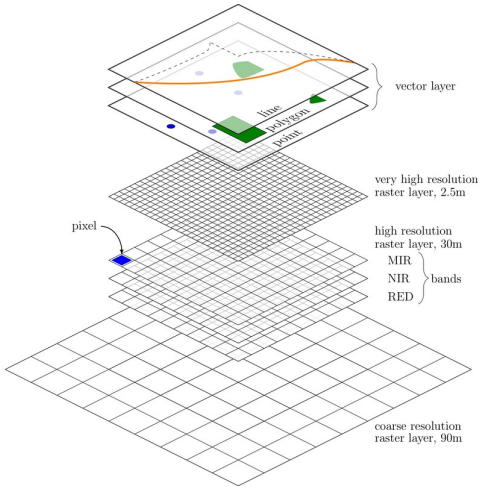
Spatial R Cheat Sheet

Remote Sensing and GIS functions



book.ecosens.org
last updated: 22nd February, 2016

Packages

A selection of packages that are used in the book is listed here, further relevant packages are available within R:

`RStoolbox`	various RS functions
`raster`	for raster data manipulation
`rgdal`	data import/export, projections
`sp`	vector data manipulation
`rgeos`	geometry commands
`wrspathrow`	Landsat WRS-2 information
`gfcanalysis`	Forest Cover Change product
`modis`	download and analyse MODIS
`bfast`	analyse time-series data
`rasterVis`	visualisation of time-series data
`glcm`	calculation of spatial metrics
`dismo`	species distribution modelling
`randomForest`	random forest modelling
`mgcv`	gam modelling
`move`	access and analyse movement data
`adehabitatHR`	home range analysis

further relevant packages:

`ggplot2`	for more fancy plots
`reshape2`	flexibly reshape data

More spatial R packages are listed here:
cran.r-project.org/web/views/Spatial.html

Relevant commands are listed below, actual syntax needs to be checked within the manual pages of each command.

Raster

Raster data manipulation is similar to a spreadsheet or matrix manipulation but with coordinates and projections, hence various also not explictly spatial commands can be applied. Here we mainly list commands designed for spatial data handling.

Import and export

raster()	import (or generate) one raster layer
brick()	import raster with multiple layers
writeRaster()	export raster data to file
writeFormats()	list of supported raster file types
getData()	retrieves DEM and climate data directly from the web

Information

click()	interactively query raster plot
hist()	histogram of raster values per layer
cellStats()	summary statistics of single layers
summary()	overall summary statistics
extent()	extent of raster data set
ncell()	number of cells (of one layer)
nlayers()	number of bands
names()	prints or sets layer names
str()	print the data structure
NAvalue()	get or set background values

Visualisation

ggR(), ggRGB()	ggplot2 plotting commands implemented in RStoolbox
plot(), plotRGB()	raster plot and RGB plot. Usefull arguments: y=bandnumber, add=TRUE (overlay multiple plots)
image(), spplot()	alternative plotting commands

RasterVis package

levelplot()	fancy way to plot raster data information
densityplot()	raster value density plot
bwplot()	violin plot of raster data values
hovmoller()	spatio-temporal plotting options

Projections

projection()	query or set projection (does NOT reproject)
projectRaster()	reprojects raster to new coordinate system

Data manipulation

Most raster commands will output a file to a chosen location, if filename= is specified. Otherwise it will use temp files.

stack()	stack different raster layers together
addLayer(); dropLayer()	add/drop a raster layer
crop()	crop raster set to smaller extent
drawExtent()	draw extent on a plot for e.g. inclusion in crop(raster,extent)
drawPolygon()	create SpatialPolygon by drawing on a plot
mask()	masking of background values
merge()	combine raster tiles to a raster with larger extent (ignores NAs)
mosaic()	combine raster tiles and apply function to overlapping pixels, e.g. mean
extract()	extract values from Raster objects, using vector data
buffer()	buffer around cells that are not NA
corLocal()	local correlation based on moving window
compareRaster()	check if 2 raster have same extent, projection, resolution etc.
cover()	replace NA values with values of other layers

