

# Package ‘shapefiles’

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**Title** Read and Write ESRI Shapefiles

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**Depends** R (>= 1.6.0), foreign

**Description** Functions to read and write ESRI shapefiles.

**License** GPL

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## Description

This package includes functions to read and write ESRI shapefiles.

## Usage

```
read.shapefile(shape.name)
read.shp(shp.name)
read.shx(shx.name)
read.dbf(dbf.name, header=FALSE)
write.shapefile(shapefile, out.name, arcgis=FALSE)
```

```

write.shp(shp, out.name)
write.shx(shx, out.name)
write.dbf(dbf, out.name, arcgis=FALSE)
calc.header(shapefile)
add.xy(shapefile)
scaleXY(shapefile, scale.factor)
convert.to.shapefile(shpTable, attTable, field, type)
convert.to.simple(shp)
change.id(shpTable, newFieldAsVector)
dp(points, tolerance)

```

### Arguments

shape.name	String of the shapefile file name without an extension
shp.name	String of the shp file name with an extension
shx.name	String of the shx file name with an extension
dbf.name	String of the dbf file name with an extension
shapefile	The shapefile object of lists created by read.shapefile
out.name	Filename to write the data to
shp	shp portion (list) of the shapefile object of lists
shx	shx portion (list) of the shapefile object of lists
dbf	dbf portion (list) of the shapefile object of lists
scale.factor	Number to divide the shapefile geography by
arcgis	Replace "." with "_" in column names for ArcGIS
shpTable	data.frame with columns in order Id, X, and Y
attTable	data.frame with first column names "Id" - polygon id (key)
type	ESRI Shape type 1=point, 3=polyLine, 5=polygon
field	A field name in the attTable
newFieldAsVector	A vector of Ids to replace to the Ids in the shpTable
points	A named list of two vectors (x and y) representing points
tolerance	A tolerance setting for the DP polyLine simplification algorithm
header	Should read.dbf return the header?

### Details

ESRI shapefiles consist of three files. The first file (\*.shp) contains the geography of each shape. The second file (\*.shx) is an index file which contains record offsets. The third file (\*.dbf) contains feature attributes with one record per feature.

read.shapefile calls read.shp, read.shx, and read.dbf to read in an entire shapefile. The result of read.shapefile is a list of many more lists. The sublists are shp, shx, and dbf. Each sublist contains a header list and some sort of data list. The shp list is a list of \$shp\$header

and `$shp$shp`. The `shx` list is a list of `$shx$header` and `$shx$index`. The `dbf` list is a list of `$dbf$header` and `$dbf$dbf`.

The write functions write out a `shp`, `shx`, and `dbf` file from the shapefile list structure. To write out a shapefile from simple R data, you need to run `convert.to.shapefile`. The inputs to this function are a simple data frame of points (for points, `polyLines`, or polygons) and a data frame representing the `dbf` file. Examples are below.

The package reads shape types 1 (point), 3 (`polyLine`), 5 (polygon), 13 (`polyLineZ`), and 15 (`polygonZ`). Reading of shape type 13 and 15 from Don MacQueen, <macq@llnl.gov>

The package writes shape types 1 (point), 3 (`polyLine`), 5 (polygon), 13 (`polyLineZ`), and 15 (`polygonZ`). Conversion of simple polygons to shapefile format from Manuel Chirouze, <Manuel.Chirouze@benfieldgroup.com>

For simple features, the only difference between `polyLines` and polygons is that the first and last point is the same for a polygon. The `convert.to.simple` function can be used to simplify the `shp` file to a simple `data.frame`. The `change.id` function can then be used to change the `Id` field for the simple `shp data.frame` to a field from a `data.frame` (`dbf`).

For details about the ESRI shapefile structure refer to <https://www.esri.com/content/dam/esrisites/sitecore-archive/Files/Pdfs/library/whitepapers/pdfs/shapefile.pdf>. A detailed description of `DBF` files can be found at <https://www.e-bachmann.dk/docs/xbase.htm>. The `arcgis` argument to `write.dbf` replaces "." with "\_" in field names since ArcGIS does not allow the former. Note that the `read.dbf` and `write.dbf` functions in the `foreign` package are now used for reading and writing `dbfs`, which greatly improves the speed of reading/writing `dbfs`.

