the configure argument `--with-proj_api=`proj_api.h``.

**VignetteBuilder** knitr

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closeDataset-methods    *closeDataset methods*

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### Description

Methods for closing GDAL datasets, used internally

### Usage

```
closeDataset(dataset)
closeDataset.default(dataset)
```

### Arguments

dataset            GDAL dataset

### Methods

**dataset = "ANY"** default method, returns error

**dataset = "GDALReadOnlyDataset"** closes the "GDALReadOnlyDataset"

**dataset = "GDALTransientDataset"** closes the "GDALTransientDataset"

---

CRS-class

*Class "CRS" of coordinate reference system arguments*

---

### Description

Interface class to the PROJ.4 projection system. The class is defined as an empty stub accepting value NA in the sp package. If the rgdal package is available, then the class will permit spatial data to be associated with coordinate reference systems

### Usage

```
checkCRSArgs(uprojargs)
checkCRSArgs_ng(uprojargs=NA_character_, SRS_string=NULL,
  get_source_if_boundcrs=TRUE)
compare_CRS(CRS1, CRS2)
```

### Arguments

uprojargs	character string PROJ.4 projection arguments
SRS_string	default NULL, experimental in connection with adaptation to GDAL >= 3 / PROJ >= 6; a valid WKT string or SRS definition such as "OGC:CRS84"
get_source_if_boundcrs	The presence of the +towgs84= key in a Proj4 string projargs= argument value may promote the output WKT2 CRS to BOUNDCRS for PROJ >= 6 and GDAL >= 3, which is a coordinate operation from the input datum to WGS84. This is often unfortunate, so a PROJ function is called through <b>rgdal</b> to retrieve the underlying source definition.
CRS1, CRS2	objects of class "CRS"

### Objects from the Class

Objects can be created by calls of the form `CRS("projargs")`, where "projargs" is a valid string of PROJ.4 arguments; the arguments must be entered exactly as in the PROJ.4 documentation, in particular there cannot be any white space in `+<arg>=<value>` strings, and successive such strings can only be separated by blanks. The initiation function calls the PROJ.4 library to verify the argument set against those known in the library, returning error messages where necessary. The complete argument set may be retrieved by examining the second list element returned by `validObject("CRS object")` to see which additional arguments the library will use (which assumptions it is making over and above submitted arguments). The function `CRSargs()` can be used to show the expanded argument list used by the PROJ.4 library.

### Slots

**projargs:** Object of class "character": projection arguments; the arguments must be entered exactly as in the PROJ.4 documentation, in particular there cannot be any white space in `+<arg>=<value>` strings, and successive such strings can only be separated by blanks.

### Methods

**show** signature(object = "CRS"): print projection arguments in object

### Note

Lists of projections may be seen by using the programs installed with the PROJ.4 library, in particular `proj` and `cs2cs`; with the latter, `-lp` lists projections, `-le` ellipsoids, `-lu` units, and `-ld` datum(s) known to the installed software (available in **rgdal** using `projInfo`). These are added to in successive releases, so tracking the website or compiling and installing the most recent revisions will give the greatest choice. Finding the very important datum transformation parameters to be given with the `+towgs84` tag is a further challenge, and is essential when the datums used in data to be used together differ. Tracing projection arguments is easier now than before the mass ownership of GPS receivers raised the issue of matching coordinates from different argument sets (GPS output and paper map, for example). See [GridsDatums](#) and [showEPSG](#) for help in finding CRS definitions.

The 4.9.1 release of PROJ.4 omitted a small file of defaults, leading to reports of "major axis or radius = 0 or not given" errors. From 0.9-3, **rgdal** checks for the presence of this file (`proj_def.dat`), and if not found, and under similar conditions to those used by PROJ.4, adds `"+ellps=WGS84"` to

the input string being checked by checkCRSArgs The “+no\_defs” tag ignores the file of defaults, and the default work-around implemented to get around this problem; strings including “init” and “datum” tags also trigger the avoidance of the work-around. Now messages are issued when a candidate CRS is checked; they may be suppressed using suppressMessages.

### Author(s)

Roger Bivand <Roger.Bivand@nhh.no>

### References

<https://proj.org/>

### Examples

```
set_thin_PROJ6_warnings(TRUE)
CRSargs(CRS("+proj=longlat"))
try(CRS("+proj=longlat"))
CRSargs(CRS("+proj=longlat +datum=NAD27"))
CRSargs(CRS("+init=epsg:4267"))
CRSargs(CRS("+init=epsg:26978"))
CRSargs(CRS(paste("+proj=stere +lat_0=52.15616055555555",
"+lon_0=5.387638888888889 +k=0.999908 +x_0=155000 +y_0=463000 +ellps=bessel",
"+towgs84=565.237,50.0087,465.658,-0.406857,0.350733,-1.87035,4.0812",
"+units=m")))
# see http://trac.osgeo.org/gdal/ticket/1987
CRSargs(CRS("+init=epsg:28992"))
crs <- CRS("+init=epsg:28992")
CRSargs(CRS(CRSargs(crs)))
library(sp)
data(meuse)
coordinates(meuse) <- c("x", "y")
proj4string(meuse) <- CRS("+init=epsg:28992")
CRSargs(CRS(proj4string(meuse)))
run <- new_proj_and_gdal()
if (run) {
c1 <- CRS(SRS_string="OGC:CRS84")
c2 <- CRS("+proj=longlat")
compare_CRS(c1, c2)
}
if (run) {
comment(c2) <- NULL
compare_CRS(c1, c2)
}
```

**Description**

Display a GDAL dataset allowing for subscenes and decimation, allowing very large images to be browsed

**Usage**

```
displayDataset(x, offset=c(0, 0), region.dim=dim(x), reduction = 1,
  band = 1, col = NULL, reset.par = TRUE, max.dim = 500, ...)
```

**Arguments**

x	a three-band GDALReadOnlyDataset object
offset	Number of rows and columns from the origin (usually the upper left corner) to begin reading from; presently ordered (y,x) - this may change
region.dim	The number of rows and columns to read from the dataset; presently ordered (y,x) - this may change
reduction	a vector of length 1 or 2 recycled to 2 for decimating the input data, 1 retains full resolution, higher values decimate
band	The band number (1-based) to read from
col	default NULL, attempt to use band colour table and default to grey scale if not available
reset.par	default TRUE - reset par() settings on completion
max.dim	default 500, forcing the image to a maximum dimension of the value
...	arguments passed to image.default()

**Value**

a list of the image data, the colour table, and the par() values on entry.

**Author(s)**

Tim Keitt

**References**

<https://gdal.org/>

**Examples**

```
## Not run:
logo <- system.file("pictures/Rlogo.jpg", package="rgdal")[1]
x <- GDAL.open(logo)
opar <- par(no.readonly=TRUE)
par(mfrow=c(2,2))
displayDataset(x, band=1, reset.par=FALSE)
displayDataset(x, band=2, reset.par=FALSE)
#displayDataset(x, band=3, reset.par=TRUE)
```

```

par(opar)
dx <- RGB2PCT(x, band=1:3)
displayDataset(dx, reset.par=FALSE)
GDAL.close(x)
GDAL.close(dx)

## End(Not run)

```

---

GDALcall

*Wrapper functions to allow more direct calling of rgdal C code*


---

## Description

These functions allow more direct access to some of the rgdal C API. These are advanced methods intended for package developers only.

## Usage

```

GDALcall(object, option, ...)
rawTransform(projfrom, projto, n, x, y, z=NULL, wkt=FALSE)

```

## Arguments

object	GDALTransientDataset (option = 'SetGeoTransform', 'SetProject') or GDALRasterBand (the other options)
option	character. One of 'SetGeoTransform', 'SetProject', 'SetNoDataValue', 'SetStatistics', 'SetRasterColorTable' or 'SetCategoryNames')
...	additional arguments. The values to be set
projfrom	character. PROJ.4 coordinate reference system (CRS) description
projto	character. PROJ.4 CRS description
n	number of coordinates
x	x coordinates
y	y coordinates
z	z coordinates
wkt	default FALSE, if TRUE, the caller determines that projfrom and projto are wkt and that new_proj_and_gdal() returns TRUE to avoid multiple warnings when the function is called repetitively

## Value

GDALcall does not return anything. rawTransform returns a matrix of transformed coordinates.

## Author(s)

Robert Hijmans

---

GDALDataset-class      *Class "GDALDataset"*

---

### Description

GDALDataset extends [GDALReadOnlyDataset-class](#) with data update commands.

### Usage

```
putRasterData(dataset, rasterData, band = 1, offset = c(0, 0))
saveDataset(dataset, filename, options=NULL, returnNewObj=FALSE)
copyDataset(dataset, driver, strict = FALSE, options = NULL, fname=NULL)
deleteDataset(dataset)
saveDatasetAs(dataset, filename, driver = NULL, options=NULL)
```

### Arguments

dataset	An object inheriting from class 'GDALDataset'
rasterData	A data array with <code>length(dim(rasterData)) = 2</code>
band	The band number (1-based) to read from
offset	Number of rows and columns from the origin (usually the upper left corner) to begin reading from
filename	name of file to contain raster data object; will be normalized with <a href="#">normalizePath</a>
returnNewObj	until and including 0.5-27, <code>saveDataset</code> returned an invisible copy of the new file handle, which was then only finalized when the garbage collector ran. The old behaviour can be retained by setting to <code>FALSE</code> , the default behaviour is to close the handle and not return it.
driver	GDAL driver name to use for saving raster data object
strict	<code>TRUE</code> if the copy must be strictly equivalent, or more normally <code>FALSE</code> indicating that the copy may adapt as needed for the output format
options	Driver specific options (currently passed to GDAL)
fname	default <code>NULL</code> , used internally to pass through a file name with a required extension (RST driver has this problem)

### Details

**putRasterData:** writes data contained in `rasterData` to the dataset, beginning at `offset` rows and columns from the origin (usually the upper left corner). Data type conversion is automatic.

**saveDataset:** saves a raster data object in a file using the driver of the object

**saveDatasetAs:** saves a raster data object in a file using the specified driver

**copyDataset:** make a copy of raster data object in a file using the specified driver

**deleteDataset:** delete the file from which the raster data object was read (should only delete files opened as GDALDataset objects)



**Objects from the Class**

Objects can be created by calls of the form `new("GDALDataset", filename, handle)`, where `name`: a string giving the name of a GDAL driver, `handle`: used internally; not for public consumption (default = NULL).

**Slots**

`handle`: Object of class "externalptr", from class "GDALReadOnlyDataset", used internally; not for public consumption

**Extends**

Class "GDALReadOnlyDataset", directly. Class "GDALMajorObject", by class "GDALReadOnlyDataset".

**Methods**

**initialize** signature(.Object = "GDALDataset"): ...

**Author(s)**

Timothy H. Keitt, modified by Roger Bivand

**See Also**

[GDALDriver-class](#), [GDALReadOnlyDataset-class](#), [GDALTransientDataset-class](#)

---

 GDALDriver-class

---

*Class "GDALDriver": GDAL Driver Object*


---

**Description**

GDALDriver objects encapsulate GDAL file format drivers. GDALDriver inherits from [GDALMajorObject-class](#).

**Usage**

```
getGDALDriverNames()
gdalDrivers()
getDriverName(driver)
getDriverLongName(driver)
getGDALVersionInfo(str = "--version")
getGDALCheckVersion()
getGDALwithGEOS()
rgdal_extSoftVersion()
getCPLConfigOption(ConfigOption)
setCPLConfigOption(ConfigOption, value)
get_cached_orig_PROJ_LIB()
```

```

get_cached_orig_GDAL_DATA()
get_cached_set_PROJ_LIB()
get_cached_set_GDAL_DATA()

```

### Arguments

driver	An object inheriting from class 'GDALDriver'
str	A string, may be one of "--version", "VERSION_NUM", "RELEASE_DATE", "RELEASE_NAME"
ConfigOption	CPL configure option documented in <a href="https://trac.osgeo.org/gdal/wiki/ConfigOptions">https://trac.osgeo.org/gdal/wiki/ConfigOptions</a> and elsewhere in GDAL source code
value	a string value to set a CPL option; NULL is used to unset the CPL option

### Details

`getGDALDriverNames, gdalDrivers`: returns all driver names currently installed in GDAL, with their declared create and copy status (some drivers can create datasets, others can only copy from a prototype with a different driver).

`getDriverName`: returns the GDAL driver name associated with the driver object.

`getDriverLongName`: returns a longer driver name.

`getGDALVersionInfo`: returns the version of the GDAL runtime shared object.

`getGDALCheckVersion`: checks the version of the GDAL headers used when building the package (GDAL\_VERSION\_MAJOR, GDAL\_VERSION\_MINOR) - if the two versions differ, problems may arise (the C++ API/ABI may have changed), and rgdal should be re-installed

`getGDALwithGEOS`: because drivers may behave differently if GDAL itself was built with GEOS support, the function uses a heuristic to check whether GDAL has access to the GEOS Union function or not

`get_cached_orig_PROJ_LIB, get_cached_orig_GDAL_DATA` The values of environment variables PROJ\_LIB and GDAL\_DATA as read when this package was loaded

`get_cached_set_PROJ_LIB, get_cached_set_GDAL_DATA` If not "", the values set when loading this package to point to metadata files included in CRAN binary packages

### Objects from the Class

Objects can be created by calls of the form `new("GDALDriver", name, handle)`, where `name`: a string giving the name of a GDAL driver, `handle`: used internally; not for public consumption (default = NULL).

### Slots

`handle`: Object of class "externalptr", from class "GDALMajorObject", used internally; not for public consumption

### Extends

Class "GDALMajorObject", directly.

**Methods**

**initialize** signature(.Object = "GDALDriver"): drivename: a string giving the name of a GDAL driver, handle: used internally; not for public consumption (default = NULL)

**Note**

Loading the rgdal package changes the GDAL\_DATA environmental variable to the GDAL support files bundled with the package.

**Author(s)**

Timothy H. Keitt, modified by Roger Bivand

**See Also**

[GDALMajorObject-class](#)

**Examples**

```
gdalDrivers()
logo <- system.file("pictures/logo.jpg", package="rgdal")[1]
x <- new("GDALReadOnlyDataset", logo)
getDriver(x)
getDriverLongName(getDriver(x))
GDAL.close(x)
```

---

GDALMajorObject-class *Class "GDALMajorObject"*

---

**Description**

"GDALMajorObject" is a virtual base class for all GDAL objects.

**Usage**

```
getDescription(object)
```

**Arguments**

object            an object inheriting from "GDALMajorObject"

**Details**

**getDescription:** returns a description string associated with the object. No setter method is defined because GDAL dataset objects use the description to hold the filename attached to the dataset. It would not be good to change that mid-stream.

### Objects from the Class

Objects can be created by calls of the form `new("GDALMajorObject", ...)`, but are only created for classes that extend this class.

### Slots

`handle`: Object of class "externalptr", used internally; not for public consumption

### Methods

No methods defined with class "GDALMajorObject" in the signature.

