PROSAD a tool for projecting and managing data about seed orchards

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Abstract

PROSAD is a database programme developed for projecting seed orchards and respective data management. It is also a useful tool for keeping data about clone archives, stool-beds and various types of field trials, including provenance plots. The programme provides powerful database functions for processing data about these objects and also various possibilities to export and import data into and from other data formats.

Introduction

Programme PROSAD allows managing and processing data on seed orchards and similar objects. Present product was built by combining previous system for seed orchards projecting and data keeping programme for seed orchards and plus trees, which were developed in 1992 - 1993 and updated in 1996. The programme is based on a relational database model, which is able to use free tables and provides a rich data management outfit for creating and managing tables in a relational database (RDBMS), generation of aggregated tables with help of the SQL language or creating output reports. It is developed in Microsoft Visual FoxPro 9.0 for desktop computers as a client – server application with supported web publishing.

Description of the programme

System requirements

The PROSAD programme has no special hardware demands. It can be installed on a computer with Intel or AMD processor under operating system MS Windows 2000 or later. CD or DVD drive and 15 MB free space on hard disk (without user data) are needed for installation. Satisfactory displaying unit is a display with minimum resolution 800 × 600 and minimum 256 palette colour is satisfactory to show the data.

Data management

A user communicates with the programme through working and dialogue windows by using built-in operating elements as buttons, options, switches, lists and pull down menus. Each working window manages a relational database (linked tables). There are several working windows in the system, which are used form managing data about administrative location, ownership etc.

Seed orchards database

This working window (Fig. 1) is used for work with the database containing linked tables of the seed orchard, plus trees (parents) used for establishing the orchard and measures realised in the seed orchard. Data are split by topics and arranged on separate pages of the working window.

In the table of the seed orchard there are kept basic data, data about tree species, data about environmental conditions, geographical and administrative location and ownership of the orchard:

- code of the basic material, name of the seed orchard, number of clones, area, year of establishing and cancelling, name of the designer, nursery
- name, botanical name, number and name of the provenance region
- number and name of the forest region, altitude, altitudinal zone, forest vegetation zone, forest management type, average precipitation, average summer and winter temperatures, slope angle and exposition, ground

- locality, forest user unit, forest management unit, owner, user (manager), district, county, competent forestry office

Fig. 1 Main working window of seed orchards database.

The table of parent's trees (plus tress, clones etc.) is linked to the seed orchard table by the code of the basic material (primary key). There are as well as in the table of seed orchard presented basic data, data about tree species, environmental characteristics, geographical and administrative location and ownership of the each registered parent tree completed by its, quantitative and qualitative description:

- age, diameter ($d_{1,3}$) and height of the tree,
- straightness, convergence and cleaning of the stem, width, length, density, shape and symmetry of the crown, position and thickness of the branches etc.

All interventions and actions in the orchard are registered in next linked table. Here are kept chronological records related directly with management of the seed orchard plot and with the administrative and organizational issues:

- date of the entry, detailed description of activity, flowering, amount of collected cones or seeds and costs connected with the particular activity.
- required actions, authority, responsible person.

It is possible to link additional information to the basic database, either in form of free tables or graphical information in vector or raster formats (Fig. 2). Dates are not saved directly into main database. Programme PROSAD registers only links to the files, where the data are

placed. This helps to prevent overloading of the programme and simple updating of these linked data. To the database are linked:

- Plot of seed orchard, which is a table with maximal number of columns and rows, where is specified the position of each tree. The plot is product of the projecting part of the programme and has specified structure. It is possible to register archive seed orchard inventories from past years in several tables, as well as evaluations of the plot expressed by numerical or character values. In the system only this table is displayed, which is currently linked (it can be easily changed).

- Current inventory list created from the seed orchard plot with names (labels) of particular clones with concrete numbers of trees situated on the plot. For detailed statistical processing is possible to create a specific list with identification of each tree position (column, row and cell on the plot) in projecting part of the PROSAD programme.

