**CRAN Task View: Analysis of Spatial Data**

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Base R includes many functions that can be used for reading, visualising, and analysing spatial data. The focus in this view is on "geographical" spatial data, where observations can be identified with geographical locations, and where additional information about these locations may be retrieved if the location is recorded with care. Base R functions are complemented by contributed packages, some of which are on CRAN, and others are still in development. One active location is [R-Forge](http://r-forge.r-project.org/), which lists "Spatial Data and Statistics" projects in its [project tree](http://r-forge.r-project.org/softwaremap/trove_list.php). Information on R-spatial packages, especially [sp](http://cran.r-project.org/web/packages/sp/index.html) will be posted on the R-Forge rspatial project [website](http://rspatial.r-forge.r-project.org/), including a visualisation gallery.

The contributed packages address two broad areas: moving spatial data into and out of R, and analysing spatial data in R.

The [R-SIG-Geo](https://stat.ethz.ch/mailman/listinfo/R-SIG-Geo/)mailing-list is a good place to begin for obtaining help and discussing questions about both accessing data, and analysing it. The mailing list is a good place to search for information about relevant courses, and a list is hosted at the [GeoDaCenter](http://geodacenter.asu.edu/projects/rsp).

The packages in this view can be roughly structured into the following topics. If you think that some package is missing from the list, please let me know. Please also visit and contribute to the [spatial data handling](http://rwiki.sciviews.org/doku.php?id=tips:spatial-data)and [spatial statistics](http://rwiki.sciviews.org/doku.php?id=tips:stats-spatial)pages on the R Wiki.

* **Classes for spatial data**: Because many of the packages importing and using spatial data have had to include objects of storing data and functions for visualising it, an initiative is in progress to construct shared classes and plotting functions for spatial data. The [sp](http://cran.r-project.org/web/packages/sp/index.html) package is discussed in a note in [R News](http://cran.r-project.org/doc/Rnews/Rnews_2005-2.pdf). Many other packages have become dependent on these classes, including[rgdal](http://cran.r-project.org/web/packages/rgdal/index.html) and [maptools](http://cran.r-project.org/web/packages/maptools/index.html). Functions provided by [vec2dtransf](http://cran.r-project.org/web/packages/vec2dtransf/index.html) for applying affine and similarity transformations on vector spatial data (sp objects). The [rgeos](http://cran.r-project.org/web/packages/rgeos/index.html) package provides an interface to topology functions for [sp](http://cran.r-project.org/web/packages/sp/index.html) objects using [GEOS](http://trac.osgeo.org/geos/). [rgeos](http://cran.r-project.org/web/packages/rgeos/index.html) is now available for Mac OSX on CRAN. The [raster](http://cran.r-project.org/web/packages/raster/index.html) package is a major extension of spatial data classes to virtualise access to large rasters, permitting large objects to be analysed, and extending the analytical tools available for both raster and vector data. Used with [rasterVis](http://cran.r-project.org/web/packages/rasterVis/index.html), it can also provide enhanced visualisation and interaction. The [spatial.tools](http://cran.r-project.org/web/packages/spatial.tools/index.html) package contains spatial functions meant to enhance the core functionality of the [raster](http://cran.r-project.org/web/packages/raster/index.html) package, including a parallel processing engine for use with rasters. The[micromap](http://cran.r-project.org/web/packages/micromap/index.html) package provides linked micromaps using ggplot2. The [spacetime](http://cran.r-project.org/web/packages/spacetime/index.html) package extends the shared classes defined in [sp](http://cran.r-project.org/web/packages/sp/index.html) for spatio-temporal data (see [Spatio-Temporal Data in R](http://www.jstatsoft.org/v51/i07)). The[Grid2Polygons](http://cran.r-project.org/web/packages/Grid2Polygons/index.html) converts a spatial object from class SpatialGridDataFrame to SpatialPolygonsDataFrame.

An alternative approach to some of these issues is implemented in the [PBSmapping](http://cran.r-project.org/web/packages/PBSmapping/index.html) package; [PBSmodelling](http://cran.r-project.org/web/packages/PBSmodelling/index.html) provides modelling support. In addition, [GEOmap](http://cran.r-project.org/web/packages/GEOmap/index.html) provides mapping facilities directed to meet the needs of geologists, and uses the [geomapdata](http://cran.r-project.org/web/packages/geomapdata/index.html) package.

