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NOTA INFORMATIVA

Qeco-Quantitative ecology software: A collaborative approach

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Introduction

Qeco is a statistical software for analysis of ecological data. It has a simple and user-friendly interface that makes the difference in the experience of data analysis. It implements state-of-the-art statistical and quantitative ecological methods. The main characteristic that makes it different is that it does not only merges the best of the ease-to-use menu-driven software with the power of R, but that it allows growing according to the needs and knowledge of the users. This is possible because Qeco creates an interface that invites the users to add new menus and menus items according to her/his needs including helps and test data. The ecological community will benefit from the collaborative efforts of its members that will make Qeco, their main companion for data analysis and interpretation.

Development team and motivation

Qeco is the initiative of an international team having a long and diverse experience in applied statistics and software development: InfoStat (Di Rienzo *et al.* 2010), FDiversity (Di Rienzo *et al.* 2008, Casanoves *et al.* 2010), Runner (Di Rienzo 2010), fgStatistics (Di Rienzo 2009). Part of this team was recently developing an integrated tool for the calculation of functional diversity indices and realized that ecologists are very prolific in developing quantitative-statistical ideas and also very demanding of new and integrated software tools. Many of them are R users and some developing their own software package.

This creative activity produce a huge amount of *ad hoc* R-scripts and packages that are not integrated are difficult to use, are disperse on a range of different repositories and at the end this means a lack visibility of the contributions. The purpose of Qeco is to give a standardized container of R applications that will be the core of an ease to use and productive statistical application. The current development is supported by Conservation International (http://www.conservation.org/), a non-profit organization that promotes innovations in science, economics, policy and community participation to protect the Earth's biodiversity around the world. We are looking for sponsors and organizations to join us in this enterprise.

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Software structure

Data handling
The software can handle its own data tables and read and write from/to different standard file formats (*.xls, *.txt, *.r, and others). Several tools allow the users to edit, sort, rearrange rows and columns of the data table, select cases using several criteria and perform basic descriptive analysis. It also has several advanced tools for data handling including transformations, formulas, merging of tables and creating categorical variables from quantitative variables among others.

The extended and flexible graphic tool makes the exploratory analysis easier than in other software (Figure 1). Graphics may be saved and retrieved for latter edition as well as exported in several formats including jpg.
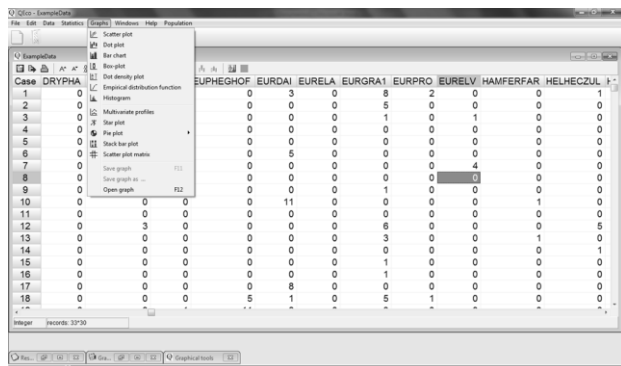

Figure 1: Qeco main window. The software has several menus to handle files, to edit data, to manipulate and transform data, to graph (submenu displayed), to select the windows to see, to invoke help. It also displays other standard and add-ons menus.

Quantitative analysis menus
The software has several built in procedures to make ecological analysis. The main routines are organized under the menus: Statistics, Population, Community, Ecosystem, and Others. However, as Qeco is a platform to share users add-ons, new menus will appear as the contributors incorporate their own procedures. These contributions will appear under any standard menu (like Statistics or Population) or even in new main menus. There is no limit for contributions, the structure is standardized and explained with detail in the user manual. All user contributions will be acknowledges. All output data

results include the procedure name, the authors list of the procedure, the corresponding-author's name and email-address, and a citable reference if it were available. The updating of the procedure, documentation and examples is the responsibility of the authors. A WEB-based repository will be available for easy contribution and maintenance.