### Author(s)

Timothy H. Keitt, modified by Roger Bivand

### References

<https://gdal.org/>

### See Also

[GDALDriver-class](#), [GDALReadOnlyDataset-class](#), [GDALDataset-class](#) and [GDALTransientDataset-class](#)

### Examples

```
driver <- new('GDALDriver', as.character(getGDALDriverNames()[1,1]))
driver
rm(driver)
logo <- system.file("pictures/logo.jpg", package="rgdal")[1]
x <- new("GDALReadOnlyDataset", logo)
x
getDescription(x)
dim(x)
GDAL.close(x)
```

---

GDALRasterBand-class    *Class "GDALRasterBand"*

---

### Description

Returns a two-dimensional array with data from a raster band, used internally within functions

**Usage**

```

getRasterData(dataset, band = NULL, offset = c(0, 0),
              region.dim = dim(dataset), output.dim = region.dim,
              interleave = c(0, 0), as.is = FALSE, list_out=FALSE)

getRasterTable(dataset, band = NULL, offset = c(0, 0),
              region.dim = dim(dataset))

getProjectionRef(dataset, OVERRIDE_PROJ_DATUM_WITH_TOWGS84 = NULL,
                enforce_xy = NULL, get_source_if_boundcrs=TRUE)

getRasterBand(dataset, band = 1)

getRasterBlockSize(raster)

toSigned(x, base)

toUnsigned(x, base)

get_OVERRIDE_PROJ_DATUM_WITH_TOWGS84()
set_OVERRIDE_PROJ_DATUM_WITH_TOWGS84(value)

```

**Arguments**

dataset	An object inheriting from class 'GDALReadOnlyDataset'
band	The band number (1-based) to read from
offset	Number of rows and columns from the origin (usually the upper left corner) to begin reading from; presently ordered (y,x) - this may change
region.dim	The number of rows and columns to read from the dataset; presently ordered (y,x) - this may change
output.dim	Number of rows and columns in the output data; if smaller than region.dim the data will be subsampled
interleave	Element and row stride while reading data; rarely needed
as.is	If false, scale the data to its natural units; if the case of thematic data, return the data as factors
list_out	default FALSE, return array, if TRUE, return a list of vector bands
raster	An object of class GDALRasterBand
x	integer variable for conversion
base	If Byte input, 8, if Int16 or UInt16, 16
OVERRIDE_PROJ_DATUM_WITH_TOWGS84	logical value, default NULL, which case the cached option set by set_OVERRIDE_PROJ_DATUM_WITH_TOWGS84 is used. Ignored if the GDAL version is less than "1.8.0" or if the CPLConfigOption variable is already set

<code>enforce_xy</code>	(PROJ6+/GDAL3+) either use global setting (default NULL) or override policy for coordinate ordering easting/x as first axis, northing/y as second axis.
<code>get_source_if_boundcrs</code>	The presence of the <code>+towgs84=</code> key in a Proj4 string <code>projargs=</code> argument value may promote the output WKT2 CRS to BOUNDCRS for PROJ $\geq 6$ and GDAL $\geq 3$ , which is a coordinate operation from the input datum to WGS84. This is often unfortunate, so a PROJ function is called through <b>rgdal</b> to retrieve the underlying source definition.
<code>value</code>	logical value to set <code>OVERRIDE_PROJ_DATUM_WITH_TOWGS84</code>

### Details

`getRasterData`: retrieves data from the dataset as an array or list of bands; will try to convert relevant bands to factor if category names are available in the GDAL driver when returning a list.

`getRasterTable`: retrieves data from the dataset as data frame.

`getProjectionRef`: returns the geodetic projection in Well Known Text format.

`getRasterBand`: returns a raster band

`getRasterBlockSize`: returns the natural block size of the raster band. Use this for efficient tiled IO.

`toSigned`: used to convert a band read as unsigned integer to signed integer

`toUnsigned`: used to convert a band read as signed integer to unsigned integer

### Objects from the Class

Objects can be created by calls of the form `new("GDALRasterBand", dataset, band)`.

### Slots

`handle`: Object of class "externalptr", from class "GDALMajorObject", used internally; not for public consumption

### Extends

Class "GDALMajorObject", directly.

### Methods

**dim** signature(`x = "GDALRasterBand"`): ...

**initialize** signature(`.Object = "GDALRasterBand"`): ...

### Note

The `OVERRIDE_PROJ_DATUM_WITH_TOWGS84` argument is used to revert GDAL behaviour to pre-1.8.0 status; from 1.8.0, any input datum may be discarded if the input also includes a `towgs84` tag in conversion to the PROJ.4 representation, see <https://trac.osgeo.org/gdal/ticket/4880> and <https://lists.osgeo.org/pipermail/gdal-dev/2012-November/034550.html>. The cached value of `OVERRIDE_PROJ_DATUM_WITH_TOWGS84` will also be used in `open.SpatialGDAL`, `sub.GDROD`, and `asGDALROD_SGDF`, which do not have a suitable argument

**Author(s)**

Timothy H. Keitt, modified by Roger Bivand

**See Also**

See also [GDALDriver-class](#), [GDALDataset-class](#), [GDALTransientDataset-class](#)

**Examples**

```
logo <- system.file("pictures/logo.jpg", package="rgdal")[1]
x <- new("GDALReadOnlyDataset", logo)
plot(density(getRasterTable(x)$band1))
GDAL.close(x)
```

---

GDALReadOnlyDataset-class

*Class "GDALReadOnlyDataset"*

---

**Description**

GDALReadOnlyDataset is the base class for a GDAL Dataset classes. Only read operations are supported. Both GDALDataset and GDALTransientDataset inherit these read operations while providing additional write operations (see [GDALDataset-class](#)). GDALReadOnlyDataset-class inherits from [GDALMajorObject-class](#).

**Usage**

```
GDAL.close(dataset)
GDAL.open(filename, read.only = TRUE, silent=FALSE,
           allowedDrivers = NULL, options=NULL)
getDriver(dataset)
```

```
getColorTable(dataset, band = 1)
getGeoTransFunc(dataset)
```

**Arguments**

dataset	An object inheriting from class 'GDALReadOnlyDataset'
filename	name of file to contain raster data object; will be normalized with <a href="#">normalizePath</a> if it is a file
band	The band number (1-based) to read from
read.only	A logical flag indicating whether to open the file as a GDALReadOnlyDataset or as a writable GDALDataset
silent	logical; if TRUE, comment and non-fatal CPL driver errors suppressed

**allowedDrivers** a character vector of suggested driver short names may be provided starting from GDAL 2.0

**options** open options may be passed to raster drivers starting from GDAL 2.0; very few drivers support these options

### Details

GDAL.open and GDAL.close are shorter versions of new("GDALReadOnlyDataset", ...) and closeDataset(). Because GDAL.close through closeDataset() uses the finalization mechanism to destroy the handles to the dataset and its driver, messages such as:

"Closing GDAL dataset handle 0x8ff7900... destroyed ... done."

may appear when GDAL.close is run, or at some later stage. getDriver returns an object inheriting from class 'GDALDriver'.

getColorTable returns the dataset colour table (currently does not support RGB imaging). getGeoTransFunc returns a warping function.

### Objects from the Class

Objects can be created by calls of the form new("GDALReadOnlyDataset", filename, handle).  
 ~~ describe objects here ~~

### Slots

handle: Object of class "externalptr", from class "GDALMajorObject" ~~

### Extends

Class "GDALMajorObject", directly.

### Methods

**closeDataset** signature(dataset = "GDALReadOnlyDataset"): ...

**dim** signature(x = "GDALReadOnlyDataset"): ...

**initialize** signature(.Object = "GDALReadOnlyDataset"): ...

### Author(s)

Timothy H. Keitt, modified by Roger Bivand

### References

<https://gdal.org/>

### See Also

See also [GDALDriver-class](#), [GDALDataset-class](#), [GDALTransientDataset-class](#).



**Examples**

```

logo <- system.file("pictures/logo.jpg", package="rgdal")[1]
x <- new("GDALReadOnlyDataset", logo)
dim(x)
plot(density(getRasterTable(x)$band1))
#displayDataset(x)
#displayDataset(x, col=function(x){rev(cm.colors(x))})
#im <- displayDataset(x, col=function(x){rev(cm.colors(x))}, reset.par=FALSE)
#contour(1:attr(im, "size")[2], 1:attr(im, "size")[1],
# t(attr(im, "index"))[,attr(im, "size")[1]:1], nlevels = 1,
# levels = 100, col = 'black', add = TRUE)
GDAL.close(x)
logo <- system.file("pictures/Rlogo.jpg", package="rgdal")[1]
x <- new("GDALReadOnlyDataset", logo)
dim(x)
#displayDataset(x)
GDAL.close(x)

```

---

GDALReadOnlyDataset-methods

*subset methods for "GDALReadOnlyDataset"*


---

**Description**

subsets GDAL objects, returning a SpatialGridDataFrame object

**Details**

The `[]` method subsets a GDAL data set, returning a SpatialGridDataFrame object. Reading is done on the GDAL side, and only the subset requested is ever read into memory.

Further named arguments to `[]` are to either `getRasterTable` or `getRasterData`:

**as.is** see [getRasterData](#)

**interleave** see [getRasterData](#)

**output.dim** see [getRasterData](#)

the other arguments, `offset` and `region.dim` are derived from row/column selection values.

An GDALReadOnlyDataset object can be coerced directly to a SpatialGridDataFrame

**Methods**

`[]` signature(`.Object = "GDALReadOnlyDataset"`): requires package `sp`; selects rows and columns, and returns an object of class `SpatialGridDataFrame` if the grid is not rotated, or else of class `SpatialPointsDataFrame`. Any arguments passed to `getRasterData` (or in case of rotation `getRasterTable`) may be passed as named arguments; the first three unnamed arguments are `row,col,band`

**Author(s)**

Edzer Pebesma

**See Also**

See also [readGDAL](#) [GDALDriver-class](#), [GDALDataset-class](#), [GDALTransientDataset-class](#), [SpatialGridDataFrame-class](#).

**Examples**

```
library(grid)
logo <- system.file("pictures/logo.jpg", package="rgdal")[1]
x <- new("GDALReadOnlyDataset", logo)
dim(x)
x.sp = x[20:50, 20:50]
class(x.sp)
summary(x.sp)
spplot(x.sp)
GDAL.close(x)

logo <- system.file("pictures/Rlogo.jpg", package="rgdal")[1]
x.gdal <- new("GDALReadOnlyDataset", logo)
x = x.gdal[, , 3]
dim(x)
summary(x)
spplot(x)
spplot(x.gdal[])
GDAL.close(x.gdal)

logo <- system.file("pictures/Rlogo.jpg", package="rgdal")[1]
x.gdal <- new("GDALReadOnlyDataset", logo)
x.as <- as(x.gdal, "SpatialGridDataFrame")
GDAL.close(x.gdal)
summary(x.as)
```

---

 GDALTransientDataset-class

*Class "GDALTransientDataset"*


---

**Description**

GDALTransientDataset is identical to [GDALDataset-class](#) except that transient datasets are not associated with any user-visible file. Transient datasets delete their associated file data when closed. See [saveDataset](#) and [saveDatasetAs](#).

**Objects from the Class**

Objects can be created by calls of the form `new("GDALTransientDataset", driver, rows, cols, bands, type, options, fname)`

**driver** A "GDALDriver" object that determines the storage format

**rows** Number of rows in the newly created dataset

**cols** Number of columns in the newly created dataset

**bands** Number of bands to create

**type** A GDAL type name as listed in `.GDALDataTypes`

**options** Driver specific options

**fname** default NULL, used internally to pass through a file name with a required extension (RST driver has this problem)

**handle** Used internally; not for public consumption

**Slots**

**handle**: Object of class "externalptr", from class "GDALDataset", used internally; not for public consumption

**Extends**

Class "GDALDataset", directly. Class "GDALReadOnlyDataset", by class "GDALDataset". Class "GDALMajorObject", by class "GDALDataset".

**Methods**

**closeDataset** signature(`dataset = "GDALTransientDataset"`): ...

**initialize** signature(`.Object = "GDALTransientDataset"`): ...

**Author(s)**

Timothy H. Keitt, modified by Roger Bivand

**See Also**

See also [GDALDriver-class](#), [GDALReadOnlyDataset-class](#)

**Examples**

```
list.files(tempdir())
x <- new('GDALTransientDataset', driver=new('GDALDriver', "GTiff"), rows=100,
  cols=100, bands=3, type='Byte')
dim(x)
list.files(tempdir())
GDAL.close(x)
list.files(tempdir())
```

---

GridsDatums

*Grids and Datums PE&RS listing*

---

### Description

A data.frame of years and months of Grids & Datums column publications by country and country code.

### Usage

```
data("GridsDatums")
```

### Format

A data frame with 241 observations on the following 4 variables.

country name of PE&RS column

month issue month

year publication year

ISO ISO code for country

### Details

The journal *Photogrammetric Engineering & Remote Sensing*, run by the American Society for Photogrammetry and Remote Sensing (ASPRS), began publishing a more-or-less monthly column on the spatial reference systems used in different countries, including their datums. The column first appeared in September 1997, and continued until March 2016; subsequent columns are updated reprints of previous ones. Some also cover other topics, such as world and Martian spatial reference systems. They are written by Clifford J. Mugnier, Louisiana State University, Fellow Emeritus ASPRS. To access the columns, visit <https://www.asprs.org/asprs-publications/grids-and-datums>.

### Source

<https://www.asprs.org/asprs-publications/grids-and-datums>

### Examples

```
data(GridsDatums)
GridsDatums[grep("Norway", GridsDatums$country),]
GridsDatums[grep("Google", GridsDatums$country),]
GridsDatums[grep("^Mars$", GridsDatums$country),]
```

---

is\_proj\_CDN\_enabled     *PROJ search paths and content download network handling*

---

## Description

From PROJ 7 (and partly 7.1), it is becoming possible to use transformation grids downloaded on demand to improve coordinate operation accuracy from a content download network (CDN). These functions report on and control the use of the CDN.

## Usage

```
is_proj_CDN_enabled()
enable_proj_CDN()
disable_proj_CDN()
proj_CDN_user_writable_dir()
get_proj_search_paths()
set_proj_search_paths(paths)
```

## Arguments

paths                    a character vector of existing directories

## Details

The PROJ user-writable CDN directory is set as soon as the internal search path is queried, and for most uses, the default value will allow all programs using PROJ such as R packages, QGIS, GRASS, etc., to access any downloaded grids. Grids are checked for staleness at regular intervals. This directory may be set to a non-default value with the PROJ\_USER\_WRITABLE\_DIRECTORY environment variable before **rgdal** (and any other package using PROJ) is loaded and attached, from PROJ >= 7.1.0.

## Value

Logical values and/or character vector search paths, often NULL for earlier versions of PROJ.

## Author(s)

Roger Bivand

## References

<https://cdn.proj.org/>.