* **Handling spatial data**: A number of packages have been written using sp classes. The [raster](http://cran.r-project.org/web/packages/raster/index.html) package introduces many GIS methods that now permit much to be done with spatial data without having to use GIS in addition to R. It may be complemented by [gdistance](http://cran.r-project.org/web/packages/gdistance/index.html), which provided calculation of distances and routes on geographic grids. [geosphere](http://cran.r-project.org/web/packages/geosphere/index.html) permits computations of distance and area to be carried out on spatial data in geographical coordinates. The [spsurvey](http://cran.r-project.org/web/packages/spsurvey/index.html) package provides a range of sampling functions. The [trip](http://cran.r-project.org/web/packages/trip/index.html) package extends sp classes to permit the accessing and manipulating of spatial data for animal tracking. The [hdeco](http://cran.r-project.org/web/packages/hdeco/index.html) package provides hierarchical decomposition of entropy for categorical map comparisons. The [GeoXp](http://cran.r-project.org/web/packages/GeoXp/index.html) package permits interactive graphical exploratory spatial data analysis. [spcosa](http://cran.r-project.org/web/packages/spcosa/index.html) provides spatial coverage sampling and random sampling from compact geographical strata.

The UScensus2000 suite of packages ([UScensus2000blkgrp](http://cran.r-project.org/web/packages/UScensus2000blkgrp/index.html), [UScensus2000cdp](http://cran.r-project.org/web/packages/UScensus2000cdp/index.html), [UScensus2000tract](http://cran.r-project.org/web/packages/UScensus2000tract/index.html)) makes the use of data from the 2000 US Census more convenient. An important data set, Guerry's "Moral Statistics of France", has been made available in the [Guerry](http://cran.r-project.org/web/packages/Guerry/index.html) package, which provides data and maps and examples designed to contribute to the integration of multivariate and spatial analysis. Modern country boundaries are provided at 2 resolutions by [rworldmap](http://cran.r-project.org/web/packages/rworldmap/index.html) along with functions to join and map tabular data referenced by country names or codes. Chloropleth and bubble maps are supported and general functions to work on user supplied maps (see [A New R package for Mapping Global Data](http://journal.r-project.org/archive/2011-1/RJournal_2011-1_South.pdf). Higher resolution country borders are available from the linked package [rworldxtra](http://cran.r-project.org/web/packages/rworldxtra/index.html). Historical country boundaries (1946-2012) can be obtained from the [cshapes](http://cran.r-project.org/web/packages/cshapes/index.html) package along with functions for calculating distance matrices (see[Mapping and Measuring Country Shapes](http://journal.r-project.org/archive/2010-1/RJournal_2010-1_Weidmann+Skrede~Gleditsch.pdf)).

The [landsat](http://cran.r-project.org/web/packages/landsat/index.html) package with accompanying [JSS paper](http://www.jstatsoft.org/v43/i04)provides tools for exploring and developing correction tools for remote sensing data. [taRifx](http://cran.r-project.org/web/packages/taRifx/index.html) is a collection of utility and convenience functions, and some interesting spatial functions.

* **Reading and writing spatial data -**[**rgdal**](http://cran.r-project.org/web/packages/rgdal/index.html): Maps may be vector-based or raster-based. The [rgdal](http://cran.r-project.org/web/packages/rgdal/index.html) package provides bindings to [GDAL](http://www.gdal.org/)-supported raster formats and [OGR](http://www.gdal.org/ogr/)-supported vector formats. It contains functions to write raster files in supported formats. The package also provides [PROJ.4](http://trac.osgeo.org/proj/)projection support for vector objects ( [this site](http://spatialreference.org/)provides searchable online PROJ.4 representations of projections). The Windows and Mac OSX CRAN binaries of [rgdal](http://cran.r-project.org/web/packages/rgdal/index.html) include subsets of possible data source drivers; if others are needed, use other conversion utilities, or install from source against a version of GDAL with the required drivers.
* **Reading and writing spatial data - other packages**: There are a number of other packages for accessing vector data on CRAN: [maps](http://cran.r-project.org/web/packages/maps/index.html) (with [mapdata](http://cran.r-project.org/web/packages/mapdata/index.html) and [mapproj](http://cran.r-project.org/web/packages/mapproj/index.html)) provides access to the same kinds of geographical databases as S - [RArcInfo](http://cran.r-project.org/web/packages/RArcInfo/index.html) allows ArcInfo v.7 binary files and \*.e00 files to be read, and [maptools](http://cran.r-project.org/web/packages/maptools/index.html) and [shapefiles](http://cran.r-project.org/web/packages/shapefiles/index.html) read and write ArcGIS/ArcView shapefiles; for NetCDF files, [ncdf](http://cran.r-project.org/web/packages/ncdf/index.html) may be used. The [maptools](http://cran.r-project.org/web/packages/maptools/index.html) package also provides helper functions for writing map polygon files to be read by WinBUGS, Mondrian, and the tmap command in Stata. It also provides interface functions between [PBSmapping](http://cran.r-project.org/web/packages/PBSmapping/index.html) and [spatstat](http://cran.r-project.org/web/packages/spatstat/index.html) and sp classes, in addition to [maps](http://cran.r-project.org/web/packages/maps/index.html) databases and sp classes. There is also an interface to GSHHS shoreline databases. For visualisation, the colour palettes provided in the [RColorBrewer](http://cran.r-project.org/web/packages/RColorBrewer/index.html) package are very useful, and may be modified or extended using the colorRampPalette function provided with R. The[classInt](http://cran.r-project.org/web/packages/classInt/index.html) package provides functions for choosing class intervals for thematic cartography. The [gmt](http://cran.r-project.org/web/packages/gmt/index.html) package gives a simple interface between GMT map-making software and R. [geonames](http://cran.r-project.org/web/packages/geonames/index.html) is an interface to the [www.geonames.org](http://cran.r-project.org/web/views/www.geonames.org)service. If the user wishes to place a map backdrop behind other displays, the the [RgoogleMaps](http://cran.r-project.org/web/packages/RgoogleMaps/index.html) package for accessing Google Maps(TM) may be useful.[ggmap](http://cran.r-project.org/web/packages/ggmap/index.html) may be used for spatial visualisation with Google Maps and OpenStreetMap. The [plotGoogleMaps](http://cran.r-project.org/web/packages/plotGoogleMaps/index.html) package provides methods for the visualisation of spatial and spatio-temporal objects in Google Maps in a web browser. [plotKML](http://cran.r-project.org/web/packages/plotKML/index.html) is a package providing methods for the visualisation of spatial and spatio-temporal objects in Google Earth. [OpenStreetMap](http://cran.r-project.org/web/packages/OpenStreetMap/index.html) gives access to open street map raster images, and [osmar](http://cran.r-project.org/web/packages/osmar/index.html) provides infrastructure to access OpenStreetMap data from different sources, to work with the data in common R manner, and to convert data into available infrastructure provided by existing R packages. [RSurvey](http://cran.r-project.org/web/packages/RSurvey/index.html) may be used as a processing program for spatially distributed data, and is capable of error corrections and data visualisation.

