

# Package ‘RArcInfo’

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**Title** Functions to import data from Arc/Info V7.x binary coverages

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**Depends** R (>= 2.3.0)

**Description** This package uses the functions written by Daniel Morissette <danmo@videotron.ca> to read geographical information in Arc/Info V 7.x format and E00 files to import the coverages into R variables.

**License** GPL (>= 2)

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avctoe00	<i>Converts a ARC/INFO binary coverage into an ESRI E00 file</i>
----------	--

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## Description

This function makes a conversion to an ESRI E00 file from a binary coverage.

## Usage

```
avctoe00(avcdir, e00file)
```

## Arguments

avcdir	The path to the binary coverage we want to convert from.
e00file	The E00 file to be created.

## Value

Returns 'NULL' on exit.

## References

More information about this topic can be found at <http://pages.infinet.net/danmo/e00/index-avce00.html>.

## See Also

e00toavc

---

`e00toavc`*Converts an ESRI E00 file into an Arc/Info V 7.x binary coverage*

---

**Description**

This function makes a conversion from an ESRI E00 file to a binary coverage. Usually two new directories are created. One with the name of the coverage and another called 'info', where some information about the tables are created. If this directory already exists (because there are already other binary coverages), then the new information is added and no file is replaced or deleted.

**Usage**

```
e00toavc(e00file, avcdir)
```

**Arguments**

<code>e00file</code>	The E00 file to be converted.
<code>avcdir</code>	The path to the binary coverage directory we want to create.

**Value**

Returns 'NULL' on exit.

**References**

More information about this topic can be found at <http://pages.infnit.net/danmo/e00/index-avce00.html>.

**See Also**

`avctoe00`

---

`get.arcdata`*Function for importing the contents of an ARC file into R*

---

**Description**

This function reads and imports into R the contents of an arcs definition file.

**Usage**

```
get.arcdata(datadir, coverage, filename="arc.adf")
```

**Arguments**

datadir	Directory under which all the coverages and a directory called 'info' are.
coverage	The name of the coverage we want to work with.
filename	The name of the file in the coverage directory that stores the data. By default, it is called 'arc.dat'.

**Value**

This function returns a list with two elements. The first one is a data frame containing the next fields (by columns):

ArcID	A number that identifies this arc.
ArcUserID	Identifier defined by the user.
FromNode	The node where the arc begins.
ToNode	The node where the arc finishes.
LeftPoly	The number of the polygon that is to the left of the arc.
RightPoly	The number of the polygon that is to the right of the arc.
NVertices	The number of vertices the arc has.

The second element is a list that stores the vertices of the arc. So, each element in this list is also a list of two arrays: the first for the X coordinates and the second for the Y coordinates.

**References**

More information about this kind of data can be found at [http://pages.infinet.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinet.net/danmo/e00/docs/v7_bin_cover.html).

---

get.bnndata                      *Function for importing the contents of a BND file into R*

---

**Description**

This function reads and imports into R the contents of a BND file. This kind of files store the bounds of the given coverage (the one we are working with). That is, the upper and lower bounds for the x and y coordinates.

**Usage**

```
get.bnndata(infodir, tablename)
```

**Arguments**

infodir	Directory where there is a file called arc.dat (usually, it is called 'info').
tablename	The name of the table in the coverage that stores the data (usually called 'COVERAGE.BND').

**Value**

A vector with the x min, y min, x max and y max values.

**References**

More information about this kind of data can be found at [http://pages.infinet.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinet.net/danmo/e00/docs/v7_bin_cover.html).

---

get.cntdata                      *Function for importing the contents of a CNT file into R*

---

**Description**

This function reads and imports into R the contents of a polygon centroid information file.

**Usage**

```
get.cntdata(datadir, coverage, filename="cnt.adf")
```

**Arguments**

datadir	Directory under which all the coverages and a directory called 'info' are.
coverage	The name of the coverage we want to work with.
filename	The name of the file in the coverage directory that stores the data (usually called 'cnt.adf').