R interface
An important feature of Qeco is that the user can switch to an R-interpreter without leaving the application's environment (Figure 2). Integration of the R-interpreter within Qeco allows the user not only to share data between both environments, but also to apply complementary analysis of the Qeco output using all available packages developed by the R-users community.

Moreover, there is a user-friendly interface to read data frames from inside R packages, which permits users to access datasets widely available in the bibliography. The user may invoke or copy R scripts from his/her own collection or from published sources, and also run and modify at will.
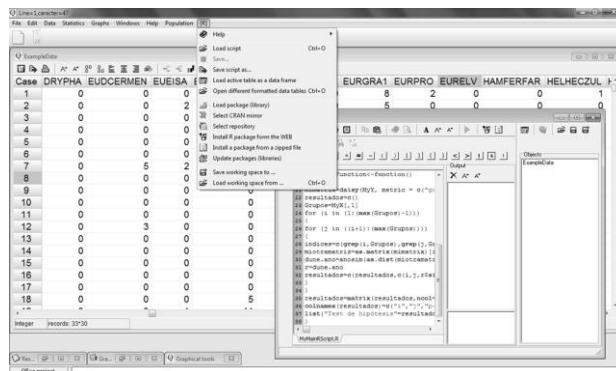

Figure 2: Qeco interface with R. The software allows writing, saving and running R scripts, transferring data set directly from Qeco to R as data frame, and recovering data outputs as Qeco tables to analysis with other built in routines or used the complete graphics options.

Documentation
The software distribution includes a User's Manual. It describes the installation procedure and, step by step, the procedures to write scripts to include them as part of Qeco. The core of a contribution is called MyMainRScrip.R, it is an R script that contains an interface block of sentences that appears as R-

comments and process instructions. The interface block of the script contains two sections: HEADER and OPTIONS. The HEADER section is mandatory and describes how the software will interact with the user.

The documentation of the procedure can be provided in two different ways: As a URL-address included in the HEADER block of the MyMainRScrip.R file or as a .pdf document. The example data is optional but it is hardly recommended to be included to let the users know how to use and interpret the results of the script. Its name is also declared in the HEADER block. Qeco accepts four file formats as test data: The application default file format (.QEDB), text (.txt), InfoStat file extension (.IDB2) and Excel 2003 (.xls).

The User Manual also includes a guide to introduce data sets, from draft or from several standard format files. The general menus File and Edit are explain with an example. The options of special menus Data and Graphics are explain in detailed.

All the procedures developed by the core team have a detailed help file with the basic concepts supporting the procedures, at least one example and results with a brief interpretation.

Conclusion

Qeco implements a new model of making software applications. Its strength is based on the collaborative environment it creates and the merging of the better of two apparently opposite paradigms: the menu-driven applications, and the flexibility of the command-based software. Qeco is a fresh promise of a very productive tool for analysis of ecological data.

References

Casanoves F, Pla L, Di Rienzo JA & Diaz S. In press. FDiversity: a software package for the integrated analysis of functional diversity. *Methods in Ecology and Evolution*

Di Rienzo JA. 2010. *Runner. A free ease-to-use R interpreter*. College of Agricultural Sciences, National University of Córdoba. Cordoba, Argentina. Available: http://sites.google.com/site/runner.

Di Rienzo JA. 2009. *fgStatistics. Statistical software for functional genomics analysis*. College of Agricultural Sciences, National University of Córdoba. Córdoba, Argentina. Available: http://sites.google.com/site/fgStatistics.

Di Rienzo JA, Casanoves F, Balzarini MG, González L, Tablada M & Robledo CW. 2010. *InfoStat*. Grupo InfoStat; FCA, Universidad Nacional de Córdoba, Argentina. Available: http://www.infostat.com.ar.

Di Rienzo JA, Casanoves F & Pla L. 2008. *FDiversity, versión 2008*. Córdoba, Argentina. Available: http://www.fdiversity.nucleodiversus.org