Integration with version 6.\* and 7 (devel) of the leading open source GIS, GRASS, is provided in CRAN package [spgrass6](http://cran.r-project.org/web/packages/spgrass6/index.html), using [rgdal](http://cran.r-project.org/web/packages/rgdal/index.html) for exchanging data. [RPyGeo](http://cran.r-project.org/web/packages/RPyGeo/index.html) is a wrapper for Python access to the ArcGIS GeoProcessor, and [RSAGA](http://cran.r-project.org/web/packages/RSAGA/index.html) is a similar shell-based wrapper for SAGA commands.

* **Point pattern analysis**: The [spatial](http://cran.r-project.org/web/packages/spatial/index.html) package is a recommended package shipped with base R, and contains several core functions, including an implementation of Khat by its author, Prof. Ripley. In addition, [spatstat](http://cran.r-project.org/web/packages/spatstat/index.html) allows freedom in defining the region(s) of interest, and makes extensions to marked processes and spatial covariates. Its strengths are model-fitting and simulation, and it has a useful [homepage](http://www.spatstat.org/). It is the only package that will enable the user to fit inhomogeneous point process models with interpoint interactions. [MarkedPointProcess](http://cran.r-project.org/web/packages/MarkedPointProcess/index.html) is another contemporary point pattern package. The [spatgraphs](http://cran.r-project.org/web/packages/spatgraphs/index.html) package provides graphs, graph visualisation and graph based summaries to be used with spatial point pattern analysis. The [splancs](http://cran.r-project.org/web/packages/splancs/index.html)package also allows point data to be analysed within a polygonal region of interest, and covers many methods, including 2D kernel densities.

[ecespa](http://cran.r-project.org/web/packages/ecespa/index.html) provides wrappers, functions and data for spatial point pattern analysis, used in the book on Spatial Ecology of the ECESPA/AEET. The functions for binning points on grids in [ash](http://cran.r-project.org/web/packages/ash/index.html) may also be of interest. The [ads](http://cran.r-project.org/web/packages/ads/index.html) package perform first- and second-order multi-scale analyses derived from Ripley's K-function. The [aspace](http://cran.r-project.org/web/packages/aspace/index.html) package is a collection of functions for estimating centrographic statistcs and computational geometries from spatial point patterns. [spatialkernel](http://cran.r-project.org/web/packages/spatialkernel/index.html) provides edge-corrected kernel density estimation and binary kernel regression estimation for multivariate spatial point process data. [DSpat](http://cran.r-project.org/web/packages/DSpat/index.html) contains functions for spatial modelling for distance sampling data, and [spatialsegregation](http://cran.r-project.org/web/packages/spatialsegregation/index.html) provides segregation measures for multitype spatial point patterns. [GriegSmith](http://cran.r-project.org/web/packages/GriegSmith/index.html) uses the Grieg-Smith method on 2 dimensional spatial data. The [dbmss](http://cran.r-project.org/web/packages/dbmss/index.html) package allows simple computation of a full set of spatial statistic functions of distance, including classical ones (Ripley's K and others) and more recent ones used by spatial economists (Duranton and Overman's Kd, Marcon and Puech's M). It relies on spatstat for core calculation.[latticeDensity](http://cran.r-project.org/web/packages/latticeDensity/index.html) contains functions that compute the lattice-based density estimator of Barry and McIntyre, which accounts for point processes in two-dimensional regions with irregular boundaries and holes.