**Value**

This functions returns a list with two elements. The first one is a data frame with the next fields (columns):

PolygonID	The polygon itself.
CoordX	An array with the X coordinates of the centroid.
CoordY	An array with the Y coordinates of the centroid.
NLabels	The number of labels this polygon has.

The second element in the list is an array with the label identifiers related to this polygon.

**References**

More information about this kind of data can be found at [http://pages.infinet.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinet.net/danmo/e00/docs/v7_bin_cover.html).

---

get.labdata                      *Function for importing the contents of a LAB file into R*

---

### Description

This function reads and imports into R the contents of a polygon labels definition file.

### Usage

```
get.labdata(datadir, coverage, filename="lab.adf")
```

### Arguments

datadir	Directory under which iall the coverages and a directory called 'info' are.
coverage	The name of the coverage we want to work with
filename	The name of the file in the coverage directory that stores the data. By default, called 'lab.adf'.

### Value

This function returns a data frame with the next fields (by columns):

LabelUserID	The label of the polygon.
PolygonID	The polygon related to the label.
Coord1X	The X component of the first coordinate.
Coord2X	The X component of the second coordinate.
Coord3X	The X component of the third coordinate.
Coord1Y	The Y component of the first coordinate.
Coord2Y	The Y component of the second coordinate.
Coord3Y	The Y component of the third coordinate.

### References

More information about this kind of data can be found at [http://pages.infinit.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinit.net/danmo/e00/docs/v7_bin_cover.html).

---

get.namesofcoverages

*Function for getting the names of the coverages*

---

### **Description**

This function returns the name of all the coverages under the given directory.

### **Usage**

```
get.namesofcoverages(directory)
```

### **Arguments**

`directory`     A character string with the name of the directory which contains the coverages.

### **Value**

A list of character strings with the names of the files and directories under the given one.

---

get.nb

*Function for calculating neighbouring polygons.*

---

### **Description**

This function allows the user to calculate, for every given polygon (in the array 'index'), the list of its neighbouring polygons.

### **Usage**

```
get.nb(arc,pal, index=NULL)
```

### **Arguments**

`arc`             The list of arc definitions, as returned by 'get.arcdata'.

`pal`             The list of polygon definitions, as returned by 'get.paldata'.

`index`           An array with the polygons we want to use to calculate their neighbours. It must be an array. If 'index' is not set, then all the polygons are used.

### **Value**

A list in which the first element is a vector of the neighbouring polygons of the first element in 'index', and so on.

---

`get.paldata`*Function for importing the contents of a PAL file into R*

---

### Description

This function reads and imports into R the contents of a polygon definitions file.

### Usage

```
get.paldata(datadir, coverage, filename="pal.adf")
```

### Arguments

<code>datadir</code>	Directory under which all the coverages and a directory called 'info' are.
<code>coverage</code>	The name of the coverage we want to work with
<code>filename</code>	The name of the file in the coverage directory that stores the data. By default, it is called 'pal.adf'

### Value

This function returns a list with two elements. The first one is a data frame with the next fields (columns):

<code>PolygonID</code>	A number that identifies this polygon.
<code>MinX</code>	Minimum value for all the X component of the coordinates.
<code>MinY</code>	Minimum value for all the Y component of the coordinates.
<code>MaxX</code>	Maximum value for all the X component of the coordinates.
<code>MaxY</code>	Maximum value for all the Y component of the coordinates.
<code>NArcs</code>	Maximum value for all the Y component of the coordinates.

The second element in the list is also a list in which each element is composed by three arrays with information about the polygons that are in the polygon boundary: 'Arc ID', 'From Node' and 'Adjacent Polygon'.

### References

More information about this kind of data can be found at [http://pages.infinit.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinit.net/danmo/e00/docs/v7_bin_cover.html).

---

get.tabledata      *Function for importing the contents of a table file into R*

---

**Description**

This function reads and imports into R the contents of a table file.