- System can complete the documentation by displaying graphical data in vector formats WMF and EMF (charts of the plot) for projective scheme and other plans with identification point, line and polygon requirements. For shows of satellite, aerial and terrestrial pictures is possible use raster formats BMP, DIB, JPG, JPEG, JPE, JFIF, GIF, TIF, EXIF and PNG. In working window miniature of graphical data are showed with option of their enlargement (dependent on size and resolution of screen).
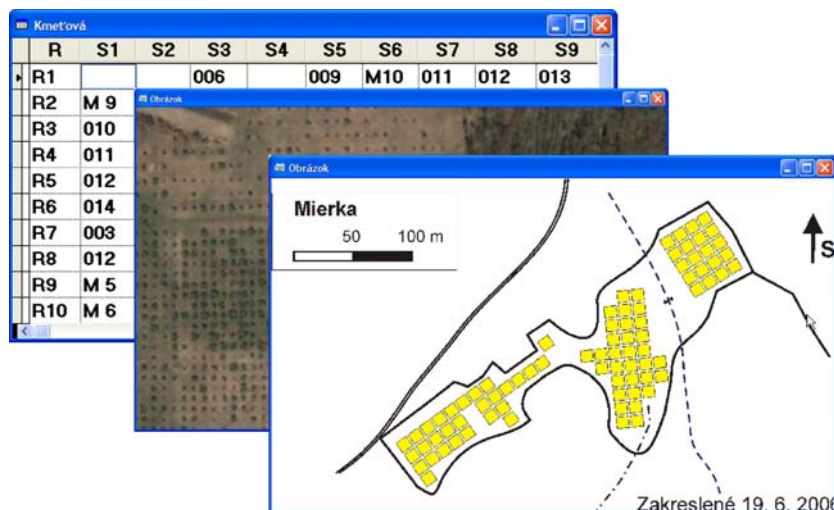

Fig. 2 Different types of information in windows showed from additional files.

Tools for data tables and files management

In the system are included tools for processing of information on one record level, as well as for multiple processing data either in one table, or several (virtual linked) tables. Tools for processing one record are available directly in the working window. They allow:

- to display current position in the table,

- to move in the table (from the first to the last record) with immediate displaying data,

- to move in the table with displaying data, which fulfils specified criteria

- to print data into defined reports

- to remove records in two steps (to improve safety of this operation) with a possibility to back-up removed data into an external file,

- to sort data according to defined simple or multiple ordering criteria (sorting indices),

- to complete automatically dependent data during input and editing, which eliminates writing mistakes,

- to display current position in the table,

- to move in the table (from the first to the last record) with immediate displaying data,

- to move in the table with displaying data, which fulfils specified criteria

- to print data into defined reports

- to remove records in two steps (to improve safety of this operation) with a possibility to back-up removed data into an external file,

- to sort data according to defined simple or multiple ordering criteria (sorting indices),

- to complete automatically dependent data during input and editing, which eliminates writing mistakes,

- to move a group of data from free tables with help of dialogue windows (e. g. information about tree species, owners or managers, administrative localisation of the plot),

- auto completing of expressions, when often repeated information is inserted

Multiple data processing tools are available through plug-in modules mediated by dialogue windows. These modules can be used universally in all working Windows. An advantage is automatic justification of the environment (opened databases and tables, defined sorting indices, setting of the system variables etc.). In a such case a programme user do not need to

justify anything. Some of the various tools for multiple data processing used in the PROSAD programme are described below.

Browsing records in the tables and records, which are indicated to be deleted

This module is used for browsing data in the tables. It is accessible from the main menu and also from each working window. When called from the working window the environment will be automatically set up (opened database or free tables, their structure, sorting and system variables). Before browsing tables, the user is allowed:

- to select records displayed by defining selection criteria for each column in the table with help of operators for comparing characters or numbers. User can combine conditions by conjunction or joining to a maximum extent of 50 simple conditions or 3,600 characters.
- to select displayed columns and their ordering. He can also justify width of the displayed column and change its position in the table.
- to create more sophisticated filters for data, valid until they are cancelled by user or by ending the session,
- to set data sorting in the browsed table before or after displaying the table,
- to see the structure of the current used tables, number of records, number of columns, sorting index, size of the file and date of the last updating,
- to justify the vertical and horizontal size of the displayed table and the size of fonts. It is possible to display several tables. If a relation between tables was set up before, the displayed data will follow the rules for the relation.