* **Geostatistics**: The [gstat](http://cran.r-project.org/web/packages/gstat/index.html) package provides a wide range of functions for univariate and multivariate geostatistics, also for larger datasets, while [geoR](http://cran.r-project.org/web/packages/geoR/index.html) and [geoRglm](http://cran.r-project.org/web/packages/geoRglm/index.html) contain functions for model-based geostatistics. Variogram diagnostics may be carried out with [vardiag](http://cran.r-project.org/web/packages/vardiag/index.html). Automated interpolation using [gstat](http://cran.r-project.org/web/packages/gstat/index.html) is available in [automap](http://cran.r-project.org/web/packages/automap/index.html). This family of packages is supplemented by [intamap](http://cran.r-project.org/web/packages/intamap/index.html)with procedures for automated interpolation and [psgp](http://cran.r-project.org/web/packages/psgp/index.html), which implements projected sparse Gaussian process kriging. A similar wide range of functions is to be found in the [fields](http://cran.r-project.org/web/packages/fields/index.html) package. The[spatial](http://cran.r-project.org/web/packages/spatial/index.html) package is shipped with base R, and contains several core functions. The [spBayes](http://cran.r-project.org/web/packages/spBayes/index.html) package fits Gaussian univariate and multivariate models with MCMC. [ramps](http://cran.r-project.org/web/packages/ramps/index.html) is a different Bayesian geostatistical modelling package. The [geospt](http://cran.r-project.org/web/packages/geospt/index.html) package contains some geostatistical and radial basis functions, including prediction and cross validation. Besides, it includes functions for the design of optimal spatial sampling networks based on geostatistical modelling.

The [RandomFields](http://cran.r-project.org/web/packages/RandomFields/index.html) package provides functions for the simulation and analysis of random fields, and variogram model descriptions can be passed between [geoR](http://cran.r-project.org/web/packages/geoR/index.html), [gstat](http://cran.r-project.org/web/packages/gstat/index.html) and this package.[SpatialExtremes](http://cran.r-project.org/web/packages/SpatialExtremes/index.html) proposes several approaches for spatial extremes modelling using [RandomFields](http://cran.r-project.org/web/packages/RandomFields/index.html). In addition, [CompRandFld](http://cran.r-project.org/web/packages/CompRandFld/index.html), [constrainedKriging](http://cran.r-project.org/web/packages/constrainedKriging/index.html) and [geospt](http://cran.r-project.org/web/packages/geospt/index.html) provide alternative approaches to geostatistical modelling. The [spTimer](http://cran.r-project.org/web/packages/spTimer/index.html) package is able to fit, spatially predict and temporally forecast large amounts of space-time data using [1] Bayesian Gaussian Process (GP) Models, [2] Bayesian Auto-Regressive (AR) Models, and [3] Bayesian Gaussian Predictive Processes (GPP) based AR Models. The [rtop](http://cran.r-project.org/web/packages/rtop/index.html) package provides functions for the geostatistical interpolation of data with irregular spatial support such as runoff related data or data from administrative units. The [georob](http://cran.r-project.org/web/packages/georob/index.html) package provides functions for fitting linear models with spatially correlated errors by robust and Gaussian Restricted Maximum Likelihood and for computing robust and customary point and block kriging predictions, along with utility functions for cross-validation and for unbiased back-transformation of kriging predictions of log-transformed data. The [SpatialTools](http://cran.r-project.org/web/packages/SpatialTools/index.html) package has an emphasis on kriging, and provides functions for prediction and simulation.

The [sgeostat](http://cran.r-project.org/web/packages/sgeostat/index.html) package is also available. Within the same general topical area are the [deldir](http://cran.r-project.org/web/packages/deldir/index.html) and [tripack](http://cran.r-project.org/web/packages/tripack/index.html) packages for triangulation and the [akima](http://cran.r-project.org/web/packages/akima/index.html) package for spline interpolation; the [MBA](http://cran.r-project.org/web/packages/MBA/index.html)package provides scattered data interpolation with multilevel B-splines. In addition, there are the [spatialCovariance](http://cran.r-project.org/web/packages/spatialCovariance/index.html) package, which supports the computation of spatial covariance matrices for data on rectangles, the [regress](http://cran.r-project.org/web/packages/regress/index.html) package building in part on [spatialCovariance](http://cran.r-project.org/web/packages/spatialCovariance/index.html), and the [tgp](http://cran.r-project.org/web/packages/tgp/index.html) package. The [Stem](http://cran.r-project.org/web/packages/Stem/index.html) package provides for the estimation of the parameters of a spatio-temporal model using the EM algorithm, and the estimation of the parameter standard errors using a spatio-temporal parametric bootstrap. [FieldSim](http://cran.r-project.org/web/packages/FieldSim/index.html) is another random fields simulations package. The [SSN](http://cran.r-project.org/web/packages/SSN/index.html) is for geostatistical modeling for data on stream networks, including models based on in-stream distance. Models are created using moving average constructions. Spatial linear models, including covariates, can be fit with ML or REML. Mapping and other graphical functions are included.