## Examples

```
is_proj_CDN_enabled()
proj_CDN_user_writable_dir()
get_proj_search_paths()
```

---

list_coordOps	<i>List PROJ 6 coordinate operations</i>
---------------	--

---

### Description

List PROJ 6 coordinate operations for a pair of source/target coordinate reference systems

### Usage

```
list_coordOps(src_crs, tgt_crs, area_of_interest = as.numeric(NA),
  strict_containment = FALSE, visualization_order = NULL)
best_instantiable_coordOp(x)
## S3 method for class 'coordOps'
print(x, ...)
```

### Arguments

src_crs	Source coordinate reference system string
tgt_crs	Target coordinate reference system string
area_of_interest	Numeric vector; either NA, or the xmin, ymin, xmax, ymax of the bounding box of the area of interest. This may be used to restrict the search for coordinate operations
strict_containment	default FALSE, permit partial matching of the area of interest; if TRUE strictly contain the area of interest. The area of interest is either as given, or as implied by the source/target coordinate reference systems (FIXME)
visualization_order	default NULL, taking the value of get_enforce_xy(); if TRUE always choose x or longitude for the first axis; if FALSE, follow the axis orders given by the coordinate reference systems when constructing the coordinate operation
x	an object of class "coordOps"
...	arguments possibly passed through, unused

### Details

(FIXME)

### Value

A data frame with rows showing the coordinate operations found, and columns:

description	String describing the operation
definition	PROJ pipeline for executing the operation
accuracy	Accuracy in meters, if negative, unknown

instantiable	Can this operation be carried out with available resources
ballpark	Does this operation only have ballpark accuracy
number_grids	The number of grids required for the operation

The object has a "grids" attribute containing a nested list of grids for each coordinate operations found; if number\_grids == 0, NULL, otherwise a list of grids. For each grid required, the short and long names of the grid are given, the package name if available in a PROJ grid package, and the download URL for that package. Three logical variables report whether the grid may be downloaded directly, whether it has an open license, and whether it is available.

### Note

Fragile: work in progress

### Author(s)

Roger Bivand <Roger.Bivand@nhh.no>

### References

<https://proj.org/>

### Examples

```
run <- new_proj_and_gdal()
if (run) {
  discarded_datum <- showSRID("EPSG:27700", "PROJ")
  (x <- list_coordOps(paste0(discarded_datum, " +type=crs"), "OGC:CRS84"))
}
if (run) {
  best_instantiable_coordOp(x)
}
if (run) {
  restored_datum <- showSRID("EPSG:27700", "PROJ")
  list_coordOps(paste0(restored_datum, " +datum=OSGB36 +type=crs"), "OGC:CRS84")
}
if (run) {
  wkt_datum <- showSRID("EPSG:27700", "WKT2")
  (x <- list_coordOps(wkt_datum, "OGC:CRS84"))
}
if (run) {
  best_instantiable_coordOp(x)
}
if (run) {
  list_coordOps("EPSG:27700", "OGC:CRS84")
}
if (run) {
}
if (run) {
  discarded_datum <- showSRID("EPSG:22525", "PROJ")
  list_coordOps(paste0(discarded_datum, " +type=crs"), "EPSG:31985")
}
```

```

}
if (run) {
}
if (run) {
  wkt_datum <- showSRID("EPSG:22525", "WKT2")
  list_coordOps(wkt_datum, "EPSG:31985")
}
if (run) {
  (x <- list_coordOps("EPSG:22525", "EPSG:31985"))
}
if (run) {
  best_instantiable_coordOp(x)
}

```

---

llgridlines

*Plot long-lat grid over projected data*


---

### Description

Plot long-lat grid over projected data

### Usage

```
llgridlines(obj, easts, norths, ndiscr = 20, lty = 2, offset=0.5, side="WS",
llcrs = "+proj=longlat +datum=WGS84", plotLines = TRUE, plotLabels =
TRUE, ...)
```

### Arguments

obj	object, deriving from <a href="#">Spatial-class</a> having projection specified
easts	numeric; see <a href="#">gridlines</a>
norths	numeric; see <a href="#">gridlines</a>
ndiscr	numeric; see <a href="#">gridlines</a>
offset	numeric; see <a href="#">gridlines</a>
side	character, default "WS"; see <a href="#">gridlines</a> ; available from <b>sp</b> 0.9-84
lty	line type to be used for grid lines
llcrs	proj4string of longitude - latitude
plotLines	logical; plot lines?
plotLabels	logical; plot labels?
...	graphics arguments passed to plot function for lines and text function for labels

### Value

none; side effect is that grid lines and lables are plotted



**See Also**

[is.projected](#), [CRS-class](#)

**Examples**

```
set_thin_PROJ6_warnings(TRUE)
data(meuse)
coordinates(meuse) = ~x+y
proj4string(meuse) <- CRS("+init=epsg:28992")
plot(meuse)
llgridlines(meuse, lty=3)
plot(meuse)
llgridlines(meuse, lty=3, side = "EN", offset = 0.2)
```

---

make\_EPSG

---

*Make a data frame of EPSG projection codes*


---

**Description**

Make a data frame of the European Petroleum Survey Group (EPSG) geodetic parameter dataset as distributed with PROJ.4 software (prior to PROJ 6.0.0, March 2019, only the CSV file, from March 2019 with PROJ  $\geq$  6 from the SQLite database). Because finding the correct projection specification is not easy, lists still known as EPSG lists are maintained, and more generally retrieved from databases. The data collated here are as distributed with PROJ.4.

**Usage**

```
make_EPSG(file)
EPSG_version()
```

**Arguments**

`file` file name of the file matching EPSG codes and PROJ.4 arguments, should usually be autodetected; not used for PROJ  $\geq$  6

**Value**

returns a data frame with columns:

<code>code</code>	integer column of EPSG code numbers
<code>note</code>	character column of notes as included in the file
<code>prj4</code>	character column of PROJ.4 arguments for the equivalent projection definitions
<code>prj_method</code>	extra character column from PROJ 6 showing the projection method

...

**Note**

See also Clifford J. Mugnier's Grids & Datums columns in Photogrammetric Engineering & Remote Sensing, <https://www.asprs.org/a/resources/grids/>, see also [GridsDatums](#).

**Author(s)**

Roger Bivand

**References**

(unlinked because of certificate issues: <https://epsg.org/home.html>).

**Examples**

```
EPSG <- try(make_EPSG())
# from PROJ 6.0.0, EPSG data is no longer stored in a flat file
if (!inherits(EPSG, "try-error")) attr(EPSG, "metadata")
# PROJ.4 version 5 and later include the EPSG version as an attribute
if (!inherits(EPSG, "try-error")) EPSG[grep("Oslo", EPSG$note), 1:2]
if (!inherits(EPSG, "try-error")) EPSG[1925:1927, 3]
if (!inherits(EPSG, "try-error")) EPSG[grep("Poland", EPSG$note), 1:2]
if (!inherits(EPSG, "try-error")) EPSG[grep("Amersfoort", EPSG$note), 1:2]
if (!inherits(EPSG, "try-error")) EPSG[grep("North Carolina", EPSG$note), 1:2]
if (!inherits(EPSG, "try-error")) EPSG[2202, 3]
```

---

nor2k

*Norwegian peaks over 2000m*

---

**Description**

Norwegian peaks over 2000m, 3D SpatialPoints data.

**Usage**

data(nor2k)

**Format**

The format is: Formal class 'SpatialPointsDataFrame' [package "sp"] with 5 slots ..@ data : 'data.frame':  
 300 obs. of 3 variables: .. ..\$ Nr. : int [1:300] 1 2 3 4 5 6 7 8 9 10 ... .. ..\$ Navn : chr [1:300]  
 "Galdhøpiggen" "Glittertinden" "Skagastølstinden, Store (Storen)" "Styggedalstinden, Store, ?st-  
 toppen" ... .. ..\$ Kommune: chr [1:300] "Lom" "Lom" "Luster / Ardal" "Luster" ... ..@ coords.nrs  
 : num(0) ..@ coords : num [1:300, 1:3] 463550 476550 439850 441450 441100 ... .. ..- attr(\*,  
 "dimnames")=List of 2 .. .. ..\$ : NULL .. .. ..\$ : chr [1:3] "East" "North" "Height" ..@ bbox : num  
 [1:3, 1:2] 404700 6804200 2001 547250 6910050 ... .. ..- attr(\*, "dimnames")=List of 2 .. .. ..\$  
 : chr [1:3] "East" "North" "Height" .. .. ..\$ : chr [1:2] "min" "max" ..@ proj4string: Formal class  
 'CRS' [package "sp"] with 1 slots .. .. ..@ projargs: chr "+proj=utm +zone=32 +datum=WGS84  
 +ellps=WGS84 +towgs84=0,0,0"

**Details**

Norwegian peaks over 2000m, coordinates in EUREF89/WGS84 UTM32N, names not fully updated, here converted to ASCII.

**Source**

<http://www.nfo2000m.no/>; [http://www.nfo2000m.no/Excel/2000m\\_data.xls](http://www.nfo2000m.no/Excel/2000m_data.xls)

**Examples**

```
data(nor2k)
summary(nor2k)
## maybe str(nor2k) ; plot(nor2k) ...
```

---

project	<i>Projection of coordinate matrices</i>
---------	--

---

**Description**

Interface to the PROJ.4 library of projection functions for geographical position data, no datum transformation possible. Use `spTransform()` for extended support.

**Usage**

```
project(xy, proj, inv = FALSE, use_ob_tran=FALSE, legacy=TRUE,
        allowNAs_if_not_legacy=FALSE, coordOp = NULL, verbose = FALSE,
        use_aoi=TRUE)
```

**Arguments**

xy	2-column matrix of coordinates
proj	character string of projection arguments; the arguments must be entered exactly as in the PROJ.4 documentation, in particular there cannot be any white space in <code>+&lt;arg&gt;=&lt;value&gt;</code> strings, and successive such strings can only be separated by blanks.
inv	default FALSE, if TRUE inverse projection to geographical coordinates
use_ob_tran	default FALSE, if TRUE and <code>"+proj=ob_tran"</code> , use General Oblique Transformation with internalised from/to projection reversal; the user oblique transforms forward rather than inverse.
legacy	default TRUE, if FALSE, use transform C functions (enforced internally for Windows 32-bit platforms)
allowNAs_if_not_legacy	used if legacy is FALSE, default FALSE; introduced to handle use of NAs as object separators in <b>oce</b>
coordOp	default NULL, for PROJ $\geq$ 6 used to pass through a pre-defined coordinate operation

verbose            default FALSE, for PROJ >=6 used to show the coordinate operation used

use\_aoi            With PROJ >= 6, use the area of interest defined as the range of xy in limiting the search for candidate coordinate operations; set FALSE if use\_ob\_tran is TRUE

### Details

Full details of projection arguments available from website below, and examples in file "epsg" in the data directory installed with PROJ.4.

Note that from PROJ.4 4.9.3, the definition of UTM is changed from TMERC to ETMERC; see example.

### Value

A two column matrix with projected coordinates.

### Note

The locations of Hawaii and Alaska in the data source are (putting it mildly) arbitrary, please avoid airlines using these positions.

### Author(s)

Barry Rowlingson, Roger Bivand <Roger.Bivand@nhh.no>

### References

<https://proj.org/>

### See Also

[CRS-class](#), [spTransform-methods](#)

### Examples

```
data(state)
res <- project(cbind(state.center$x, state.center$y),
  "+proj=lcc +lat_1=48 +lat_2=33 +lon_0=-100 +ellps=WGS84")
res1 <- project(res, "+proj=lcc +lat_1=48 +lat_2=33 +lon_0=-100 +ellps=WGS84",
  inv=TRUE)
summary(res1 - cbind(state.center$x, state.center$y))
plot(cbind(state.center$x, state.center$y), asp=1, type="n")
text(cbind(state.center$x, state.center$y), state.abb)
plot(res, asp=1, type="n")
text(res, state.abb)
broke_proj <- FALSE
pv <- .Call("PROJ4VersionInfo", PACKAGE="rgdal")[[2]]
# https://github.com/OSGeo/PROJ/issues/1525
if (pv >= 600 && pv < 620) broke_proj <- TRUE
if (!broke_proj) {
  crds <- matrix(data=c(9.05, 48.52), ncol=2)
```

```

a <- project(crds, paste("+proj=ob_tran +o_proj=longlat",
  "+o_lon_p=-162 +o_lat_p=39.25 +lon_0=180 +ellps=sphere +no_defs"),
  use_ob_tran=TRUE)
a
#should be (-5.917698, -1.87195)
project(a, paste("+proj=ob_tran +o_proj=longlat",
  "+o_lon_p=-162 +o_lat_p=39.25 +lon_0=180 +ellps=sphere +no_defs"),
  inv=TRUE, use_ob_tran=TRUE)
#added after posting by Martin Ivanov
}
#
getPROJ4VersionInfo()
# Test for UTM == TMERC (<= 4.9.2) or UTM == ETMERC (> 4.9.2)
nhh <- matrix(c(5.304234, 60.422311), ncol=2)
nhh_utm_32N_P4 <- project(nhh, "+init=epsg:3044")
nhh_tmerc_P4 <- project(nhh, paste("+proj=tmerc +k=0.9996 +lon_0=9",
  "+x_0=500000 +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs"))
nhh_etmerc_P4 <- project(nhh, paste("+proj=etmerc +k=0.9996 +lon_0=9",
  "+x_0=500000 +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs"))
all.equal(nhh_utm_32N_P4, nhh_tmerc_P4, tolerance=1e-9, scale=1)
# UTM == TMERC: PROJ4 <=4.9.2
all.equal(nhh_utm_32N_P4, nhh_etmerc_P4, tolerance=1e-9, scale=1)
# UTM == ETMERC: PROJ4 > 4.9.2
unis <- matrix(c(15.653453, 78.222504), ncol=2)
unis_utm_33N_P4 <- project(unis, "+init=epsg:3045")
unis_tmerc_P4 <- project(unis, paste("+proj=tmerc +k=0.9996 +lon_0=15",
  "+x_0=500000 +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs"))
unis_etmerc_P4 <- project(unis, paste("+proj=etmerc +k=0.9996 +lon_0=15",
  "+x_0=500000 +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +units=m +no_defs"))
all.equal(unis_utm_33N_P4, unis_tmerc_P4, tolerance=1e-9, scale=1)
# UTM == TMERC: PROJ4 <=4.9.2
all.equal(unis_utm_33N_P4, unis_etmerc_P4, tolerance=1e-9, scale=1)
# UTM == ETMERC: PROJ4 > 4.9.2
#pv <- attr(getPROJ4VersionInfo(), "short")
#if (pv < 500) {
# valgrind leakages in some cases for PROJ >= 5; many non-projection proj values added
# available projections and their inverses if provided
# For >=4.9.3 returns non-finite points rather than needing crash protection
projs <- as.character(projInfo()$name)
res <- logical(length(projs))
names(res) <- projs
msgs <- character(length(projs))
names(msgs) <- projs
owarn <- options("warn")$warn
options(warn=2L)
for (i in seq(along=res)) {
  iprs <- paste("+proj=", projs[i], sep="")
  xy <- try(project(cbind(0, 0), iprs, legacy=TRUE, use_aoi=FALSE), silent=TRUE)
  if (inherits(xy, "try-error")) {
    res[i] <- NA
    msgs[i] <- paste("fwd:", strsplit(xy, "\n")[[1]][2])
  } else if (any(abs(xy) > 1e+08)) {
    res[i] <- NA
  }
}