Exporting and importing records

Export and import are joined in one plug-in module and allow the user to communicate with other programmes and create data in other data formats. The environment is set up automatically as well as in the previous module. Main functions and features:

- Export and import are supported in several standard formats dBase, FoxPlus, FoxPro, VisiCalc, Data Interchange Format, MS Multiplan, System Data Format, Symbolic Link Format, Lotus 1-2-3, Lotus Symphony, CSV, MS Excel, ASCII text, Framework a Paradox). All used formats are well documented.

- Possibility to set up several separators to isolate columns, when the data are exported into text files.

- Filter is available for selection and sorting exported records.

- The code page, in which the source data were created, can be set up for import.

- It is possible to export a table ordered by user defined sorting.

Creating tables by SQL language

The module for using SQL language is able to work with all opened databases and free tables. The environment is automatically set up according to the working window, from which the module was called. The tool allows creating various temporal tables, which can be subsequently exported in the above mentioned data formats. Main features:

- Optional column from the open databases or free tables can be chosen for the output. The columns are clear marked and ordered by their belonging to the tables. It is also possible to compute the aggregated data values (such as average, number, minimum, maximum and sum).

- Tables can be linked together by compatible columns. At the some time it is possible to define other conditions to create views for used columns or also for columns included in the source tables.

- It is possible to create associated views (data joined from two or several tables) or aggregated views (grouped by defined column eventually also by using mathematical functions).

Printing data

There are several tools available for output data on printer. Data are always printed into defined output reports, which can be prepared for simple tables or for tables linked by relations. It is possible to print single or summary values (average, sum, numbers etc.). Several sections with specific rules for printing data can be defined in an output report. The saved outputs reports can be modified later. Programme user can directly apply following tools:

- Module for direct usage of the output reports. The user can choose a report and printer or to set up parameters for the printing. Single pages can be displayed on screen before printing them. This module can be called from the each working window.

- Module for guided creating output reports. The system has three "wizards" for creating reports: first one for simple outputs, the second for reports from tables linked by relations and the third one for printing labels.

- There is also a special module to output data in HTML format for publishing on web sites.

Functions for experts

For processing big databases sometimes the functions are needed, which are not a standard part of the database programmes. On account of this a module for experts was included into the PROSAD programme. With help of the module an advanced user can manually open and close the databases and tables, change their structure, change the system settings and by single commands carry out many other changes.

Other useful tools are using simple programmes (scripts), where the user can subsequently write often used commands or creating composite conditions for filtering or getting a view on data by the SQL language. Users can exchange these conditions and so provide for uniform data processing, if they work on the same projects or in the same databases.

Projecting seed orchards

This part was developed for projecting of seed orchards (stool-beds, clone archives and various field trials, including provenance plots). The procedure works with regular distribution of the single trees on the plot in a rectangular spacing. The projecting tool can be started from the part of the working window with tools in the particular dialogue window.

Projecting is based on the defined plot and the list of the clones, available for stocking the plot. Main features of the projecting:

- There can be used an equal or unequal number of trees of the particular clones for stocking the plot. The programme PROSAD will distribute them in a well balanced way on the whole plot.

- Maximum number of the columns on the plot is 254, number of the rows is not limited.

- It is possible to choose number of the zones (one to three), in which the number of the current distributed clone will not occur (Fig. 3). Of course, with the growing number of such zones, there is also higher need to use more equal representation of the clones.

- In projecting process up to two schematic thinnings can be planned. In several steps the programme distributes the clones in such a way, which allows keeping on the plot after each thinning the same ratio of the clones as there was at the beginning. This procedure will prevent the dropping out any of the clones during schematic thinning.

- PROSAD can stock also irregular plots with eventual free area on it. It is assured by the generator for stochastic selection of the clones, by rules for uniform distribution of the clones on the plot, by definition of the zone without repetition of the clone and by number of the thinnings.

- In the projection process various distribution on the plots can be created and apply the most suitable of them.