* **Disease mapping and areal data analysis**: [DCluster](http://cran.r-project.org/web/packages/DCluster/index.html) is a package for the detection of spatial clusters of diseases. It extends and depends on the [spdep](http://cran.r-project.org/web/packages/spdep/index.html) package, which provides basic functions for building neighbour lists and spatial weights, tests for spatial autocorrelation for areal data like Moran's I, and functions for fitting spatial regression models, such as SAR and CAR models. These models assume that the spatial dependence can be described by known weights. The [SpatialEpi](http://cran.r-project.org/web/packages/SpatialEpi/index.html) package provides implementations of cluster detection and disease mapping functions, including Bayesian cluster detection, and supports strata. Regionalisation of polygon objects is provided by [AMOEBA](http://cran.r-project.org/web/packages/AMOEBA/index.html): a function to calculate spatial clusters using the Getis-Ord local statistic. It searches irregular clusters (ecotopes) on a map, and by skater in [spdep](http://cran.r-project.org/web/packages/spdep/index.html). The [seg](http://cran.r-project.org/web/packages/seg/index.html) package provides functions for measuring spatial segregation. The [spgwr](http://cran.r-project.org/web/packages/spgwr/index.html) package contains an implementation of geographically weighted regression methods for exploring possible non-stationarity. The [gwrr](http://cran.r-project.org/web/packages/gwrr/index.html) package fits geographically weighted regression (GWR) models and has tools to diagnose and remediate collinearity in the GWR models. Also fits geographically weighted ridge regression (GWRR) and geographically weighted lasso (GWL) models. The [GWmodel](http://cran.r-project.org/web/packages/GWmodel/index.html)package contains functions for computing geographically weighted models. The [sparr](http://cran.r-project.org/web/packages/sparr/index.html) package provides another approach to relative risks. The [CARBayes](http://cran.r-project.org/web/packages/CARBayes/index.html) package implements Bayesian hierarchical spatial areal unit models. In such models the spatial correlation is modelled by a set of random effects, which are assigned a conditional autoregressive (CAR) prior distribution. Examples of the models included are the BYM model as well as a recently developed localised spatial smoothing model. The [glmmBUGS](http://cran.r-project.org/web/packages/glmmBUGS/index.html) package is a helpful way of passing out spatial models to WinBUGS.
* **Spatial regression**: The choice of function for spatial regression will depend on the support available. If the data are characterised by point support and the spatial process is continuous, geostatistical methods may be used, or functions in the [nlme](http://cran.r-project.org/web/packages/nlme/index.html) package. If the support is areal, and the spatial process is not being treated as continuous, functions provided in the [spdep](http://cran.r-project.org/web/packages/spdep/index.html) package may be used. This package can also be seen as providing spatial econometrics functions, and, as noted above, provides basic functions for building neighbour lists and spatial weights, tests for spatial autocorrelation for areal data like Moran's I, and functions for fitting spatial regression models. It provides the full range of local indicators of spatial association, such as local Moran's I and diagnostic tools for fitted linear models, including Lagrange Multiplier tests. Spatial regression models that can be fitted using maximum likelihood include spatial lag models, spatial error models, and spatial Durbin models. For larger data sets, sparse matrix techniques can be used for maximum likelihood fits, while spatial two stage least squares and generalised method of moments estimators are an alternative. When using GMM, [sphet](http://cran.r-project.org/web/packages/sphet/index.html) can be used to accommodate both autocorrelation and heteroskedasticity. Spatial count regression is