```

```

    msgs[i] <- paste("fwd: huge value")
  } else {
    out <- try(project(xy, iprs, inv=TRUE, legacy=TRUE, use_aoi=FALSE), silent=TRUE)
    if (inherits(out, "try-error")) {
      res[i] <- NA
      msgs[i] <- paste("inv:", strsplit(out, "\n")[[1]][2])
    } else {
      res[i] <- isTRUE(all.equal(cbind(0,0), out))
    }
  }
}
options(warn=owarn)
df <- data.frame(res=unname(res), msgs=unname(msgs), row.names=names(res))
# projection and inverse projection failures
# fwd: missing parameters
# inv: mostly inverse not defined
df[is.na(df$res),]
# inverse not equal to input
# (see http://lists.maptools.org/pipermail/proj/2011-November/006015.html)
df[!is.na(df$res) & !df$res,]
# inverse equal to input
row.names(df[!is.na(df$res) & df$res,])
#}
# oce data representation with NAs
l1 <- structure(c(12.1823368669203, 11.9149630062421, 12.3186076188739,
12.6207597184845, 12.9955172054652, 12.6316117692658, 12.4680041846297,
12.4366882666609, NA, NA, -5.78993051516384, -5.03798674888479,
-4.60623015708619, -4.43802336997614, -4.78110320396188, -4.99127125409291,
-5.24836150474498, -5.68430388755925, NA, NA), .Dim = c(10L,
2L), .Dimnames = list(NULL, c("longitude", "latitude")))
try(xy0 <- project(l1, "+proj=moll", legacy=TRUE))
if (!PROJis6ormore()) { # legacy=TRUE PROJ >= 6
try(xy1 <- project(l1, "+proj=moll", legacy=FALSE, allowNAs_if_not_legacy=FALSE))
try(xy2 <- project(l1, "+proj=moll", legacy=FALSE, allowNAs_if_not_legacy=TRUE))
if (exists("xy0")) all.equal(xy0, xy2)
}
if (!exists("xy0")) xy0 <- structure(c(1217100.8468177, 1191302.229156,
1232143.28841193, 1262546.27733232, 1299648.82357849, 1263011.18154638,
1246343.17808186, 1242654.33986052, NA, NA, -715428.207551599,
-622613.577983058, -569301.605757784, -548528.530156422, -590895.949857199,
-616845.926397351, -648585.161643274, -702393.1160979, NA, NA),
.Dim = c(10L, 2L), .Dimnames = list(NULL, c("longitude", "latitude")))
try(l10 <- project(xy0, "+proj=moll", inv=TRUE, legacy=TRUE))
if (!PROJis6ormore()) { # legacy=TRUE PROJ >= 6
try(l11 <- project(xy0, "+proj=moll", inv=TRUE, legacy=FALSE, allowNAs_if_not_legacy=FALSE))
try(l12 <- project(xy0, "+proj=moll", inv=TRUE, legacy=FALSE, allowNAs_if_not_legacy=TRUE))
if (exists("l10")) all.equal(l10, l12)
}
if (exists("l10")) all.equal(l10, l1)

```

---

projInfo

*List PROJ.4 tag information*

---

**Description**

The projInfo function lists known values and descriptions for PROJ.4 tags for tag in c("proj", "ellps", "datum", "units"). getPROJ4VersionInfo returns the version of the underlying PROJ.4 release, getPROJ4libPath returns the value of the PROJ\_LIB environment variable, projNAD detects the presence of NAD datum conversion tables (looking for conus).

**Usage**

```
projInfo(type = "proj")
getPROJ4VersionInfo()
getPROJ4libPath()
projNAD()
GDAL_OSR_PROJ()
GDALis3ormore()
PROJis6ormore()
new_proj_and_gdal()
```

**Arguments**

type                    One of these tags: c("proj", "ellps", "datum", "units")

**Details**

The output data frame lists the information given by the proj application with flags -lp, -le, -ld or -lu. From PROJ 6, "datum" is not available. From PROJ 7.1.0, "units" returns the conversion factor as numeric, not character.

**Value**

A data frame with a name and description column, and two extra columns for the "ellps" and "datum" tags.

**Note**

Loading the rgdal package may change the PROJ\_LIB environmental variable to the PROJ.4 support files if bundled with binary packages.

**Author(s)**

Roger Bivand <Roger.Bivand@nhh.no>

**References**

<https://proj.org/>

**Examples**

```

getPROJ4VersionInfo()
projInfo()
projInfo("ellps")
projInfo("units")

```

---

readGDAL

*Read/write between GDAL grid maps and Spatial objects*


---

**Description**

The functions read or write GDAL grid maps. They will set the spatial reference system if available. GDALinfo reports the size and other parameters of the dataset. create2GDAL creates a GDAL data set from a SpatialGridDataFrame object, in particular to be able to save to GDAL driver formats that only permit copying rather than creation.

**Usage**

```

readGDAL(fname, offset, region.dim, output.dim, band, p4s=NULL, ...,
  half.cell=c(0.5, 0.5), silent = FALSE, OVERRIDE_PROJ_DATUM_WITH_TOWGS84=NULL,
  allowedDrivers = NULL, enforce_xy = NULL, options=NULL)
asSGDF_GROD(x, offset, region.dim, output.dim, p4s=NULL, ...,
  half.cell=c(0.5,0.5), OVERRIDE_PROJ_DATUM_WITH_TOWGS84=NULL, enforce_xy = NULL)
writeGDAL(dataset, fname, drivename = "GTiff", type = "Float32",
  mvFlag = NA, options=NULL, copy_drivename = "GTiff", setStatistics=FALSE,
  colorTables = NULL, catNames=NULL, enforce_xy = NULL)
create2GDAL(dataset, drivename = "GTiff", type = "Float32", mvFlag = NA,
  options=NULL, fname = NULL, setStatistics=FALSE, colorTables = NULL,
  catNames=NULL, enforce_xy = NULL)
GDALinfo(fname, silent=FALSE, returnRAT=FALSE, returnCategoryNames=FALSE,
  returnStats=TRUE, returnColorTable=FALSE,
  OVERRIDE_PROJ_DATUM_WITH_TOWGS84=NULL, returnScaleOffset=TRUE,
  allowedDrivers = NULL, enforce_xy = NULL, options=NULL)
GDALSpatialRef(fname, silent=FALSE, OVERRIDE_PROJ_DATUM_WITH_TOWGS84=NULL,
  allowedDrivers = NULL, enforce_xy = NULL, get_source_if_boundcrs=TRUE, options=NULL)

```

**Arguments**

fname	file name of grid map; in create2GDAL provides a way to pass through a file name with driver-required extension for sensitive drivers
x	A GDALReadOnlyDataset object
offset	Number of rows and columns from the origin (usually the upper left corner) to begin reading from; presently ordered (y,x) - this may change
region.dim	The number of rows and columns to read from the dataset; presently ordered (y,x) - this may change



output.dim	The number of rows and columns to return in the created object using GDAL's method to take care of image decimation / replication; presently ordered (y,x) - this may change
band	if missing, all bands are read
p4s	PROJ4 string defining CRS, if default (NULL), the value is read from the GDAL data set
half.cell	Used to adjust the intra-cell offset from corner to centre, usually as default, but may be set to c=(0,0) if needed; presently ordered (y,x) - this may change
silent	logical; if TRUE, comment and non-fatal CPL driver errors suppressed
OVERVERRIDE_PROJ_DATUM_WITH_TOWGS84	logical value, default NULL, which case the cached option set by set_OVERRIDE_PROJ_DATUM_WITH_TOWGS84 is used. Ignored if the GDAL version is less than "1.8.0" or if the CPLConfigOption variable is already set; see <a href="#">getProjectionRef</a> for further details
allowedDrivers	a character vector of suggested driver short names may be provided starting from GDAL 2.0
...	arguments passed to either getRasterData, or getRasterTable, depending on rotation angles (see below); see the rgdal documentation for the available options (subsetting etc.)
dataset	object of class <a href="#">SpatialGridDataFrame-class</a> or <a href="#">SpatialPixelsDataFrame-class</a>
drivername, copy_drivername	GDAL driver name; if the chosen driver does not support dataset creation, an attempt is made to use the copy_drivername driver to create a dataset, and copyDataset to copy to the target driver
type	GDAL write data type, one of: 'Byte', 'Int16', 'Int32', 'Float32', 'Float64'; 'UInt16', 'UInt32' are available but have not been tests
mvFlag	default NA, missing value flag for output file; the default value works for 'Int32', 'Float32', 'Float64', but suitable in-range value that fits the data type should be used for other data types, for example 255 for 'Byte', -32768 for 'Int16', and so on; see Details below.
enforce_xy	(PROJ6+/GDAL3+) either use global setting (default NULL) or override policy for coordinate ordering easting/x as first axis, northing/y as second axis.
get_source_if_boundcrs	The presence of the +towgs84= key in a Proj4 string projargs= argument value may promote the output WKT2 CRS to BOUNDCRS for PROJ >= 6 and GDAL >= 3, which is a coordinate operation from the input datum to WGS84. This is often unfortunate, so a PROJ function is called through <b>rgdal</b> to retrieve the underlying source definition.
options	driver-specific options to be passed to the GDAL driver; only available for opening datasets from GDAL 2.0; see copying and creation details below
setStatistics	default FALSE, if TRUE, attempt to set per-band statistics in the output file (driver-dependent)
colorTables	default NULL, if not NULL, a list of length equal to the number of bands, with NULL components for bands with no color table, or either an integer matrix of red, green, blue and alpha values (0-255), or a character vector of colours. The number of colours permitted may vary with driver.

catNames	default NULL, if not NULL, a list of length equal to the number of bands, with NULL components for bands with no category names, or a string vector of category names
returnRAT	default FALSE, if TRUE, return a list with a Raster Attribute Table or NULL for each band
returnCategoryNames	default FALSE, if TRUE, return a list with a character vector of CategoryNames or NULL for each band
returnStats	default TRUE, return band-wise statistics if available (from 0.7-20 set to NA if not available)
returnColorTable	default FALSE; if TRUE return band-wise colour tables in a list attribute "ColorTables"
returnScaleOffset	default TRUE, return a matrix of bandwise scales and offsets

### Details

In `writeGDAL`, if types other than 'Int32', 'Float32', 'Float64' are used, the "mvFlag" argument should be used to set a no data value other than the default NA. Note that the flag only replaces NA values in the data being exported with the value of the argument - it does not mark data values equal to "mvFlag" as missing. The value is stored in the file being written in driver-specific ways, and may be used when the file is read. When the default "mvFlag=NA" is used, no NoDataValue is written to the file, and the input data is written as is.

Also in `writeGDAL`, the "options" argument may be used to pass a character vector of one or more options to the driver, for example 'options="INTERLEAVE=PIXEL"', or 'options=c("INTERLEAVE=PIXEL", "COMPRESS=DEFLATE")'. Typical cases are given in the examples below; it may also be necessary in some cases to escape quotation marks if included in the string passed to the driver.

### Value

`readGDAL` returns the data in the file as a Spatial object.

Usually, GDAL maps will be north-south oriented, in which case the `rgdal` function `getRasterData` is used to read the data, and an object of class [SpatialGridDataFrame-class](#) is returned.

Some map formats supported by GDAL are not north-south oriented grids. If this is the case, `readGDAL` returns the data as a set of point data, being of class [SpatialPointsDataFrame-class](#). If the points are on a 45 or 90 degree rotated grid, you can try to enforce gridding later on by e.g. using `gridded-methods(x)=TRUE`.

### Warning

Some raster files may have an erroneous positive y-axis resolution step, leading to the data being flipped on the y-axis. `readGDAL` will issue a warning: Y axis resolution positive, examine data for flipping, when the step is positive, but this need not mean that the data are flipped. Examine a display of the data compared with your knowledge of the file to determine whether this is the case (one known case is interpolation files created under Qgis up to February 2010 at least). To retrieve the correct orientation, use `flip`.

**Note**

Non-fatal CPL errors may be displayed for some drivers, currently for the AIG ArcInfo 9.3 binary raster driver using GDAL  $\geq$  1.6.2; the data has been read correctly, but the contents of the info directory did not meet the specifications used to reverse engineer the driver used in GDAL (see <https://trac.osgeo.org/gdal/ticket/3031>)

**Author(s)**

Edzer Pebesma, Roger Bivand

**See Also**

[image](#), [asciigrid](#)

**Examples**

```
set_thin_PROJ6_warnings(TRUE)
library(grid)
GDALinfo(system.file("external/test.ag", package="sp")[1])
x <- readGDAL(system.file("external/test.ag", package="sp")[1])
class(x)
image(x)
summary(x)
x@data[[1]][x@data[[1]] > 10000] <- NA
summary(x)
image(x)

x <- readGDAL(system.file("external/simple.ag", package="sp")[1])
class(x)
image(x)
summary(x)
x <- readGDAL(system.file("pictures/big_int_arc_file.asc", package="rgdal")[1])
summary(x)
cat("if the range is not 10000, 77590, your GDAL does not detect big\n")
cat("integers for this driver\n")
y = readGDAL(system.file("pictures/Rlogo.jpg", package = "rgdal")[1], band=1)
summary(y)
y = readGDAL(system.file("pictures/Rlogo.jpg", package = "rgdal")[1])
summary(y)
splot(y, names.attr=c("red", "green", "blue"),
col.regions=grey(0:100/100),
main="example of three-layer (RGB) raster image", as.table=TRUE)
data(meuse.grid)
gridded(meuse.grid) = ~x+y
proj4string(meuse.grid) = CRS("+init=epsg:28992")
fn <- tempfile()
writeGDAL(meuse.grid["dist"], fn)
GDALinfo(fn)
writeGDAL(meuse.grid["dist"], fn, setStatistics=TRUE)
GDALinfo(fn)
mg2 <- readGDAL(fn)
proj4string(mg2)
```

```

SP27GTIF <- readGDAL(system.file("pictures/SP27GTIF.TIF",
package = "rgdal")[1], output.dim=c(100,100))
summary(SP27GTIF)
slot(SP27GTIF, "proj4string")
if (new_proj_and_gdal()) comment(slot(SP27GTIF, "proj4string"))
image(SP27GTIF, col=grey(1:99/100))
GDALinfo(system.file("pictures/cea.tif", package = "rgdal")[1])
(o <- GDALSpatialRef(system.file("pictures/cea.tif", package = "rgdal")[1]))
if (new_proj_and_gdal()) comment(o)
cea <- readGDAL(system.file("pictures/cea.tif", package = "rgdal")[1],
output.dim=c(100,100))
summary(cea)
image(cea, col=grey(1:99/100))
slot(cea, "proj4string")
if (new_proj_and_gdal()) comment(slot(cea, "proj4string"))
fn <- system.file("pictures/erdas_spnad83.tif", package = "rgdal")[1]
erdas_spnad83 <- readGDAL(fn, offset=c(50, 100), region.dim=c(400, 400),
output.dim=c(100,100))
summary(erdas_spnad83)
slot(erdas_spnad83, "proj4string")
if (new_proj_and_gdal()) comment(slot(erdas_spnad83, "proj4string"))
image(erdas_spnad83, col=grey(1:99/100))
erdas_spnad83a <- readGDAL(fn, offset=c(50, 100), region.dim=c(400, 400))
bbox(erdas_spnad83)
bbox(erdas_spnad83a)
gridparameters(erdas_spnad83)
gridparameters(erdas_spnad83a)
tf <- tempfile()
writeGDAL(erdas_spnad83, tf, drivername="GTiff", type="Byte", options=NULL)
erdas_spnad83_0 <- readGDAL(tf)
slot(erdas_spnad83_0, "proj4string")
if (new_proj_and_gdal()) comment(slot(erdas_spnad83_0, "proj4string"))
all.equal(erdas_spnad83, erdas_spnad83_0)
writeGDAL(erdas_spnad83, tf, drivername="GTiff", type="Byte",
options="INTERLEAVE=PIXEL")
erdas_spnad83_1 <- readGDAL(tf)
slot(erdas_spnad83_1, "proj4string")
if (new_proj_and_gdal()) comment(slot(erdas_spnad83_1, "proj4string"))
all.equal(erdas_spnad83, erdas_spnad83_1)
writeGDAL(erdas_spnad83, tf, drivername="GTiff", type="Byte",
options=c("INTERLEAVE=PIXEL", "COMPRESS=DEFLATE"))
erdas_spnad83_2 <- readGDAL(tf)
slot(erdas_spnad83_2, "proj4string")
if (new_proj_and_gdal()) comment(slot(erdas_spnad83_2, "proj4string"))
all.equal(erdas_spnad83, erdas_spnad83_2)

x <- GDAL.open(system.file("pictures/erdas_spnad83.tif", package = "rgdal")[1])
erdas_spnad83 <- asSGDF_GROD(x, output.dim=c(100,100))
GDAL.close(x)
summary(erdas_spnad83)
image(erdas_spnad83, col=grey(1:99/100))

tf <- tempfile()