**Usage**

```
get.tabledata( infodir, tablename)
```

**Arguments**

infodir      Info directory where there is a file called arc.dat  
tablename    The name of the table from which we want to import the data

**Value**

This function returns a data frame in which each column stores the data of a field from the table. The columns are not assigned the names of the fields, but this can be got with the get.tablefields function.

**References**

More information about this kind of data can be found at [http://pages.infinet.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinet.net/danmo/e00/docs/v7_bin_cover.html).

---

get.tablefields      *Function for reading names of the table fields in the coverages*

---

**Description**

This function returns the names of the fields (and its type) in the table whose names are provided by the user.

**Usage**

```
get.tablefields( infodir, tablename)
```

**Arguments**

infodir      Info directory where there is a file called arc.dat  
tablename    The name of the table from which we want to get the fields

**Value**

This function returns a data frame with the next fields (columns):

FieldName	The name of the field.
FieldType	This is an integer from 1 to 6 that explain the kind of data: <ol style="list-style-type: none"> <li>1 Date</li> <li>2 Character String</li> <li>3 Integer (stored as a character string)</li> <li>4 Numeric (stored as a character string)</li> <li>5 Binary integer</li> <li>6 Binary float</li> </ol>

**References**

More information about this kind of data can be found at [http://pages.infn.it/~danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infn.it/~danmo/e00/docs/v7_bin_cover.html).

---

`get.tablenames`      *Function for reading the names of the tables in the coverages*

---

**Description**

This function reads the `arc.dat` file in the `info` directory and it returns a list with some data about the tables. Each element of this list is another list with data from a single table.

**Usage**

```
get.tablenames(info_dir)
```

**Arguments**

`info_dir`      info dir where there is a file called `arc.dat`

**Value**

A list with some information about the tables stored in all the coverages:

Table Name	info dir where there is a file called <code>arc.dat</code>
Info File	info dir where there is a file called <code>arc.dat</code>
Number of fields	info dir where there is a file called <code>arc.dat</code>
Record Size	info dir where there is a file called <code>arc.dat</code>
Number of records	info dir where there is a file called <code>arc.dat</code>
Internal/External Table (FALSE/TRUE)	info dir where there is a file called <code>arc.dat</code>

## References

More information about this kind of data can be found at [http://pages.infinit.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinit.net/danmo/e00/docs/v7_bin_cover.html).

---

get.toldata	<i>Function for importing the contents of a TOL file into R</i>
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---

## Description

This function reads and imports into R the contents of a tolerance definition file.

## Usage

```
get.toldata(datadir, coverage, filename="tol.adf")
```

## Arguments

datadir	Directory under which all the coverages and a directory called 'info' are.
coverage	The name of the coverage we want to work with
filename	The name of the file in the coverage directory that stores the data. By default it is called 'tol.adf'. In some cases, when the values are stored in double precision, the tolerances are in a file whose name is 'par.adf'.

## Value

This function returns a data frame with the next fields (columns):

Type	A number from 1 to 10 showing the tolerance type.
Status	This field indicates whether the tolerance is active or not.
Value	Tolerance value.

## References

More information about this kind of data can be found at [http://pages.infinit.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinit.net/danmo/e00/docs/v7_bin_cover.html).

---

`get.txtdata`*Function for importing the contents of an TXT file into R*

---

### Description

This function reads and imports into R the contents of a file of annotations (TXT).

### Usage

```
get.txtdata(datadir, coverage, filename="txt.adf")
```

### Arguments

<code>datadir</code>	Directory under which all the coverages and a directory called 'info' are.
<code>coverage</code>	The name of the coverage we want to work with.
<code>filename</code>	The name of the file in the coverage directory that stores the data. By default, it is called 'txt.dat'.

### Value

This function returns a list with two elements. The first one is a dataframe with the next columns:

<code>TxtID</code>	This field identifies the annotation.
<code>UserID</code>	Identifier defined by the user.
<code>Level</code>	I don't know what this exactly means. Please, help me to fix this.
<code>NVerticesLine</code>	Number of vertices pairs that are valid.
<code>NVerticesArrow</code>	I don't know what this exactly means. Please, help me to fix this.
<code>Text</code>	Some text related to the annotation.