provided using custom MCMC by [spatcounts](http://cran.r-project.org/web/packages/spatcounts/index.html). The [McSpatial](http://cran.r-project.org/web/packages/McSpatial/index.html) provides functions for locally weighted regression, semiparametric and conditionally parametric regression, fourier and cubic spline functions, GMM and linearized spatial logit and probit, k-density functions and counterfactuals, nonparametric quantile regression and conditional density functions, Machado-Mata decomposition for quantile regressions, spatial AR model, repeat sales models, and conditionally parametric logit and probit. The [splm](http://cran.r-project.org/web/packages/splm/index.html) package provides methods for fitting spatial panel data by maximum likelihood and GM. [spatialprobit](http://cran.r-project.org/web/packages/spatialprobit/index.html) make possible Bayesian estimation of the spatial autoregressive probit model (SAR probit model).
* **Ecological analysis**: There are many packages for analysing ecological and environmental data. They include [ade4](http://cran.r-project.org/web/packages/ade4/index.html) for exploratory and Euclidean methods in the environmental sciences, the[adehabitat](http://cran.r-project.org/web/packages/adehabitat/index.html) family of packages for the analysis of habitat selection by animals ([adehabitatHR](http://cran.r-project.org/web/packages/adehabitatHR/index.html), [adehabitatHS](http://cran.r-project.org/web/packages/adehabitatHS/index.html), [adehabitatLT](http://cran.r-project.org/web/packages/adehabitatLT/index.html), and [adehabitatMA](http://cran.r-project.org/web/packages/adehabitatMA/index.html)), [pastecs](http://cran.r-project.org/web/packages/pastecs/index.html) for the regulation, decomposition and analysis of space-time series, [vegan](http://cran.r-project.org/web/packages/vegan/index.html) for ordination methods and other useful functions for community and vegetation ecologists, and many other functions in other contributed packages. One such is [tripEstimation](http://cran.r-project.org/web/packages/tripEstimation/index.html), basing on the classes provided by [trip](http://cran.r-project.org/web/packages/trip/index.html). [ncf](http://cran.r-project.org/web/packages/ncf/index.html) has entered CRAN recently, and provides a range of spatial nonparametric covariance functions. [rangeMapper](http://cran.r-project.org/web/packages/rangeMapper/index.html) is a package to manipulate species range (extent-of-occurrence) maps, mainly tools for easy generation of biodiversity (species richness) or life-history traits maps. [ModelMap](http://cran.r-project.org/web/packages/ModelMap/index.html) builds on other packages to create models using underlying GIS data. The [gstudio](http://cran.r-project.org/web/packages/gstudio/index.html) package contains classes and functions for the spatial analysis of marker data to include structure statistics, analyses based upon allele frequencies, and Population Graphs network analysis of spatial conditional genetic covariance. This package interfaces with raster and sp objects directly. An off-CRAN package - [Rcitrus](http://www.leg.ufpr.br/Rcitrus/)- is for the spatial analysis of plant disease incidence. The [Geneland](http://cran.r-project.org/web/packages/Geneland/index.html) package uses [fields](http://cran.r-project.org/web/packages/fields/index.html) and [RandomFields](http://cran.r-project.org/web/packages/RandomFields/index.html) to make use of both geographic and genetic informations to estimate the number of populations in a dataset and delineate their spatial organisation. The [ngspatial](http://cran.r-project.org/web/packages/ngspatial/index.html) package provides tools for analyzing spatial data, especially non-Gaussian areal data. It supports the sparse spatial generalized linear mixed model of Hughes and Haran (2013) and the centered autologistic model of Caragea and Kaiser (2009). The [Environmetrics](http://cran.r-project.org/web/views/Environmetrics.html)Task View contains a much more complete survey of relevant functions and packages.