Function `dp` is an implementation of the Douglas-Peucker `polyLine` simplification algorithm. Douglas, D. and Peucker, T. (1973). "Algorithms for the reduction of the number of points required to represent a digitized line or its caricature." *The Canadian Cartographer* 10(2). 112-122. `dp` currently uses the line, not the line segment to determine the distance of the points from the line. This can result in the omission of extreme "outlier-like" points. See [doi:10.3138/FM576770U75U7727](https://doi.org/10.3138/FM576770U75U7727) for more information.

## Value

<code>read.shapefile</code>	list	shapefile list object
<code>read.shp</code>	list	shp list object
<code>read.shx</code>	list	shx list object
<code>read.dbf</code>	list	DBF list object
<code>write.shapefile</code>	NA	Nothing returned
<code>write.shp</code>	NA	Nothing returned
<code>write.shx</code>	NA	Nothing returned
<code>write.dbf</code>	NA	Nothing returned
<code>calc.header</code>	list	shapefile list object
<code>add.xy</code>	list	shapefile list object
<code>scaleXY</code>	list	shapefile list object
<code>convert.to.shapefile</code>	list	shapefile list object
<code>convert.to.simple</code>	list	data.frame list data.frame

```
change.id      list  data.frame list data.frame
dp             list  data.frame list data.frame
```

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### Examples

```
## Not run:
#Read entire shapefile
shapefile <- read.shapefile("links")

#Write entire shapefile
write.shapefile(shapefile, "temp", T)

#Read shp, shx, or dbf file
dbf <- read.dbf("links.dbf")

#Write shp, shx, or dbf file
write.dbf(dbf, "links.dbf", T)

#Calculate header (to clean up GeoMedia shapefile exports)
shapefile <- calc.header(shapefile)

#Add the X and Y coordinates to the dbf list of the shapefile list object
shapefile <- add.xy(shapefile)

#Scale the shapefile by scale.factor
shapefile <- scaleXY(shapefile, scale.factor)

#Samples of using the convert.to.shapefile function to write out simple shapefiles
#from basic R data.frames

#Point
dd <- data.frame(Id=c(1,2),X=c(3,5),Y=c(9,6))
ddTable <- data.frame(Id=c(1,2),Name=c("Item1","Item2"))
ddShapefile <- convert.to.shapefile(dd, ddTable, "Id", 1)
write.shapefile(ddShapefile, "c:/test", arcgis=T)

#PolyLine
dd <- data.frame(Id=c(1,1,1,2,2,2),X=c(3,5,8,6,7,8),Y=c(9,8,3,6,7,4))
ddTable <- data.frame(Id=c(1,2),Name=c("Item1","Item2"))
ddShapefile <- convert.to.shapefile(dd, ddTable, "Id", 3)
write.shapefile(ddShapefile, "c:/test", arcgis=T)

#Polygon
dd <- data.frame(Id=c(1,1,1,1,2,2,2,2),X=c(3,5,8,3,6,7,8,6),Y=c(9,8,3,9,6,7,4,6))
```

```
ddTable <- data.frame(Id=c(1,2),Name=c("Item1","Item2"))
ddShapefile <- convert.to.shapefile(dd, ddTable, "Id", 5)
write.shapefile(ddShapefile, "c:/test", arcgis=T)

#Convert to list of shapes
ddAsList <- by(dd,dd$Id, function(x) x)

#Convert to data.frame
dd <- do.call(rbind, ddAsList)

#Read in shp file and convert to simple format
shpTest <- read.shp("c:/test.shp")
simpleShpFormat <- convert.to.simple(shpTest)
simpleShpFormat <- change.id(simpleShpFormat, c("a","b"))
simpleAsList <- by(simpleShpFormat, simpleShpFormat[,1], function(x) x)
backToShape <- convert.to.shapefile(simpleShpFormat,
data.frame(index=c("a","b")), "index", 5)
write.shapefile(backToShape, "c:/test", arcgis=T)

#Polyline simplification with dp algorithm
x <- c(5,3,4,1,8,9,10,11)
y <- c(6,4,2,1,1,5,2,3)
points <- list(x=x,y=y)
plot(points, type="l")
simpleLine <- dp(points, 2)
lines(simpleLine, type="l", col="blue")

## End(Not run)
```

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