The second element in the list is another list containing the vertices related the annotation. For each annotation there are two vectors, for the X and Y coordinates.

### References

More information about this kind of data can be found at [http://pages.infinit.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinit.net/danmo/e00/docs/v7_bin_cover.html).

---

plotarc

*Plots the data imported from an ARC file*


---

### Description

Taking as argument the list returned by the `get.arcdata` function, this function plots all the arcs. With the argument `new` the user can decide whether to plot on a new window/device or on the last window/device.

If the user provides the arguments `'xlim'` and `'ylim'` they will be used when calling the `'plot'` function. Other way, the real boundary of the plotted arcs will be used.

### Usage

```
plotarc(arc, new=TRUE, index=NULL, ...)
```

### Arguments

<code>arc</code>	The data returned by a call to <code>get.arcdata</code>
<code>new</code>	Do you want to plot on the last window/device or on a new one?
<code>index</code>	A vector containing the indexes of the arcs to be plotted. If it nos supplied all the arcs will be plotted.
<code>...</code>	Options to be passed to a call to the function <code>plot</code> when creating the display (i. e., window or file).

### Value

This function returns nothing, but plots a nice map :-D.

---

plotpal

*Plots the data imported from an ARC file according to the contents of a PAL file*


---

### Description

This function works like `plotarc`, but we can also decide what polygons to plot. The arc definitions are stored in the `arc` variable, and the polygon definitions are in the `pal` variable.

### Usage

```
plotpal(arc, pal, new=TRUE, index, ...)
```

**Arguments**

arc	The data returned by a call to get.arcdata
pal	The data returned by a call to get.paldata
new	Do you want to plot on the last window/device or on a new one?
index	The indices of the polygons to be plotted.
...	Options to be passed to a call to the function plot when creating the display (i. e., window or file).

**Value**

This function returns nothing, but plots a nice map :-D.

---

plotpoly                      *Plots polygons defined by the coverages.*

---

**Description**

This function is capable of plotting polygons, referenced by its id number. These can be filled with colors according to a given variate.

**Usage**

```
plotpoly(arc,bnd,pal,index=NULL,col, border=NULL,xratio=1, yratio=1,...)
```

**Arguments**

arc	The data returned by a call to get.arcdata
bnd	The data returned by a call to get.bnndata
pal	The data returned by a call to get.paldata
index	IDs of the polygon to be plotted. If it is 'NULL' then all the polygons are plotted.
col	Colors to be used when filling the polygons
border	Colors used for the lines of the polygons. If it's not set, it is set to the value of 'col'.
xratio	Controls x-axis ratio. It can take any value from 0 to 1.
yratio	Controls y-axis ratio. It can take any value from 0 to 1.
...	Options to be passed to a call to the function plot when creating the display (i. e., window or file).

**Value**

This function returns nothing, but plots a nice map. :-D

**Examples**

```

#This example is the same as the one provided under the test directory

#1.- Create temporary directory (if needed)
#1.- Extract the E00 file form a ZIP file
#2.- Create an Arc/Info binary coverage
#3.- Create the map

#get current working directory
cwd<-getwd()
#Create tmp directory.
tmpdir<-tempdir()

datadir<-system.file("exampleData",package="RArcInfo")
setwd(datadir)
file.copy(c("valencia.zip", "data_valencia.csv"), tmpdir, overwrite = TRUE)

setwd(tmpdir)

#Convert E00 file to a binary covertage to be imported into R

#Comment this line if the file valencia.e00 already exists
zip.file.extract(file="valencia.e00", zipname="valencia.zip")

#Comments this lines if the binary coverage already exists
library(RArcInfo)
e00toavc("valencia.e00", "valencia")

library(RColorBrewer)
library(RArcInfo)

#Read map data
arcsmuni<-get.arcdata(".", "valencia")
palmuni<-get.paldata(".", "valencia")
bnd.muni<-get.bnndata("info/", "VALENCIA.BND")
patmuni<-get.tabledata("./info", "VALENCIA.PAT")

#Number of polygons
nmuni<-length(palmuni[[1]][[1]])

municipios<-data.frame(1:nmuni, patmuni$"VALENCIA-ID")
names(municipios)<-c("INDEX", "CODMUNICI")

#Datafiles to be used

unemp<-read.table(file="data_valencia.csv", sep=";",
  dec = ", ", skip=1)

unemp<-unemp[,c(1,3)]
names(unemp)<-c("CODMUNICI", "UNEMP")

breaks<-quantile(unemp[,2], c(0, .025, .2, .8, .975, 1))