**CRAN packages:**

* [ade4](http://cran.r-project.org/web/packages/ade4/index.html)
* [adehabitat](http://cran.r-project.org/web/packages/adehabitat/index.html)
* [adehabitatHR](http://cran.r-project.org/web/packages/adehabitatHR/index.html)
* [adehabitatHS](http://cran.r-project.org/web/packages/adehabitatHS/index.html)
* [adehabitatLT](http://cran.r-project.org/web/packages/adehabitatLT/index.html)
* [adehabitatMA](http://cran.r-project.org/web/packages/adehabitatMA/index.html)
* [ads](http://cran.r-project.org/web/packages/ads/index.html)
* [akima](http://cran.r-project.org/web/packages/akima/index.html)
* [AMOEBA](http://cran.r-project.org/web/packages/AMOEBA/index.html)
* [ash](http://cran.r-project.org/web/packages/ash/index.html)
* [aspace](http://cran.r-project.org/web/packages/aspace/index.html)
* [automap](http://cran.r-project.org/web/packages/automap/index.html)
* [CARBayes](http://cran.r-project.org/web/packages/CARBayes/index.html)
* [classInt](http://cran.r-project.org/web/packages/classInt/index.html) (core)
* [CompRandFld](http://cran.r-project.org/web/packages/CompRandFld/index.html)
* [constrainedKriging](http://cran.r-project.org/web/packages/constrainedKriging/index.html)
* [cshapes](http://cran.r-project.org/web/packages/cshapes/index.html)
* [dbmss](http://cran.r-project.org/web/packages/dbmss/index.html)
* [DCluster](http://cran.r-project.org/web/packages/DCluster/index.html) (core)
* [deldir](http://cran.r-project.org/web/packages/deldir/index.html) (core)
* [DSpat](http://cran.r-project.org/web/packages/DSpat/index.html)
* [ecespa](http://cran.r-project.org/web/packages/ecespa/index.html)
* [fields](http://cran.r-project.org/web/packages/fields/index.html)
* [FieldSim](http://cran.r-project.org/web/packages/FieldSim/index.html)
* [gdistance](http://cran.r-project.org/web/packages/gdistance/index.html)
* [Geneland](http://cran.r-project.org/web/packages/Geneland/index.html)
* [GEOmap](http://cran.r-project.org/web/packages/GEOmap/index.html)
* [geomapdata](http://cran.r-project.org/web/packages/geomapdata/index.html)
* [geonames](http://cran.r-project.org/web/packages/geonames/index.html)
* [geoR](http://cran.r-project.org/web/packages/geoR/index.html) (core)
* [geoRglm](http://cran.r-project.org/web/packages/geoRglm/index.html)
* [georob](http://cran.r-project.org/web/packages/georob/index.html)
* [geosphere](http://cran.r-project.org/web/packages/geosphere/index.html)
* [geospt](http://cran.r-project.org/web/packages/geospt/index.html)
* [geospt](http://cran.r-project.org/web/packages/geospt/index.html)
* [GeoXp](http://cran.r-project.org/web/packages/GeoXp/index.html)
* [ggmap](http://cran.r-project.org/web/packages/ggmap/index.html)
* [glmmBUGS](http://cran.r-project.org/web/packages/glmmBUGS/index.html)
* [gmt](http://cran.r-project.org/web/packages/gmt/index.html)
* [Grid2Polygons](http://cran.r-project.org/web/packages/Grid2Polygons/index.html)
* [GriegSmith](http://cran.r-project.org/web/packages/GriegSmith/index.html)
* [gstat](http://cran.r-project.org/web/packages/gstat/index.html) (core)
* [gstudio](http://cran.r-project.org/web/packages/gstudio/index.html)
* [Guerry](http://cran.r-project.org/web/packages/Guerry/index.html)
* [GWmodel](http://cran.r-project.org/web/packages/GWmodel/index.html)
* [gwrr](http://cran.r-project.org/web/packages/gwrr/index.html)
* [hdeco](http://cran.r-project.org/web/packages/hdeco/index.html)
* [intamap](http://cran.r-project.org/web/packages/intamap/index.html)
* [landsat](http://cran.r-project.org/web/packages/landsat/index.html)
* [latticeDensity](http://cran.r-project.org/web/packages/latticeDensity/index.html)
* [mapdata](http://cran.r-project.org/web/packages/mapdata/index.html)
* [mapproj](http://cran.r-project.org/web/packages/mapproj/index.html)
* [maps](http://cran.r-project.org/web/packages/maps/index.html)
* [maptools](http://cran.r-project.org/web/packages/maptools/index.html) (core)
* [MarkedPointProcess](http://cran.r-project.org/web/packages/MarkedPointProcess/index.html)
* [MBA](http://cran.r-project.org/web/packages/MBA/index.html)
* [McSpatial](http://cran.r-project.org/web/packages/McSpatial/index.html)
* [micromap](http://cran.r-project.org/web/packages/micromap/index.html)
* [ModelMap](http://cran.r-project.org/web/packages/ModelMap/index.html)
* [ncdf](http://cran.r-project.org/web/packages/ncdf/index.html)
* [ncf](http://cran.r-project.org/web/packages/ncf/index.html)
* [ngspatial](http://cran.r-project.org/web/packages/ngspatial/index.html)
* [nlme](http://cran.r-project.org/web/packages/nlme/index.html)
* [OpenStreetMap](http://cran.r-project.org/web/packages/OpenStreetMap/index.html)
* [osmar](http://cran.r-project.org/web/packages/osmar/index.html)
* [pastecs](http://cran.r-project.org/web/packages/pastecs/index.html)
* [PBSmapping](http://cran.r-project.org/web/packages/PBSmapping/index.html)