```

```

xx <- create2GDAL(erdas_spnad83, type="Byte")
xxx <- copyDataset(xx, driver="PNG")
saveDataset(xxx, tf)
GDAL.close(xx)
GDAL.close(xxx)
GDALinfo(tf)

tf2 <- tempfile()
writeGDAL(erdas_spnad83, tf2, drivename="PNG", type="Byte")
GDALinfo(tf2)

GT <- GridTopology(c(0.5, 0.5), c(1, 1), c(10, 10))
set.seed(1)
SGDF <- SpatialGridDataFrame(GT, data=data.frame(z=runif(100)))
opar <- par(mfrow=c(2,2), mar=c(1,1,4,1))
image(SGDF, "z", col=colorRampPalette(c("blue", "yellow"))(20))
title(main="input values")
pfunc <- colorRamp(c("blue", "yellow"))
RGB <- pfunc(SGDF$z)
SGDF$red <- RGB[,1]
SGDF$green <- RGB[,2]
SGDF$blue <- RGB[,3]
image(SGDF, red="red", green="green", blue="blue")
title(main="input RGB")
tf <- tempfile()
writeGDAL(SGDF[c("red", "green", "blue")], tf, type="Byte", drivename="PNG")
t1 <- readGDAL(tf)
image(t1, red=1, green=2, blue=3)
title(main="output PNG RGB")
par(opar)

t0 <- meuse.grid["ffreq"]
fullgrid(t0) <- TRUE
t0$ffreq <- as.integer(t0$ffreq)-1
# convert factor to zero-base integer
CT <- c("red", "orange", "green", "transparent")
cN <- c("annual", "2-5 years", "infrequent")
tf <- tempfile()
writeGDAL(t0, tf, type="Byte", colorTable=list(CT), catNames=list(cN),
  mvFlag=3L)
attr(GDALinfo(tf, returnStats=FALSE, returnCategoryNames=TRUE),
  "CATlist")[[1]]
## Not run:
ds <- GDAL.open(tf)
displayDataset(ds, reset.par=FALSE)
t(col2rgb(getColorTable(ds)[1:4]))
GDAL.close(ds)

## End(Not run)
fn <- system.file("pictures/test_envi_class.envi", package = "rgdal")[1]
Gi <- GDALinfo(fn, returnColorTable=TRUE, returnCategoryNames=TRUE)
CT <- attr(Gi, "ColorTable")[[1]]

```

```

CT
attr(Gi, "CATlist")[[1]]
with <- readGDAL(fn)
with <- readGDAL(fn, silent=TRUE)
table(with$band1)
table(as.numeric(with$band1))
with1 <- readGDAL(fn, as.is=TRUE)
table(with1$band1)
spplot(with, col.regions=CT)
tf <- tempfile()
cN <- levels(with$band1)
with$band1 <- as.integer(with$band1)-1
writeGDAL(with, tf, drivename="ENVI", type="Int16", colorTable=list(CT),
  catNames=list(cN), mvFlag=11L)
cat(paste(readLines(paste(tf, "hdr", sep=".")), "\n", sep=""), "\n")
wGi <- GDALinfo(tf, returnColorTable=TRUE, returnCategoryNames=TRUE)
CTN <- attr(wGi, "ColorTable")[[1]]
CTN
attr(wGi, "CATlist")[[1]]
withN <- readGDAL(tf)
table(withN$band1)
withN1 <- readGDAL(tf, as.is=TRUE)
table(withN1$band1)
spplot(withN, col.regions=CTN)

# a file with scale and offset
fn <- system.file("pictures/scaleoffset.vrt", package = "rgdal")[1]
g <- GDALinfo(fn)
attr(g, 'ScaleOffset')
g

f1 <- system.file("pictures/MR5905167_372.nc", package="rgdal")[1]
if (file.exists(f1)) {
  flstr <- paste0("NETCDF:\\"", f1, "\":TEMP")
  if ("netCDF" %in% gdalDrivers()$name) GDALinfo(flstr)
}

```

---

readOGR

*Read OGR vector maps into Spatial objects*


---

## Description

The function reads an OGR data source and layer into a suitable Spatial vector object. It can only handle layers with conformable geometry features (not mixtures of points, lines, or polygons in a single layer). It will set the spatial reference system if the layer has such metadata.

If reading a shapefile, the data source name (`dsn=` argument) is the folder (directory) where the shapefile is, and the layer is the name of the shapefile (without the `.shp` extension). For example to read `bounds.shp` from `C:/Maps`, do `map <- readOGR(dsn="C:/Maps", layer="bounds")`. The logic behind this is that typically one keeps all the shapefiles for a project in one folder (directory).

As noted below, for other file type drivers, the `dsn=` argument is interpreted differently, and may be the file name itself, as for example with the GPX driver for reading GPS data as `layer="tracks"` lines or `layer="track_points"` points.

## Usage

```
readOGR(dsn, layer, verbose = TRUE, p4s=NULL,
  stringsAsFactors=as.logical(NA),
  drop_unsupported_fields=FALSE,
  pointDropZ=FALSE, dropNULLGeometries=TRUE,
  useC=TRUE, disambiguateFIDs=FALSE, addCommentsToPolygons=TRUE,
  encoding=NULL, use_iconv=FALSE, swapAxisOrder=FALSE, require_geomType = NULL,
  integer64="no.loss", GDAL1_integer64_policy=FALSE, morphFromESRI = NULL,
  dumpSRS = FALSE, enforce_xy = NULL, D3_if_2D3D_points=FALSE, missing_3D=0)
ogrInfo(dsn, layer, encoding=NULL,
  use_iconv=FALSE, swapAxisOrder=FALSE, require_geomType = NULL,
  morphFromESRI = NULL, dumpSRS = FALSE, enforce_xy = NULL,
  D3_if_2D3D_points=FALSE)
ogrFIDs(dsn, layer)
ogrDrivers()
OGRSpatialRef(dsn, layer, morphFromESRI=NULL, dumpSRS = FALSE, driver = NULL,
  enforce_xy = NULL, get_source_if_boundcrs=TRUE)
ogrListLayers(dsn)
## S3 method for class 'ogrinfo'
print(x, ...)
```

## Arguments

<code>dsn</code>	data source name (interpretation varies by driver — for some drivers, <code>dsn</code> is a file name, but may also be a folder)
<code>layer</code>	layer name (varies by driver, may be a file name without extension). From rgdal 1.2.*, <code>layer</code> may be missing, in which case <code>ogrListLayers</code> examines the <code>dsn</code> , and fails if there are no layers, silently reads the only layer if only one layer is found, and reads the first layer if multiple layers are present, issuing a warning that layer should be given explicitly.
<code>verbose</code>	report progress
<code>p4s</code>	PROJ4 string defining CRS, if default NULL, the value is read from the OGR data set
<code>stringsAsFactors</code>	logical: should character vectors be converted to factors? Default NA, which uses the deprecated <code>default.stringsAsFactors()</code> in R < 4.1.0 (see <a href="#">link[base][{data.frame}]</a> ). Before R 4, strings were converted to factors by default, as argument value TRUE. See <a href="https://developer.r-project.org/Blog/public/2020/02/16/stringsasfactors/index.html">https://developer.r-project.org/Blog/public/2020/02/16/stringsasfactors/index.html</a> for details of changes.
<code>drop_unsupported_fields</code>	default FALSE, if TRUE skip fields other than String, Integer, and Real; Date, Time and DateTime are converted to String

pointDropZ	default FALSE, if TRUE, discard third coordinates for point geometries; third coordinates are always discarded for line and polygon geometries
dropNULLGeometries	default TRUE, drop both declared NULL geometries, and empty geometries with no coordinates; if FALSE, return a data frame with the attribute values of the NULL and empty geometries. From 1.3-6, setting FALSE also works when there are no geometries at all, returning a data.frame including all FIDs
useC	default TRUE, if FALSE use original interpreted code in a loop
disambiguateFIDs	default FALSE, if TRUE, and FID values are not unique, they will be set to unique values 1:N for N features; problem observed in GML files
addCommentsToPolygons	default TRUE, may be set FALSE for legacy behaviour; used to indicate which interior rings are holes in which exterior rings in conformance with OGC SFS specifications
encoding	default NULL, if set to a character string, and the driver is "ESRI Shapefile", and use_iconv is FALSE, it is passed to the CPL Option "SHAPE_ENCODING" immediately before reading the DBF of a shapefile. If use_iconv is TRUE, and encoding is not NULL, it will be used to convert input strings from the given value to the native encoding for the system/platform.
use_iconv	default FALSE; if TRUE and encoding is not NULL, it will be used to convert input strings from the given value to the native encoding for the system/platform.
swapAxisOrder	default FALSE, if TRUE, treat y coordinate as Easting, x as Northing, that is the opposite to the assumed order; this may be needed if some OGR read drivers do not behave as expected
require_geomType	, default NULL, if one of: c("wkbPoint", "wkbLineString", "wkbPolygon"), then in input with multiple geometry types, the chosen type will be read
integer64	default "no.loss" (from rgdal 1.2.*). From GDAL 2, fields to be read may also take Integer64 values. As R has no such storage mode, three options are offered, analogous with <code>type.convert</code> for numeric conversion: "allow.loss" which clamps to 32-bit signed integer (default < rgdal 1.2), "warn.loss" - as "allow.loss" but warns when clamping occurs, and "no.loss", which reads as a character string using the formatting applied by default by GDAL (default >= rgdal 1.2). The use of 64-bit integers is usually a misunderstanding, as such data is almost always a long key ID.
GDAL1_integer64_policy	default FALSE, if TRUE, Integer64 fields are read as doubles
morphFromESRI	default NULL, morph from ESRI WKT1 dialect
dumpSRS	dump SRS to stdout from inside GDAL to debug conversion - developer use only
enforce_xy	(PROJ6+/GDAL3+) either use global setting (default NULL) or override policy for coordinate ordering easting/x as first axis, northing/y as second axis.
get_source_if_boundcrs	The presence of the +towgs84= key in a Proj4 string projargs= argument value may promote the output WKT2 CRS to BOUNDCRS for PROJ >= 6 and GDAL



	$\geq 3$ , which is a coordinate operation from the input datum to WGS84. This is often unfortunate, so a PROJ function is called through <b>rgdal</b> to retrieve the underlying source definition.
D3_if_2D3D_points	<a href="https://github.com/r-spatial/sf/issues/1683">https://github.com/r-spatial/sf/issues/1683</a> case of mixed 2D/3D track points - set TRUE to 3D to pass
missing_3D	default 0, may be finite real numbers; <a href="https://github.com/r-spatial/sf/issues/1683">https://github.com/r-spatial/sf/issues/1683</a>
driver	default NULL, driver found using <code>ogrListLayers</code> from the data source; otherwise already known and passed through from a calling function
x	ogrinfo object
...	other arguments to print method

### Details

The drivers available will depend on the installation of GDAL/OGR, and can vary; the `ogrDrivers()` function shows which are available, and which may be written (but all are assumed to be readable). Note that stray files in data source directories (such as \*.dbf) may lead to suprious errors that accompanying \*.shp are missing.

### Value

A Spatial object is returned suiting the vector data source, either a `SpatialPointsDataFrame` (using an `AttributeList` for its data slot directly), a `SpatialLinesDataFrame`, or a `SpatialPolygonsDataFrame`.

### Note

The bases for this implementation are taken from functions in Barry Rowlingson's draft Rmap package, and from Radim Blazek's `v.in.ogr` program in GRASS.

Please note that the OGR drivers used may not handle missing data gracefully, and be prepared to have to correct for this manually. From `rgdal` 0.5-27, missing value handling has been improved, and OGR unset field values are set to NA in R, but drivers and external files may vary in their representations of missing values.

In addition, from 0.6-9 date and time fields are read as strings rather than being treated as unsupported; NULL geometries are identified and dropped. There are differences in the reporting of NULL geometries between `ogrInfo` and `readOGR` - in `ogrInfo`, only declared NULL geometries are reported, but in `readOGR`, any line or polygon geometries with no coordinates are assigned NULL geometry status as well. An attempt is made to close unclosed rings in polygon geometries.

For reading GPX files, refer to the OGR GPX format documentation for the use of layer tags: "waypoints", "tracks", "routes", "track\_points" and "route\_points" - reading GPX files requires a build of GDAL/OGR with the `expat` XML library.

From 0.6-10, attempts are made to detect deleted features still present in the layer, but not read. Apparently features deleted in Qgis are only marked as deleted, but are still in the layer. These are not NULL geometries, but still need to be handled. An attempt is made to check the FID values, and `ogrFIDs` now returns attributes permitting this oddity to be detected. Such deleted features were seen as NULL in 0.6-9, but are not such.

From 0.7-24, if the layer has no fields, a single field containing the FID values is placed in the data slot of the returned object.

From 0.7-24, attempts are begun to provide users with arguments to control reading from OGR/shapefile driver when the encoding is inappropriate (especially the setting of LDID in shapefile DBFs, and the SHAPE\_ENCODING environment variable).

While there is no certainty, newer drivers such as KML, GML, SQLite and Geopackage (GPKG) may encode string fields as UTF-8. Users are advised to explore this on a case to case basis using [Encoding](#) on string fields of input objects.

Because of the representation of DateTime data in OGR, decimal seconds in input data are rounded to integer seconds, see: <https://trac.osgeo.org/gdal/ticket/2680>.