```

```

unemp<-cbind(unemp, CAT=as.ordered(cut(unemp[,2], breaks, include.lowest = TRUE) ))

#Colors to be used in maps
#colors<-brewer.pal(5, "Oranges")
colors<-brewer.pal(5, "Greens")

ldata<-merge(unemp, municipios, by.x="CODMUNICI", by.y="CODMUNICI")

#Valencia
idx<-(ldata$"CODMUNICI">=46000)
bnd.muni<-c(626679.9, 4250000, 760000, 4460000)

p<-par()
pin<-1.5*p$pin
main<-"Rate of unemployment"

plotpoly(arc=arcsmuni, pal=palmuni, bnd=bnd.muni,
         index=ldata$INDEX[idx], col=colors[ldata$CAT][idx],
         xlab="", ylab="", main=main,
         xaxt="n", yaxt="n", bty="n")

#Set legend
l<-levels(unemp$CAT)
l[1]<-"[0.00,1.26]"
legend(700000, 4460000, fill=colors,
       legend=l, bty="n", cex=1)

setwd(cwd)

```

---

RArcInfo

*RArcInfo*


---

## Description

This package allows the user to import into R binary coverages in format Arc/Info V 7.x. These coverages represent geographical data in several forms: points, lines, polygons, point labels, etc.

RArcInfo uses the library AVCE00, written by Daniel Morissette, to whom I would thank for his marvelous work. But RArcInfo is much more than a wrapper of this library, because it provides functions to plot the data and draw maps.

Since the geographical data are separated into several files, RArcInfo provides a different function to read each file. These functions are called `get.XXXdata`, where XXX is the file name to open (usually the extension is 'adf'):

`get.arcdata`

ARC files contain arcs definition and their vertices.

`get.bnndata`

BND files contain coordinates for the boundary of the data.

get.cntdata

CNT files contain polygon centroid information.

get.labdata

LAB files contain label point records.

get.paldata

PAL files contain the polygon definitions.

get.toldata

TOL files contain the tolerance values that were used when processing the polygon coverage.

get.txtdata

TXT files contain annotations (or labels) about the data.

Besides these files, binary coverage store several tables containing additional information (like name of the city, population, etc.). To get this data, RArcInfo provides the next functions:

get.tablenames

Gets all the table names and the coverage each table belongs to.

get.tablefields

Gets the names of the fields for a given table.

get.tabledata

Gets the data stored in the table.

In order to plot the data, RArcInfo has several functions:

plotarc

Plots all the arcs.

plotpal

Plots all the polygons.

plotpoly

Like plotpal, but it allows to select the polygons we want to plot, colour and other stuff. This is useful to plot maps according the value of some covariate.

To get all the names of the coverages, the user can call 'get.namesofcoverages'.

Other two interesting functions are:

thinlines

Useful to reduce the number of points in an arc according to a given tolerance.

get.nb

Calculates the neighbouring polygons of a given set of polygons.

## References

V. Gómez-Rubio and A. López-Quílez (2005). RArcInfo: Using GIS data with R. *Computers & Geosciences* 3(8), 1000-1006.

More information about this kind of data can be found at [http://pages.infinit.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinit.net/danmo/e00/docs/v7_bin_cover.html).