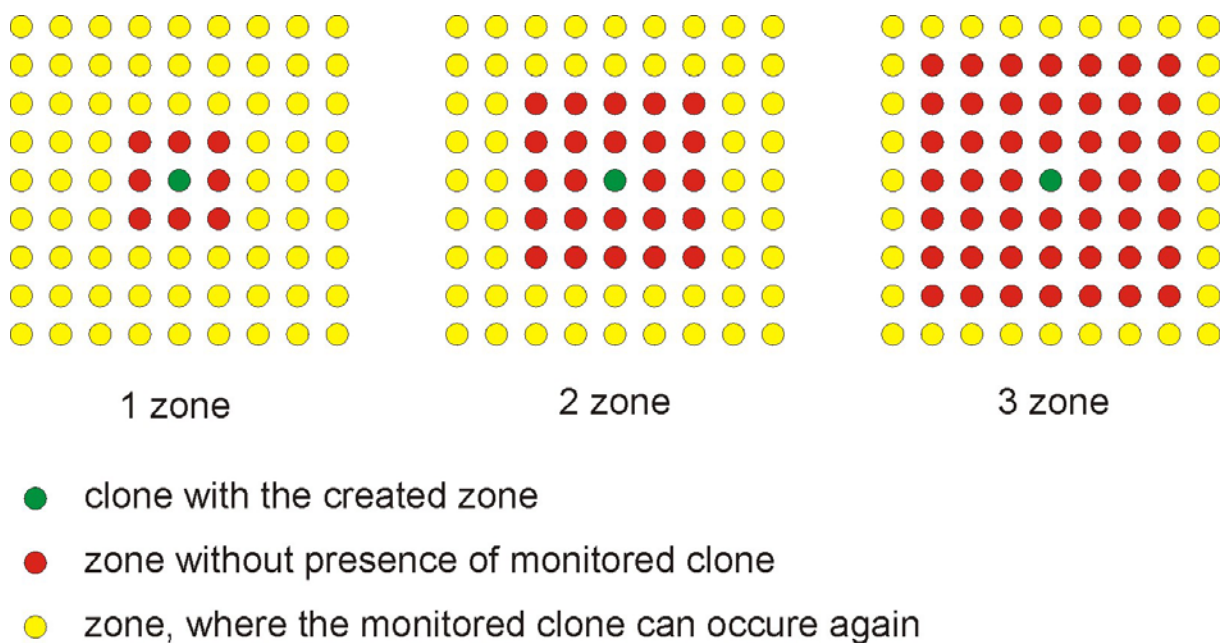- During the updating of the data, historical inventories of the plot and of the clone list can be kept.

1 zone   2 zone   3 zone

● clone with the created zone

● zone without presence of monitored clone

○ zone, where the monitored clone can occure again

Fig. 3 Creating of isolation zones.

Processing data on the plots and processing the lists

This functions packet was included into PROSAD programme with the aim to have tools for processing data from the field trials and provenance plots. Basis for creating, updating and processing data is projected and stocked plot of the orchard or field trial. Assuming, that the plot will be evaluated in the future and the data will be processed in statistical programmes

PROSAD allows to keep updated copies of the plot table with the inserted character or numerical data. Advantage of such a way of data keeping is exact identification and positioning of each single tree on the plot and possibility to compare changes of its traits (expressed by numerical or character data types) in the subsequent time periods. Following functions support the data processing on the plots:

- Creating copy of the plot table prepared for inserting values in character or numerical form. Extent of the character values can reach from one to ten characters, numerical values can be inserted in interval of one integer and six decimal places to ten integers.

- Conversion of the evaluation table with character or numerical data to a list. In the list is specified automatically the position of the each particular value (cell, column, row) and the matching value from the evaluation table. It is possible to add one to five further columns with numerical or character format to the list, which allows detailed description of the plot (e.g. year or season of the evaluation, altitude, exposition, rainfall or other values useful for statistical evaluation).

- Converted lists can be effectively joined to the files suitable for simple or extensive statistical evaluation. The lists can be joined in horizontal direction (e.g. for correlation and regression analysis) or in the vertical direction (analysis of variance or other data comparisons). Joined table can be exported in various formats with help of tools described in the data management part.

Conclusions

Amount of data regarding basic material of forest reproductive material grows constantly. There is also a need to process such data to analyse amounts and quality of production in the changed ecological conditions.

The programme PROSAD is a part of database system for keeping data about basic material, evaluation of the seed quality, plants grown in the nurseries and about damaging agents in forests and forest nurseries.

This programme allows easy and effective projecting seed orchards and other similar plots.

It also serves powerful tools for keeping and processing relevant data about these objects and evaluating their growth, production, quality and other parameters.

Architecture of the data allows to export the kept or processed data to the other computer systems and also to adapt data from older programmes.