* [PBSmodelling](http://cran.r-project.org/web/packages/PBSmodelling/index.html)
* [plotGoogleMaps](http://cran.r-project.org/web/packages/plotGoogleMaps/index.html)
* [plotKML](http://cran.r-project.org/web/packages/plotKML/index.html)
* [psgp](http://cran.r-project.org/web/packages/psgp/index.html)
* [ramps](http://cran.r-project.org/web/packages/ramps/index.html)
* [RandomFields](http://cran.r-project.org/web/packages/RandomFields/index.html) (core)
* [rangeMapper](http://cran.r-project.org/web/packages/rangeMapper/index.html)
* [RArcInfo](http://cran.r-project.org/web/packages/RArcInfo/index.html)
* [raster](http://cran.r-project.org/web/packages/raster/index.html) (core)
* [rasterVis](http://cran.r-project.org/web/packages/rasterVis/index.html)
* [RColorBrewer](http://cran.r-project.org/web/packages/RColorBrewer/index.html) (core)
* [regress](http://cran.r-project.org/web/packages/regress/index.html)
* [rgdal](http://cran.r-project.org/web/packages/rgdal/index.html) (core)
* [rgeos](http://cran.r-project.org/web/packages/rgeos/index.html) (core)
* [RgoogleMaps](http://cran.r-project.org/web/packages/RgoogleMaps/index.html)
* [RPyGeo](http://cran.r-project.org/web/packages/RPyGeo/index.html)
* [RSAGA](http://cran.r-project.org/web/packages/RSAGA/index.html)
* [RSurvey](http://cran.r-project.org/web/packages/RSurvey/index.html)
* [rtop](http://cran.r-project.org/web/packages/rtop/index.html)
* [rworldmap](http://cran.r-project.org/web/packages/rworldmap/index.html)
* [rworldxtra](http://cran.r-project.org/web/packages/rworldxtra/index.html)
* [seg](http://cran.r-project.org/web/packages/seg/index.html)
* [sgeostat](http://cran.r-project.org/web/packages/sgeostat/index.html)
* [shapefiles](http://cran.r-project.org/web/packages/shapefiles/index.html)
* [sp](http://cran.r-project.org/web/packages/sp/index.html) (core)
* [spacetime](http://cran.r-project.org/web/packages/spacetime/index.html) (core)
* [sparr](http://cran.r-project.org/web/packages/sparr/index.html)
* [spatcounts](http://cran.r-project.org/web/packages/spatcounts/index.html)
* [spatgraphs](http://cran.r-project.org/web/packages/spatgraphs/index.html)
* [spatial](http://cran.r-project.org/web/packages/spatial/index.html)
* [spatial.tools](http://cran.r-project.org/web/packages/spatial.tools/index.html)
* [spatialCovariance](http://cran.r-project.org/web/packages/spatialCovariance/index.html)
* [SpatialEpi](http://cran.r-project.org/web/packages/SpatialEpi/index.html)
* [SpatialExtremes](http://cran.r-project.org/web/packages/SpatialExtremes/index.html)
* [spatialkernel](http://cran.r-project.org/web/packages/spatialkernel/index.html)
* [spatialprobit](http://cran.r-project.org/web/packages/spatialprobit/index.html)
* [spatialsegregation](http://cran.r-project.org/web/packages/spatialsegregation/index.html)
* [SpatialTools](http://cran.r-project.org/web/packages/SpatialTools/index.html)
* [spatstat](http://cran.r-project.org/web/packages/spatstat/index.html) (core)
* [spBayes](http://cran.r-project.org/web/packages/spBayes/index.html)
* [spcosa](http://cran.r-project.org/web/packages/spcosa/index.html)
* [spdep](http://cran.r-project.org/web/packages/spdep/index.html) (core)
* [spgrass6](http://cran.r-project.org/web/packages/spgrass6/index.html)
* [spgwr](http://cran.r-project.org/web/packages/spgwr/index.html)
* [sphet](http://cran.r-project.org/web/packages/sphet/index.html)
* [splancs](http://cran.r-project.org/web/packages/splancs/index.html) (core)
* [splm](http://cran.r-project.org/web/packages/splm/index.html)
* [spsurvey](http://cran.r-project.org/web/packages/spsurvey/index.html)
* [spTimer](http://cran.r-project.org/web/packages/spTimer/index.html)
* [SSN](http://cran.r-project.org/web/packages/SSN/index.html)
* [Stem](http://cran.r-project.org/web/packages/Stem/index.html)
* [taRifx](http://cran.r-project.org/web/packages/taRifx/index.html)
* [tgp](http://cran.r-project.org/web/packages/tgp/index.html)
* [trip](http://cran.r-project.org/web/packages/trip/index.html)
* [tripack](http://cran.r-project.org/web/packages/tripack/index.html)
* [tripEstimation](http://cran.r-project.org/web/packages/tripEstimation/index.html)
* [UScensus2000blkgrp](http://cran.r-project.org/web/packages/UScensus2000blkgrp/index.html)
* [UScensus2000cdp](http://cran.r-project.org/web/packages/UScensus2000cdp/index.html)
* [UScensus2000tract](http://cran.r-project.org/web/packages/UScensus2000tract/index.html)
* [vardiag](http://cran.r-project.org/web/packages/vardiag/index.html)
* [vec2dtransf](http://cran.r-project.org/web/packages/vec2dtransf/index.html)
* [vegan](http://cran.r-project.org/web/packages/vegan/index.html)

**Related links:**

* CRAN Task View: [Environmetrics](http://cran.r-project.org/web/views/Environmetrics.html)
* [Rgeo: Spatial Statistics with R](http://geodacenter.asu.edu/projects/rsp)
* [R-SIG-Geo mailing list](https://www.stat.math.ethz.ch/mailman/listinfo/R-SIG-Geo/)