## See Also

`get.arcdata`, `get.bnndata`, `get.cntdata`, `get.labdata`, `get.paldata`, `get.toldata`, `get.txtdata`, `get.tablenames`, `get.tablefields`, `get.tabledata`, `get.namesofcoverages`, `read.coverage`, `thinlines`, `get.nb`

## Examples

```
#See example(plotpoly) for another example

library(RArcInfo)

datadir<-system.file("exampleData",package="RArcInfo")
infodir<-system.file("exampleData","info",package="RArcInfo")
coveragedir<-system.file("exampleData","wetlands",package="RArcInfo")

#get.bnndata needs the last slash...
infodir<-paste(c(infodir,"/"), collapse="")

#List all the tables

covnames<-get.namesofcoverages(datadir)
tablenames<-get.tablenames(infodir)

#Display the name of the table and its fields
for(i in 1:length(tablenames[[1]]))
{
  print(c("Table: ",tablenames$TableName[i]))

  fields<-get.tablefields(infodir,tablenames$TableName[i])
  print("Fields")
  for(j in 1:length(fields))
    print(fields[[j]][1])

  #Get the data
  if(i==1)
    tabledata<-get.tabledata(infodir,tablenames$TableName[i])
  else
    tabledata<-c(tabledata, get.tabledata(infodir,tablenames$TableName[i]) )
}

#Import data from some tables
arc<-get.arcdata(datadir,"wetlands")
pal<-get.paldata(datadir,"wetlands")
lab<-get.labdata(datadir,"wetlands")
```

```

cnt<-get.cntdata(datadir,"wetlands")

bnd<-get.bnndata(infodir,"WETLANDS.BND")

print("Plotting all the arcs")
plotarc(arc)

print("Plotting the first ten polygons (in red) on the previous plot")
par(col="red")
plotpal(arc,pal,new=FALSE, index=1:10)

```

---

read.coverage      *Function for retrieving basic data from a given coverage*

---

### Description

This function allows the user to retrieve the main data stored in the chosen coverage. This doesn't mean that all the data are retrieved, but only the most important.

Tables are not imported, but a dataframe containing the information provided by a call to `get.tablenames` of all the tables related to the coverage.

For a single coverage there can be more than one pal file, so just their names are imported (into 'palfiles'). Then, the user can choose which one to import by calling `get.paldata`. But, if there is just one pal file, it is imported into 'pal'.

The names of the different files are supposed to be the default names when calling the proper `get.XXXdata`. If some of these names change then the function will not import that feature properly. But this fact should never happen.

### Usage

```
read.coverage(datadir, coverage)
```

### Arguments

datadir	Directory under which all the coverages and a directory called 'info' are.
coverage	The name of the coverage we want to work with

### Value

This function returns a list of all the data directory, coverage name and all the data imported: i

datadir	The directory where all the coverages are stored, the one used when this function was called.
coverage	The name of the coverage used when calling this function.
arc	The arc definitions, as returned by <code>get.arcdata</code> .
bnd	The bounday definition, as returned by <code>get.bnndata</code> .
cnt	The polygon centroids, as returned by <code>get.cntdata</code> .

lab	The label point records of the coverage.
pal	If there is just one file for the polygon definitions inside the coverage, it is imported here using get.paldata. Otherwise, it is filled with a 'NULL'.
palfiles	The names of all the polygon definitions files.
tblnames	The description of all the tables related to the coverage, as returned by get.tblnames.
tol	The tolerance values.

## References

More information about this kind of data can be found at [http://pages.infinit.net/danmo/e00/docs/v7\\_bin\\_cover.html](http://pages.infinit.net/danmo/e00/docs/v7_bin_cover.html).

---

thinlines	<i>Function for deleting points in an arc definition object</i>
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## Description

Usually the plotting device resolution allows us to plot only a few points per arc with no difference.

## Usage

```
thinlines(arc, tol)
```

## Arguments

arc	The original arc definition object, as returned by get.arcdata.
tol	The threshold we used to define which polygons are 'too close'.

## Value

A new arc definition object, usually with less points per arc than the original. Notice that no modification is made to the topology but the number of vertices is updated in the table related to the arc definition.

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