Because some drivers support reading string, integer and real list fields, support has been introduced into ogrInfo from version 0.9-1 to report their presence and the maximum counts of list items. This may lead to the introduction of the `-splitlistfields` facility from the command line utility `ogrinfo`. In addition, `ogrInfo` reports that there are no features when counting FIDs in a while loop over features in `ogrFIDs` never enters the loop, despite the layer feature count reporting at least one feature.

### Author(s)

Roger Bivand

### References

<https://gdal.org/drivers/vector/index.html>, <https://resources.oreilly.com/examples/9780596008659>

### See Also

[SpatialPointsDataFrame-class](#), [SpatialLinesDataFrame-class](#), [SpatialPolygonsDataFrame-class](#), [readShapePoly](#), [iconv](#)

### Examples

```
set_thin_PROJ6_warnings(TRUE)
ogrDrivers()
dsn <- system.file("vectors", package = "rgdal")[1]
ogrListLayers(dsn)
ogrInfo(dsn)
ogrInfo(dsn=dsn, layer="cities")
owd <- getwd()
setwd(dsn)
ogrInfo(dsn="cities.shp")
ogrInfo(dsn="cities.shp", layer="cities")
setwd(owd)
ow <- options("warn")$warn
options("warn"=1)
cities <- readOGR(dsn=dsn, layer="cities")
str(slot(cities, "data"))
if (new_proj_and_gdal()) comment(slot(cities, "proj4string"))
```

```

cities$POPULATION <- type.convert(as.character(cities$POPULATION),
  na.strings="-99", numerals="no.loss")
str(slot(cities, "data"))
cities <- readOGR(dsn=dsn, layer="cities", GDAL1_integer64_policy=TRUE)
str(slot(cities, "data"))
options("warn"=ow)
summary(cities)
table(Encoding(as.character(cities$NAME)))
ogrInfo(dsn=dsn, layer="kiritimati_primary_roads")
OGRSpatialRef(dsn=dsn, layer="kiritimati_primary_roads")
kiritimati_primary_roads <- readOGR(dsn=dsn, layer="kiritimati_primary_roads")
summary(kiritimati_primary_roads)
if (new_proj_and_gdal()) comment(slot(kiritimati_primary_roads, "proj4string"))
ogrInfo(dsn=dsn, layer="scot_BNG")
OGRSpatialRef(dsn=dsn, layer="scot_BNG")
scot_BNG <- readOGR(dsn=dsn, layer="scot_BNG")
summary(scot_BNG)
if (new_proj_and_gdal()) comment(slot(scot_BNG, "proj4string"))
if ("GML" %in% ogrDrivers()$name) {
  dsn <- system.file("vectors/airports.gml", package = "rgdal")[1]
  airports <- try(readOGR(dsn=dsn, layer="airports"))
  if (!inherits(airports, "try-error")) {
    summary(airports)
    if (new_proj_and_gdal()) comment(slot(airports, "proj4string"))
  }
}
dsn <- system.file("vectors/ps_cant_31.MIF", package = "rgdal")[1]
ogrInfo(dsn=dsn, layer="ps_cant_31")
ps_cant_31 <- readOGR(dsn=dsn, layer="ps_cant_31")
summary(ps_cant_31)
sapply(as(ps_cant_31, "data.frame"), class)
if (new_proj_and_gdal()) comment(slot(ps_cant_31, "proj4string"))
ps_cant_31 <- readOGR(dsn=dsn, layer="ps_cant_31", stringsAsFactors=FALSE)
summary(ps_cant_31)
sapply(as(ps_cant_31, "data.frame"), class)
dsn <- system.file("vectors/Up.tab", package = "rgdal")[1]
ogrInfo(dsn=dsn, layer="Up")
Up <- readOGR(dsn=dsn, layer="Up")
summary(Up)
if (new_proj_and_gdal()) comment(slot(Up, "proj4string"))
dsn <- system.file("vectors/test_trk2.gpx", package = "rgdal")[1]
test_trk2 <- try(readOGR(dsn=dsn, layer="tracks"))
if (!inherits(test_trk2, "try-error")) {
  summary(test_trk2)
  if (new_proj_and_gdal()) comment(slot(test_trk2, "proj4string"))
}
test_trk2pts <- try(readOGR(dsn=dsn, layer="track_points"))
if (!inherits(test_trk2pts, "try-error")) {
  summary(test_trk2pts)
  if (new_proj_and_gdal()) comment(slot(test_trk2pts, "proj4string"))
}
dsn <- system.file("vectors", package = "rgdal")[1]
ogrInfo(dsn=dsn, layer="trin_inca_pl03")

```

```

birds <- readOGR(dsn=dsn, layer="trin_inca_pl03")
summary(birds)
if (new_proj_and_gdal()) comment(slot(birds, "proj4string"))
dsn <- system.file("vectors/PacoursIKA2.TAB", package = "rgdal")[1]
try(ogrInfo(dsn, "PacoursIKA2"))
ogrInfo(dsn, "PacoursIKA2", require_geomType="wkbPoint")
plot(readOGR(dsn, "PacoursIKA2", require_geomType="wkbLineString"), col="red")
plot(readOGR(dsn, "PacoursIKA2", require_geomType="wkbPoint"), add=TRUE)
odir <- getwd()
setwd(system.file("vectors", package = "rgdal")[1])
ow <- options("warn")$warn
options("warn"=1)
ogrInfo("test64.vrt", "test64")
str(readOGR("test64.vrt", "test64", verbose=FALSE, integer64="allow.loss")$val)
str(readOGR("test64.vrt", "test64", verbose=FALSE, integer64="warn.loss")$val)
str(readOGR("test64.vrt", "test64", verbose=FALSE, integer64="no.loss")$val)
str(readOGR("test64.vrt", "test64", verbose=FALSE, stringsAsFactors=FALSE,
  integer64="no.loss")$val)
setwd(odir)
options("warn"=ow)

```

---

RGB2PCT

*Convert RGB three band to single band colour table*


---

## Description

This function converts a three-band GDALReadOnlyDataset into a single band of colour indices as a GDALTransientDataset.

## Usage

```
RGB2PCT(x, band, driver.name = 'MEM', ncolors = 256, set.ctab = TRUE)
```

## Arguments

<code>x</code>	a three-band GDALReadOnlyDataset object
<code>band</code>	a vector of numbers, recycled up to 3 in length
<code>driver.name</code>	default MEM
<code>ncolors</code>	a number of colours between 2 and 256
<code>set.ctab</code>	default TRUE, when the dithered dataset handle is returned, otherwise a list of the dataset and the PCT colour table

## Value

The value returned is either a GDALTransientDataset or a list of a GDALTransientDataset and a colour table.

**Author(s)**

Tim Keitt

**References**<https://gdal.org/>**Examples**

```
## Not run:
logo <- system.file("pictures/Rlogo.jpg", package="rgdal")[1]
x <- GDAL.open(logo)
dim(x)
dx <- RGB2PCT(x, band=1:3)
displayDataset(dx, reset.par=FALSE)
dim(dx)
GDAL.close(x)
GDAL.close(dx)

## End(Not run)
```

SGDF2PCT

*Convert RGB three band to single band colour table***Description**

This function converts a three-band `SpatialGridDataFrame` into a single band of colour indices and a colour look-up table using `RGB2PCT`. `vec2RGB` uses given breaks and colours (like `image`) to make a three column matrix of red, green, and blue values for a numeric vector.

**Usage**

```
SGDF2PCT(x, ncolors = 256, adjust.bands=TRUE)
vec2RGB(vec, breaks, col)
```

**Arguments**

<code>x</code>	a three-band <code>SpatialGridDataFrame</code> object
<code>ncolors</code>	a number of colours between 2 and 256
<code>adjust.bands</code>	default <code>TRUE</code> ; if <code>FALSE</code> the three bands must lie each between 0 and 255, but will not be stretched within those bounds
<code>vec</code>	a numeric vector
<code>breaks</code>	a set of breakpoints for the colours: must give one more breakpoint than colour
<code>col</code>	a list of colors

**Value**

The value returned is a list:

idx	a vector of colour indices in the same spatial order as the input object
ct	a vector of RGB colours

**Author(s)**

Roger Bivand

**References**

<https://gdal.org/>

**Examples**

```
logo <- system.file("pictures/Rlogo.jpg", package="rgdal")[1]
SGlogo <- readGDAL(logo)
cols <- SGDF2PCT(SGlogo)
SGlogo$idx <- cols$idx
image(SGlogo, "idx", col=cols$ct)
SGlogo <- readGDAL(logo)
cols <- SGDF2PCT(SGlogo, ncolors=64)
SGlogo$idx <- cols$idx
image(SGlogo, "idx", col=cols$ct)
SGlogo <- readGDAL(logo)
cols <- SGDF2PCT(SGlogo, ncolors=8)
SGlogo$idx <- cols$idx
image(SGlogo, "idx", col=cols$ct)
data(meuse.grid)
coordinates(meuse.grid) <- c("x", "y")
gridded(meuse.grid) <- TRUE
fullgrid(meuse.grid) <- TRUE
summary(meuse.grid$dist)
opar <- par(no.readonly=TRUE)
par(mfrow=c(1,2), mar=c(1,1,1,1)+0.1)
image(meuse.grid, "dist", breaks=seq(0,1,1/10), col=bpy.colors(10))
RGB <- vec2RGB(meuse.grid$dist, breaks=seq(0,1,1/10), col=bpy.colors(10))
summary(RGB)
meuse.grid$red <- RGB[,1]
meuse.grid$green <- RGB[,2]
meuse.grid$blue <- RGB[,3]
cols <- SGDF2PCT(meuse.grid[c("red", "green", "blue")], ncolors=10,
  adjust.bands=FALSE)
is.na(cols$idx) <- is.na(meuse.grid$dist)
meuse.grid$idx <- cols$idx
image(meuse.grid, "idx", col=cols$ct)
par(opar)
# Note: only one wrongly classified pixel after NA handling/dropping
# The functions are not written to be reversible
sort(table(findInterval(meuse.grid$dist, seq(0,1,1/10), all.inside=TRUE)))
sort(table(cols$idx))
```

---

showWKT	<i>Show Well-Known Text spatial reference system metadata</i>
---------	---

---

## Description

In modern workflows with PROJ  $\geq 6$  and GDAL  $\geq 3$ , use only `showSRID()` DEPRECATED: Use GDAL/OGR spatial reference objects to convert a PROJ.4 representation to a Well-Known Text representation, and report an EPSG code if it can be determined by OGR SRS services.

## Usage

```
showWKT(p4s, file = NULL, morphToESRI = FALSE, enforce_xy = NULL)
showP4(wkt, morphFromESRI=FALSE, enforce_xy = NULL)
showEPSG(p4s, enforce_xy = NULL)
showSRID(inSRID, format="WKT2", multiline="NO", enforce_xy = NULL, EPSG_to_init=TRUE,
  prefer_proj=NULL)
get_P6_datum_hard_fail()
set_P6_datum_hard_fail(value)
get_thin_PROJ6_warnings()
set_thin_PROJ6_warnings(value)
get_prefer_proj()
set_prefer_proj(value)
get_rgdal_show_exportToProj4_warnings()
set_rgdal_show_exportToProj4_warnings(value)
get_PROJ6_warnings_count()
OSRIsProjected(obj)
```

## Arguments

p4s	A valid PROJ.4 string representing a spatial reference system
file	if not NULL, a file name to which the output Well-Known Text representation should be written
morphToESRI	default FALSE, morph the WKT string to the representation used by ESRI; set FALSE by default 2020-03-04 to avoid occasional Windows crashes seen when passing a very modern WKT string to an old version of PROJ: <a href="https://github.com/edzer/sp/issues/75">https://github.com/edzer/sp/issues/75</a>
enforce_xy	(PROJ6+/GDAL3+) either use global setting (default NULL) or override policy for coordinate ordering easting/x as first axis, northing/y as second axis.
wkt	A valid WKT character string representing a spatial reference system
morphFromESRI	default TRUE, morph the WKT string from the representation used by ESRI
inSRID	Input coordinate reference string
obj	valid CRS object
format	Output format, default WKT2
multiline	Multiline output, either "NO" or "YES"

EPSG_to_init	default TRUE, workaround for PROJ 6.3.0 frailty leading to the dropping of +ellps= and +units=; DATUM seems to disappear in the internal definition
prefer_proj	default NULL, if TRUE, use PROJ compiled code directly, rather than FALSE using PROJ via GDAL SRS; if NULL, uses value shown by get_prefer_proj() set on startup to TRUE.
value	a logical value. For set_P6_datum_hard_fail(): by default, a deprecated/ignored input DATUM key/value pair on reading a file with PROJ6 will give a warning (default FALSE); if TRUE, an error is triggered, which may be trapped using try. For set_thin_PROJ6_warnings() default FALSE, can be set to TRUE to report only once and count the number of non-issues warnings, retrieved by get_PROJ6_warnings_count(). For set_rgdal_show_exportToProj4_warnings(), default in <b>rgdal</b> version 1.5.* TRUE, from 1.6 FALSE. The options("rgdal_show_exportToProj4_war" may be used before loading <b>rgdal</b> to set the internal logical variables; if the option is set to "all", all warnings reporting CRS degradation stemming from the GDAL OSR function exportToProj4() even if trivial are reported; if set to "thin", all warnings are detected but thinned so that one report is given per function call; if set to "none", the degradations are detected but not reported.

### Value

For showWKT, a character string containing the WKT representation of the PROJ.4 string.

### Note

The options("rgdal\_show\_exportToProj4\_warnings"="x") may be used before loading **rgdal** to set the internal logical variables; if the option is set to "all", all warnings reporting CRS degradation stemming from the GDAL OSR function exportToProj4() even if trivial are reported; if set to "thin", all warnings are detected but thinned so that one report is given per function call; if set to "none", the degradations are detected but not reported.

### Author(s)

Roger Bivand

### References

[https://gdal.org/tutorials/osr\\_api\\_tut.html](https://gdal.org/tutorials/osr_api_tut.html)

### See Also

[is.projected, CRS-class](#)

### Examples

```
set_thin_PROJ6_warnings(TRUE)
cities <- readOGR(system.file("vectors", package = "rgdal")[1], "cities")
readLines(system.file("vectors/cities.prj", package = "rgdal")[1])
showWKT(proj4string(cities))
showWKT("+init=epsg:28992")
showP4(showWKT("+init=epsg:28992"))
```



```

showEPSG("+proj=utm +zone=30")
showEPSG("+proj=longlat +ellps=WGS84")
exts <- rgdal_extSoftVersion()
run <- new_proj_and_gdal()
if (run) {
  cat(showSRID("EPSG:27700", multiline="YES"), "\n")
}
if (run) {
  (prj <- showSRID("EPSG:27700", "PROJ"))
}
if (run) {
  showSRID(paste0(prj, " +datum=OSGB36"), "WKT1")
}
if (run) {
  showSRID(paste0(prj, " +towgs84=370.936,-108.938,435.682"), "WKT1")
}
if (run) {
  showSRID(paste0(prj, " +nadgrids=OSTN15_NTv2_OSGBtoETRS.gsb"), "WKT1")
}
if (run) {
  showSRID(paste0(prj, " +datum=OSGB36"), "WKT2")
}
if (run) {
  showSRID(paste0(prj, " +towgs84=370.936,-108.938,435.682"), "WKT2")
}
if (run) {
  showSRID(paste0(prj, " +nadgrids=OSTN15_NTv2_OSGBtoETRS.gsb"), "WKT2")
}
if (run) {
  showSRID("ESRI:102761", "WKT2")
}
if (run) {
  showSRID("OGC:CRS84", "WKT2")
}
if (run) {
  showSRID("urn:ogc:def:crs:OGC:1.3:CRS84", "WKT2")
}
if (run) {
  try(showSRID("", "WKT2"))
}

OSRIsProjected(CRS("+proj=longlat"))
OSRIsProjected(CRS("+proj=geocent"))
OSRIsProjected(CRS("+proj=geocent +units=km"))

```

**Description**

Class for spatial attributes that have spatial locations on a (full) regular grid on file, not (yet) actually read.