Basic Operations

raster*2/raster2	any basic algebra operation
calc()	more efficient raster algebra, applies a function to raster data
overlay()	apply a function which uses specific bands, e.g. to calculate NDVI
focal()	moving window operations
distance()	calculate distance to closest feature, e.g. distance to water
terrain()	calculate terrain attributes from DEM, e.g. slope
zonal()	zonal statistics, for classified raster
reclassify()	reclassify raster values
subs()	substitutes values
cut()	relcassify values using ranges
stackApply()	computations on layer stack
resample()	resampling of raster to raster
aggregate()	aggregation of cells to coarser resolution
disaggregate()	disaggregation of cells to finer resolution
rasterToPoints()	converts a raster to vector points
rasterToPolygons()	converts a raster to polygons
rasterToContour()	converts raster values to contour
[[ ]]	address specific raster layer, e.g. myRaster[[1]] for first layer
x <- raster > 50	boolean operation, binary output
raster[raster <= 50] <- 0	replace all values < 50 with 0

Remote Sensing Operations

Image Analysis

superClass()	supervised classification
unsuperClass()	unsupervised classification
getValidation()	extract validation from superClass object
validateMap()	validation of existing classification
rasterEntropy()	class diversity across different classifications
spectralIndices()	computation of spectral indices
rasterCVA()	change vector analysis for change detection
rasterPCA()	principal component analysis
tasseledCap()	tasseled cap transformation
fCover()	analysis of fractional cover
	cloud masking

Preprocessing

cloudMask()	
cloudShadowMask()	cloud shadow masking
topCor()	topographic correction
panSharpen()	pan sharpening
histMatch()	image to image contrast matching
decodeQA()	quality flags to bit-words

Vector

Vector data often come in shp format including a variety of auxiliary files. All of them are relevant and are needed for further analysis. Note that readShapePoly() etc. from package maptools do NOT automatically read projection information from shapefiles. It is reccomended to use readOGR() instead.

Import and Export

readOGR()	import vector file
writeOGR()	export vector file
ogrDrivers()	list supported file formats

Information

plot()	vector plot. add=TRUE overlays multiple plots, e.g. combine with raster data
summary()	metadata and data summary
extent()	extent/bounding box of vector data
coordinates()	sets spatial coordinates to create spatial data, or retrieves spatial coordinates

Projections

projection()	query or set projection (does NOT reproject)
spTransform()	reproject vector data to new coordinate system

Data Manipulation

Check out the functions in the rgeos package, which provides most of the classical vector GIS operations such as buffers etc.

subset()	subset spatial data, based on a condition, e.g. keep only certain points
merge()	Merge a Spatial object having a data.frame (i.e. merging of non-spatial attributes)
over()	spatial overlay for points, grids and polygons
rasterize()	Rasterize points, lines, or polygons
distanceFromPoints()	computes the distance to points, output is a raster
extract()	extracts raster values behind points, lines or polygons
gIntersection()	intersection of vector data sets
gBuffer()	Buffer Geometry

Spatial Modeling

kfold()	partitioning of data set for training/validation purpose
evaluate()	cross-validation of models with presence/absence data
randomForest()	fits a randomForest model
maxent()	executes Maxent from R
gam()	fits a GAM
svm()	support vector machine
predict()	predicts statistical model into space (raster)
move()	import of movement data sets from movebank.org
angle()	extracts turning angles from a move object
speed()	extracts speed from a move object
distance()	extracts distance between locations from a move object
move::spTransform()	changes the projection of a move object to a default of Azimuthal Equi-distance
mcp()	calculates minimum convex polygons for SpPdf
kernelUD()	calculates a kernel density surface for SpPdf

Miscellaneous

Some useful commands which are related to spatial data analysis.

gmap()	get google maps for your plot
geocode()	geocoding in R
complete.cases()	returns only cases with no missing values
gridSample()	sample point from a grid e.g. just one point per pixel
function(...){..}	generates a defined functions
return(...)	returns the output of a function
if (...) {...} else{...}	if else statement
for (...) {...}	for loop
while (...) { ...}	while statement

Further Packages

`rNOMADS`	data retrievel from NOAA, global/regional weather models
`MODISTools`	download and process MODIS data
`modis`	download and process MODIS data
`bfastspatial`	spatial temporal breakpoint detection

further spatial R packages:
https://cran.r-project.org/web/views/Spatial.html

---

compiled by:

Martin Wegmann (martin.wegmann@ecosens.org) and
Benjamin Leutner (benjamin.leutner@ecosens.org)
University of Wuerzburg, Dept. of Remote Sensing
2016

Compiled for the book “Remote and GIS for Ecologists - Using Open Source Software” book.ecosens.org