**Usage**

```
## S3 method for class 'SpatialGDAL'
open(con, ..., silent = FALSE, allowedDrivers = NULL, options=NULL)
## S3 method for class 'SpatialGDAL'
close(con, ...)
copy.SpatialGDAL(dataset, fname, driver = getDriver(dataset@grid),
  strict = FALSE, options = NULL, silent = FALSE)
```

**Arguments**

con	file name of grid map for opening, SpatialGDAL object for closing
...	other arguments (currently ignored)
silent	logical; if TRUE, comment and non-fatal CPL driver errors suppressed
dataset	object of class SpatialGDAL
fname	file name of grid map
driver	GDAL driver name
strict	TRUE if the copy must be strictly equivalent, or more normally FALSE indicating that the copy may adapt as needed for the output format
allowedDrivers	a character vector of suggested driver short names may be provided starting from GDAL 2.0
options	driver-specific options to be passed to the GDAL driver; only available for opening datasets from GDAL 2.0

**Objects from the Class**

Objects can be created by calls of the form `open.SpatialGDAL(name)`, where `name` is the name of the GDAL file.

**Slots**

`points`: see [SpatialPoints](#); points slot which is not actually filled with all coordinates (only with min/max)

`grid`: see [GridTopology-class](#); grid parameters

`grid.index`: see [SpatialPixels-class](#); this slot is of zero length for this class, as the grid is full

`bbox`: Object of class "matrix"; bounding box

`proj4string`: Object of class "CRS"; projection

`data`: Object of class `data.frame`, containing attribute data

**Extends**

Class [Spatial-class](#), directly.

**Methods**

[ signature(x = "SpatialGDAL", i, j, ...): selects rows (i), columns (j), and bands (third argument); returns an object of class [SpatialGridDataFrame-class](#). Only the selection is actually read.

[[ signature(i): reads band i and returns the values as a numeric vector

**Note**

Non-fatal CPL errors may be displayed for some drivers, currently for the AIG ArcInfo 9.3 binary raster driver using GDAL >= 1.6.2; the data has been read correctly, but the contents of the info directory did not meet the specifications used to reverse engineer the driver used in GDAL (see <https://trac.osgeo.org/gdal/ticket/3031>)

**Author(s)**

Edzer Pebesma, <edzer.pebesma@uni-muenster.de>

**See Also**

[SpatialGridDataFrame-class](#), which is actually sub-classed.

**Examples**

```
x <- open.SpatialGDAL(system.file("external/test.ag", package="sp")[1])
image(x[])
image(as(x, "SpatialGridDataFrame"))
summary(as(x, "SpatialGridDataFrame"))
spplot(as(x, "SpatialGridDataFrame"))
# select first 50 rows:
summary(x[1:50])
# select first 50 columns:
summary(x[,1:50])
# select band 1:
summary(x[,1])
# select first 50 rows, first 50 columns, band 1:
summary(x[1:50,1:50,1])
# get values of first band:
summary(x[[1]])
close(x)
```

## Description

The spTransform methods provide transformation between datum(s) and conversion between projections (also known as projection and/or re-projection), from one unambiguously specified coordinate reference system (CRS) to another, prior to version 1.5 using Proj4 projection arguments. From version 1.5, Well-Known Text 2 (WKT2 2019) strings are used. For simple projection, when no Proj4 +datum tags are used, datum projection does not occur. When datum transformation is required, the datum should be defined with a valid value both in the CRS of the object to be transformed, and in the target CRS. In general datum is to be preferred to ellipsoid, because the datum always fixes the ellipsoid, but the ellipsoid never fixes the datum.

In addition, before version 1.5 the +towgs84 tag should have been used where needed to make sure that datum transformation would take place. Parameters for +towgs84 were taken from the legacy bundled EPSG file if they are known unequivocally, but could be entered manually from known authorities. Not providing the appropriate +datum and +towgs84 tags led to coordinates being out by hundreds of metres. Unfortunately, there is no easy way to provide this information: the user has to know the correct metadata for the data being used, even if this can be hard to discover.

From version 1.5, spTransform uses the modern PROJ coordinate operation framework for transformations. This avoids pivoting through WGS84 if possible, and uses WKT2 (2019) strings for source and target CRS often constructed from the bundled EPSG SQLite database. The database is searched for feasible candidate coordinate operations, and the most accurate available is chosen. More details are available in a vignette: vignette("CRS\_projections\_transformations").

## Usage

```
get_transform_wkt_comment()
set_transform_wkt_comment(value)
get_enforce_xy()
set_enforce_xy(value)
get_last_coordOp()
```

## Arguments

value	A non-NA logical value
-------	------------------------

## Methods

"ANY" default void method

"SpatialPoints", CRSObj = CRS returns transformed coordinates of an "SpatialPoints" object using the projection arguments in "CRSObj", of class CRS

"SpatialPointsDataFrame", CRSObj = CRS returns transformed coordinates of an "SpatialPoints-DataFrame" object using the projection arguments in "CRSObj", of class CRS

"SpatialLines", CRSObj = CRS returns transformed coordinates of an "SpatialLines" object using the projection arguments in "CRSObj", of class CRS

"SpatialLinesDataFrame", CRSObj = CRS returns transformed coordinates of an "SpatialLines-DataFrame" object using the projection arguments in "CRSObj", of class CRS

"SpatialPolygons", CRSObj = CRS returns transformed coordinates of an "SpatialPolygons" object using the projection arguments in "CRSObj", of class CRS

**"SpatialPolygonsDataFrame", CRSobj = CRS** returns transformed coordinates of an "SpatialPolygonsDataFrame" object using the projection arguments in "CRSobj", of class CRS

**"SpatialPixelsDataFrame", CRSobj = CRS** Because regular grids will usually not be regular after projection/datum transformation, the input object is coerced to a SpatialPointsDataFrame, and the transformation carried out on that object. A warning: "Grid warping not available, coercing to points" is given.

**"SpatialGridDataFrame", CRSobj = CRS** Because regular grids will usually not be regular after projection/datum transformation, the input object is coerced to a SpatialPointsDataFrame, and the transformation carried out on that object. A warning: "Grid warping not available, coercing to points" is given.

### Note

The projection arguments had to be entered exactly as in the PROJ.4 documentation, in particular there cannot be any white space in +<arg>=<value> strings, and successive such strings can only be separated by blanks. Note that warnings about different projections may be issued when the PROJ.4 library extends projection arguments; examine the warning to see if the differences are real.

Also note that re-projection and/or datum transformation will usually not work for regular grids. The term used for similar operations for regular grids is warping, which involved resampling to a regular grid in the target coordinate reference system.

The methods may take an optional argument "use\_ob\_tran", default FALSE, if TRUE and "+proj=ob\_tran", use General Oblique Transformation with internalised from/to projection reversal (the user oblique transforms from longlat to oblique forward rather than inverse as suggested in PROJ.4 mailing list postings); these changes are intended to meet a need pointed out by Martin Ivanov (2012-08-15). A subsequent point raised by Martin Ivanov (2017-04-28) was that use of a projected CRS with "+proj=ob\_tran" led to errors, so mixing projected CRS and "+proj=ob\_tran" is blocked. Transform first "+proj=ob\_tran" to or from "+proj=longlat", and then on from geographical coordinates to those desired or the reverse - see example.

If a SpatialPoints object has three dimensions, the third will also be transformed, with the metric of the third dimension assumed to be meters if the vertical units metric is not given in the projection description with +vunits= or +vto\_meter= (which is 1.0 by default) <https://proj.org/faq.html>.

Note that WGS84 is both an ellipse and a datum, and that since 1984 there have been changes in the relative positions of continents, leading to a number of modifications. This is discussed for example in [https://www.uvm.edu/giv/resources/WGS84\\_NAD83.pdf](https://www.uvm.edu/giv/resources/WGS84_NAD83.pdf); there are then multiple transformations between NAD83 and WGS84 depending on the WGS84 definition used. One would expect that "+towgs84=" is a no-op for WGS84, but this only applies sometimes, and as there are now at least 30 years between now and 1984, things have shifted. It may be useful to note that "+nadgrids=@null" can help, see these threads: <https://stat.ethz.ch/pipermail/r-sig-geo/2014-August/021611.html>, <http://lists.maptools.org/pipermail/proj/2014-August/006894.html>, with thanks to Hermann Peifer for assistance.

Note that from PROJ.4 4.9.3, the definition of UTM is changed from TMERC to ETMERC; see example.

### Author(s)

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## Examples

```

set_thin_PROJ6_warnings(TRUE)
# state
data(state)
states <- data.frame(state.x77, state.center)
states <- states[states$x > -121,]
coordinates(states) <- c("x", "y")
proj4string(states) <- CRS("+proj=longlat +ellps=clrk66")
summary(states)
state.ll83 <- spTransform(states, CRS("+proj=longlat +ellps=GRS80"))
summary(state.ll83)
state.merc <- spTransform(states, CRS=CRS("+proj=merc +ellps=GRS80"))
summary(state.merc)
state.merc <- spTransform(states,
  CRS=CRS("+proj=merc +ellps=GRS80 +units=us-mi"))
summary(state.merc)
# NAD
## Not run:
if (PROJis6ormore() || (!PROJis6ormore() && projNAD())) {
states <- data.frame(state.x77, state.center)
states <- states[states$x > -121,]
coordinates(states) <- c("x", "y")
proj4string(states) <- CRS("+init=epsg:4267")
print(summary(states))
state.ll83 <- spTransform(states, CRS("+init=epsg:4269"))
print(summary(state.ll83))
state.kansasSlcc <- spTransform(states, CRS=CRS("+init=epsg:26978"))
print(summary(state.kansasSlcc))
SFpoint_NAD83 <- SpatialPoints(matrix(c(-103.869667, 44.461676), nrow=1),
  proj4string=CRS("+init=epsg:4269"))
SFpoint_NAD27 <- spTransform(SFpoint_NAD83, CRS("+init=epsg:4267"))
print(all.equal(coordinates(SFpoint_NAD83), coordinates(SFpoint_NAD27)))
print(coordinates(SFpoint_NAD27), digits=12)
print(coordinates(SFpoint_NAD83), digits=12)
}

## End(Not run)
data(meuse)
coordinates(meuse) <- c("x", "y")
proj4string(meuse) <- CRS("+init=epsg:28992")
# see http://trac.osgeo.org/gdal/ticket/1987
summary(meuse)
meuse.utm <- spTransform(meuse, CRS("+proj=utm +zone=32 +datum=WGS84"))
summary(meuse.utm)
cbind(coordinates(meuse), coordinates(meuse.utm))
## Not run:
# Kiritimati
kiritimati_primary_roads <- readOGR(system.file("vectors",
  package = "rgdal")[1], "kiritimati_primary_roads")
kiritimati_primary_roads_ll <- spTransform(kiritimati_primary_roads,
  CRS("+proj=longlat +datum=WGS84"))
opar <- par(mfrow=c(1,2))

```

```

plot(kiritimati_primary_roads, axes=TRUE)
plot(kiritimati_primary_roads_ll, axes=TRUE, las=1)
par(opar)
# scot_BNG
scot_BNG <- readOGR(system.file("vectors", package = "rgdal")[1],
  "scot_BNG")
scot_LL <- spTransform(scot_BNG, CRS("+proj=longlat +datum=WGS84"))
plot(scot_LL, axes=TRUE)
grdtxt_LL <- gridat(scot_LL)
grd_LL <- gridlines(scot_LL, ndiscr=100)
summary(grd_LL)
target <- CRS(proj4string(scot_BNG))
grd_BNG <- spTransform(grd_LL, target)
grdtxt_BNG <- spTransform(grdtxt_LL, target)
opar <- par(mfrow=c(1,2))
plot(scot_BNG, axes=TRUE, las=1)
plot(grd_BNG, add=TRUE, lty=2)
text(coordinates(grdtxt_BNG),
  labels=parse(text=as.character(grdtxt_BNG$labels)))
par(opar)

## End(Not run)
# broke_proj
broke_proj <- FALSE
# https://github.com/OSGeo/PROJ/issues/1525
pv <- .Call("PROJ4VersionInfo", PACKAGE="rgdal")[[2]]
if (pv >= 600 && pv < 620) broke_proj <- TRUE
if (!broke_proj) {
  crds <- matrix(data=c(9.05, 48.52), ncol=2)
  spPoint <- SpatialPoints(coords=crds,
    proj4string=CRS("+proj=longlat +ellps=sphere +no_defs"))
  ob_tran_def <- paste("+proj=ob_tran +o_proj=longlat",
    "+o_lon_p=-162 +o_lat_p=39.25 +lon_0=180 +ellps=sphere +no_defs")
  tg <- CRS(ob_tran_def)
  # proj4string not propagated in GDAL 3.0.0
  a <- spTransform(spPoint, tg, use_ob_tran=TRUE)
  a
}
#should be (-5.917698, -1.87195)
if (!broke_proj) {
  spTransform(a, CRS("+proj=longlat +ellps=sphere +no_defs"),
    use_ob_tran=TRUE)
}
if (!broke_proj) {
  try(spTransform(a, CRS(paste("+proj=tmerc +lat_0=0 +lon_0=9 +k=1",
    "+x_0=3500000 +y_0=0 +ellps=bessel +units=m +no_defs")),
    use_ob_tran=TRUE))
}
if (!broke_proj) {
  spTransform(spPoint, CRS(paste("+proj=tmerc +lat_0=0 +lon_0=9 +k=1",
    "+x_0=3500000 +y_0=0 +ellps=bessel +units=m +no_defs")))
}
if (!broke_proj) {

```

```

spTransform(spTransform(a, CRS("+proj=longlat +ellps=sphere +no_defs"),
  use_ob_tran=TRUE), CRS(paste("+proj=tmerc +lat_0=0 +lon_0=9 +k=1",
"+x_0=3500000 +y_0=0 +ellps=bessel +units=m +no_defs")))
}
crds1 <- matrix(data=c(7, 51, 8, 52, 9, 52, 10, 51, 7, 51), ncol=2,
byrow=TRUE, dimnames=list(NULL, c("lon", "lat")));
crds2 <- matrix(data=c(8, 48, 9, 49, 11, 49, 9, 48, 8, 48), ncol=2,
byrow=TRUE, dimnames=list(NULL, c("lon", "lat")));
crds3 <- matrix(data=c(6, 47, 6, 55, 15, 55, 15, 47, 6, 47), ncol=2,
byrow=TRUE, dimnames=list(NULL, c("lon", "lat")));
spLines <- SpatialLines(list(Lines(list(Line(crds1), Line(crds2),
Line(crds3)), ID="a")));
slot(spLines, "proj4string") <- CRS("+proj=longlat +ellps=sphere +no_defs");
bbox(spLines);
if (!broke_proj) {
spLines_tr <- spTransform(spLines, tg, use_ob_tran=TRUE);
bbox(spLines_tr)
}
if (!broke_proj) {
bbox(spTransform(spLines_tr, CRS("+proj=longlat +ellps=sphere"),
  use_ob_tran=TRUE))
}
if (!broke_proj) {
spPolygons <- SpatialPolygons(list(Polygons(list(Polygon(crds1),
Polygon(crds2), Polygon(crds3)), ID="a")));
slot(spPolygons, "proj4string") <- CRS("+proj=longlat +ellps=sphere +no_defs");
bbox(spPolygons);
}
if (!broke_proj) {
spPolygons_tr <- spTransform(spPolygons, tg, use_ob_tran=TRUE);
bbox(spPolygons_tr)
}
if (!broke_proj) {
bbox(spTransform(spPolygons_tr, CRS("+proj=longlat +ellps=sphere"),
  use_ob_tran=TRUE))
}
# added after posting by Martin Ivanov
## Not run:
data(nor2k)
summary(nor2k)
nor2kNGO <- spTransform(nor2k, CRS("+init=epsg:4273"))
summary(nor2kNGO)
all.equal(coordinates(nor2k)[,3], coordinates(nor2kNGO)[,3])
# added after posting by Don MacQueen
crds <- cbind(c(-121.524764291826, -121.523480804667), c(37.6600366036405, 37.6543604613483))
ref <- cbind(c(1703671.30566227, 1704020.20113366), c(424014.398045834, 421943.708664294))
crs.step1.cf <- CRS(paste("+proj=lcc +lat_1=38.4333333333333",
"+lat_2=37.0666666666667 +lat_0=36.5 +lon_0=-120.5",
"+x_0=2000000.0 +y_0=500000.0 +ellps=GRS80 +units=us-ft +no_defs",
"+towgs84=-0.991,1.9072,0.5129,0.025789908,0.0096501,0.0116599,0.0"))
locs.step1.cf <- spTransform(SpatialPoints(crds,
proj4string=CRS("+proj=longlat +datum=WGS84")), crs.step1.cf)
suppressWarnings(proj4string(locs.step1.cf) <- CRS(paste("+proj=lcc",

```



```

"+lat_1=38.43333333333333 +lat_2=37.06666666666667 +lat_0=36.5",
"+lon_0=-120.5 +x_0=2000000.0 +y_0=5000000.0 +ellps=GRS80 +units=us-ft",
"+no_defs +nadgrids=@null"))))
locs.step2.cfb <- spTransform(locs.step1.cf, CRS("+init=epsg:26743"))
coordinates(locs.step2.cfb) - ref
all.equal(unname(coordinates(locs.step2.cfb)), ref)

## End(Not run)
## Not run:
# new_proj_and_gdal()
run <- new_proj_and_gdal()
if (run) {
# Test for UTM == TMERC (<= 4.9.2) or UTM == ETMERC (> 4.9.2)
nhh <- SpatialPointsDataFrame(matrix(c(5.304234, 60.422311), ncol=2),
  proj4string=CRS(SRS_string="OGC:CRS84"), data=data.frame(office="RSB"))
nhh_utm_32N_P4 <- spTransform(nhh, CRS("+init=epsg:3044"))
nhh_tmerc_P4 <- spTransform(nhh, CRS(paste("+proj=tmerc +k=0.9996",
  "+lon_0=9 +x_0=500000 +ellps=GRS80 +towgs84=0,0,0,0,0,0 +units=m +no_defs")))
nhh_etmerc_P4 <- spTransform(nhh, CRS(paste("+proj=etmerc +k=0.9996",
  "+lon_0=9 +x_0=500000 +ellps=GRS80 +towgs84=0,0,0,0,0,0 +units=m +no_defs")))
all.equal(coordinates(nhh_utm_32N_P4), coordinates(nhh_tmerc_P4),
  tolerance=1e-9, scale=1)
# UTM == TMERC: PROJ4 <=4.9.2
all.equal(coordinates(nhh_utm_32N_P4), coordinates(nhh_etmerc_P4),
  tolerance=1e-9, scale=1)
# UTM == ETMERC: PROJ4 > 4.9.2
unis <- SpatialPointsDataFrame(matrix(c(15.653453, 78.222504), ncol=2),
  proj4string=CRS(SRS_string="OGC:CRS84"), data=data.frame(office="UNIS"))
unis_utm_33N_P4 <- spTransform(unis, CRS("+init=epsg:3045"))
unis_tmerc_P4 <- spTransform(unis, CRS(paste("+proj=tmerc +k=0.9996 +lon_0=15",
  "+x_0=500000 +ellps=GRS80 +towgs84=0,0,0,0,0,0 +units=m +no_defs")))
unis_etmerc_P4 <- spTransform(unis, CRS(paste("+proj=etmerc +k=0.9996",
  "+lon_0=15 +x_0=500000 +ellps=GRS80 +towgs84=0,0,0,0,0,0 +units=m +no_defs")))
all.equal(coordinates(unis_utm_33N_P4), coordinates(unis_tmerc_P4),
  tolerance=1e-9, scale=1)
# UTM == TMERC: PROJ4 <=4.9.2
all.equal(coordinates(unis_utm_33N_P4), coordinates(unis_etmerc_P4),
  tolerance=1e-9, scale=1)
# UTM == ETMERC: PROJ4 > 4.9.2
}

## End(Not run)

```

---

writeOGR

Write spatial vector data using OGR

---

## Description

The function is an interface with the OGR abstraction library for spatial vector data, allowing data to be written out using supported drivers. The drivers supported will depend on the local installa-

tion, and the capabilities of those drivers (many are read-only). The objects exported are SpatialPointsDataFrame, SpatialLinesDataFrame, or SpatialPolygonsDataFrame objects as defined in the sp package.

### Usage

```
writeOGR(obj, dsn, layer, driver, dataset_options = NULL,
         layer_options=NULL, verbose = FALSE, check_exists=NULL,
         overwrite_layer=FALSE, delete_dsn=FALSE, morphToESRI=NULL,
         encoding=NULL, shp_edge_case_fix=FALSE, dumpSRS = FALSE)
```

### Arguments

obj	a SpatialPointsDataFrame, SpatialLinesDataFrame, or a SpatialPolygonsDataFrame object.
dsn	data source name (interpretation varies by driver — for some drivers, dsn is a file name, but may also be a folder)
layer	layer name (varies by driver, may be a file name without extension)
driver	a character string equal to one of the driver names returned by <a href="#">ogrDrivers</a>
dataset_options	a character vector of options, which vary by driver, and should be treated as experimental
layer_options	a character vector of options, which vary by driver, and should be treated as experimental
verbose	if TRUE, returns a list of information about the attempted write operation
check_exists	default NULL, which tests for the GDAL version, and sets FALSE if < 1.8.0, or TRUE for >= 1.8.0
overwrite_layer	default FALSE, if TRUE and check_exists=TRUE, delete the existing layer of the same name from the data source before writing the new layer; this will delete data and must be used with extreme caution, its behaviour varies between drivers, and accommodates changes that may appear in GDAL 1.8
delete_dsn	default FALSE, may be set to TRUE if overwrite_layer reports that the data source cannot be updated; this will delete data and must be used with extreme caution, its behaviour varies between drivers, and accommodates changes that may appear in GDAL 1.8
morphToESRI	default NULL, in which case set TRUE if driver is “ESRI Shapefile” or FALSE otherwise; may be used to override this default
encoding	default NULL, if set to a character string, it will be used to convert output strings from the given value to UTF-8 encoding.
shp_edge_case_fix	default FALSE, if TRUE, attempt to work around MULTIPOLYGON to POLYGON degradation in ESRI Shapefile output with two touching exterior rings in a single feature (not yet implemented).
dumpSRS	dump SRS to stdout from inside GDAL to debug conversion - developer use only

## Details

Working out which combination of dsn, layer, and driver (and option) values give the desired output takes time and care, and is constrained by the ability of drivers to write output; many are read-only. Use of the references given is highly advisable, with searches in the archives of other software using GDAL/OGR. Note that for the “ESRI Shapefile” driver and GDAL  $\geq$  1.9, the layer\_options value of ‘ENCODING=“LDID/CP1252”’ or other values found on <http://www.autopark.ru/ASBProgrammerGuide/dbfstruc.htm> to set the encoding byte of the output DBF file (link referred to in ogr/ogrsf\_frmts/shape/ogrshapelayer.cpp. The effect of setting the LDID may vary depending on whether GDAL is built with iconv or not, and on the setting of the CPL Option “SHAPE\_ENCODING”.

While there is no certainty, newer drivers such as KML, GML, SQLite and Geopackage (GPKG) may encode string fields as UTF-8. Users are advised to explore this on a case to case basis using [Encoding](#) on string fields of objects to be output, converting where necessary with [iconv](#) or assigning the appropriate value with [Encoding](#).

## Value

if verbose=TRUE, a list of information about the attempted write operation

## Warning

The overwrite\_layer and delete\_dsn arguments are provided only for experienced script writers who need to be able to destroy data, for example during repetitive simulation runs. They should never be used by anyone who is not confident about deleting files.

## writeOGR Polygon bug in 1.1-1

In fixing a bug in the correct handling of SFS polygon geometries in version 1.1-1, a further bug was introduced affecting cases of wkbPolygon (not wkbMultiPolygon) output where SFS hole status in the output object was (correctly) defined in the comment to Polygons objects. The error only occurred when all the Polygons objects had one exterior ring, and zero or more interior rings. The error led to the coordinates of the rings cumulating, because the rings were not emptied before assigning the next ring. Version 1.1-2 corrects the error; thanks to JamesWorrall for a complete bug report <https://stat.ethz.ch/pipermail/r-sig-geo/2015-December/023796.html>.

## Note

Only a subset of possible data slot column classes may be written out; if the function returns an error that the data type of stated columns is unknown, examine the classes and check that they are one of c(“numeric”, “character”, “factor”, “POSIXt”, “integer”, “logical”), and if not convert to such classes. Classes c(“factor”, “POSIXt”) are converted to character strings, and c(“logical”) to integer internally.

For writing with the KML and GPX drivers, note that the geometries should be in geographical coordinates with datum WGS84.

## Author(s)

Roger Bivand

## References

<https://gdal.org/drivers/vector/index.html>, <https://resources.oreilly.com/examples/9780596008659>

## See Also

[readOGR](#)

## Examples

```

set_thin_PROJ6_warnings(TRUE)
cities <- readOGR(system.file("vectors", package = "rgdal")[1], "cities")
is.na(cities$POPULATION) <- cities$POPULATION == -99
summary(cities$POPULATION)
td <- file.path(tempdir(), "rgdal_examples"); dir.create(td)
# BDR 2016-12-15 (MapInfo driver fails writing to directory with ".")
if(nchar(Sys.getenv("OSGEO4W_ROOT")) > 0) {
  OLDPWD <- getwd()
  setwd(td)
  td <- "."
}
writeOGR(cities, td, "cities", driver="ESRI Shapefile")
try(writeOGR(cities, td, "cities", driver="ESRI Shapefile"))
writeOGR(cities, td, "cities", driver="ESRI Shapefile", overwrite_layer=TRUE)
cities2 <- readOGR(td, "cities")
summary(cities2$POPULATION)
if ("SQLite" %in% ogrDrivers()$name) {
  tf <- tempfile()
  try(writeOGR(cities, tf, "cities", driver="SQLite", layer_options="LAUNDER=NO"))
}
if ("GeoJSON" %in% ogrDrivers()$name) {
  js <- '{
    "type": "MultiPolygon",
    "coordinates": [[[[[102.0, 2.0], [103.0, 2.0], [103.0, 3.0], [102.0, 3.0],
      [102.0, 2.0]]], [[100.0, 0.0], [101.0, 0.0], [101.0, 1.0], [100.0, 1.0],
      [100.0, 0.0]]]]
  }'
  spdf <- readOGR(js, layer='OGRGeoJSON')
  in1_comms <- sapply(slot(spdf, "polygons"), comment)
  print(in1_comms)
  tf <- tempfile()
  writeOGR(spdf, tf, "GeoJSON", driver="GeoJSON")
  #spdf1 <- readOGR(tf, "GeoJSON")
  spdf1 <- readOGR(tf)
  in2_comms <- sapply(slot(spdf1, "polygons"), comment)
  print(in2_comms)
  print(isTRUE(all.equal(in1_comms, in2_comms)))
}
## Not run: if ("GML" %in% ogrDrivers()$name) {
  airports <- try(readOGR(system.file("vectors/airports.gml",
    package = "rgdal")[1], "airports"))
  if (class(airports) != "try-error") {

```

```

writeOGR(cities, paste(td, "cities.gml", sep="/"), "cities", driver="GML")
cities3 <- readOGR(paste(td, "cities.gml", sep="/"), "cities")
}
}
## End(Not run)
# The GML driver does not support coordinate reference systems
if ("KML" %in% ogrDrivers()$name) {
  data(meuse)
  coordinates(meuse) <- c("x", "y")
  proj4string(meuse) <- CRS("+init=epsg:28992")
  meuse_ll <- spTransform(meuse, CRS("+proj=longlat +datum=WGS84"))
  writeOGR(meuse_ll["zinc"], paste(td, "meuse.kml", sep="/"), "zinc", "KML")
}
list.files(td)
roads <- readOGR(system.file("vectors", package = "rgdal")[1],
  "kiritimati_primary_roads")
summary(roads)
if (strsplit(getGDALVersionInfo(), " ")[[1]][2] < "2") {
# For GDAL >= 2, the TAB driver may need a BOUNDS layer option
writeOGR(roads, td, "roads", driver="MapInfo File")
roads2 <- readOGR(paste(td, "roads.tab", sep="/"), "roads")
summary(roads2)
}
scot_BNG <- readOGR(system.file("vectors", package = "rgdal")[1], "scot_BNG")
summary(scot_BNG)
if (strsplit(getGDALVersionInfo(), " ")[[1]][2] < "2") {
# For GDAL >= 2, the TAB driver may need a BOUNDS layer option
writeOGR(scot_BNG, td, "scot_BNG", driver="MapInfo File")
list.files(td)
scot_BNG2 <- readOGR(paste(td, "scot_BNG.tab", sep="/"), "scot_BNG",
  addCommentsToPolygons=FALSE)
summary(scot_BNG2)
}
writeOGR(scot_BNG, td, "scot_BNG", driver="MapInfo File",
  dataset_options="FORMAT=MIF")
list.files(td)
scot_BNG3 <- readOGR(paste(td, "scot_BNG.mif", sep="/"), "scot_BNG")
summary(scot_BNG3)
if (nchar(Sys.getenv("OSGE04W_ROOT")) > 0) {
  setwd(OLDPWD)
}
}

```

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