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The National Forest Inventory has been gathering data about the Swiss forest for more than 25 years. To analyze this vast amount of data the software NAFIDAS was developed over the last four years. It provides the user with a set of tools to manage, analyze and visualize NFI data and to produce concise reports in an efficient and consistent way. It was the essential tool to produce the results for the third NFI, which will be published in spring 2010.

## web based user interface

Users can access the software directly over the internet with the Firefox Browser. This keeps software maintenance on the client side to a minimum. Over a secured connection users can work from home or anywhere in the world.

## easy to use

To produce a report, the user is guided through a series of simple steps in which he has to choose a number of different parameters. Only valid combinations of parameters are presented to the user to minimize potential errors.

## real-time analysis

Reports are generated in real-time. Therefore, the calculated results are always based on the most current data. Mean values are presented with their corresponding standard errors.

## transparent and reproducible

Users can retrieve a large amount of information about each variable in the system, giving the users a full overview of the parameters used.

## fast and reliable

By distributing different tasks of the software to separate high performance servers, the system's availability, stability and scalability are guaranteed. Due to the speed of the system, reports can be generated on demand in no time.

## Analysis and reporting

The main purpose of the program is to create reports containing tabular results including standard errors (screenshot 1). The structure and content of a result table are defined by

The screenshot shows a web browser window displaying the NAFIDAS interface. The main content is a table titled 'Vorrat • Eigentum • Nadel- und Laubholz' with the following data:

Eigentum	Nadel- und Laubholz	Aussageeinheit: Produktionsregion											
		Jura		Mittelland		Voralpen		Alpen		Alpensüdseite		Schweiz	
		m <sup>3</sup>	± %	m <sup>3</sup>	± %	m <sup>3</sup>	± %	m <sup>3</sup>	± %	m <sup>3</sup>	± %	m <sup>3</sup>	± %
öffentlich	Laubholz	23547969	4	20711301	5	9481031	8	7766693	7	9635469	7	71142463	3
	Nadelholz	28745270	4	24841693	5	32164475	5	72444093	3	16388869	6	174584401	2
	unbestimmt	0	.	0	.	0	.	0	.	0	.	0	.
	Total	52293238	3	45552994	4	41645506	4	80210787	3	26024339	4	245726864	2
privat	Laubholz	9877127	9	18997610	6	12651874	7	7667810	10	7113068	8	56307489	4
	Nadelholz	11786369	8	26459249	6	40890775	5	23227624	6	975531	25	103339549	3
	unbestimmt	0	.	0	.	0	.	0	.	0	.	0	.
	Total	21663496	7	45456859	4	53542649	4	30895434	5	8088600	8	159647039	2
Total	Laubholz	33425095	3	39708911	3	22132906	5	15434503	6	16748538	5	127449953	2
	Nadelholz	40531639	3	51300943	3	73055250	3	95671718	2	17364400	6	277923950	1
	unbestimmt	0	.	0	.	0	.	0	.	0	.	0	.
	Total	73956734	2	91009854	2	95188156	2	111106221	2	34112938	3	405373903	1

Umkodierung: Laub- oder Nadelbaum: Laubholz [2], Nadelholz [1], unbestimmt [9..1]  
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LFI NAFIDAS v4.0, letzte Änderung am 06.08.2009

Screenshot 1: Calculated result table including a standard error for each mean value and a caption summarizing the parameters used in the analysis.

several parameters, which have to be selected by the user through a series of steps. These choices comprise mainly the variable to be analyzed, the variable defining the columns and up to three grouping variables that will set the rows of the table. Other parameters that can be selected restrict the data to a subset or define the unit or number format. Users can also decide to have each cell value expressed as a fraction of a row total, column total or a subtotal.

Once the parameters have been selected, they are posted to the SAS application server, where the tabular data, including standard errors, are calculated. The result is then returned to the web server and from there back to the user.

The reports are styled in an appealing manner, so they are ready to be distributed as is or uploaded to the NFI website. They can also be exported to Excel for further processing. If needed, all parameters used to create a specific report can be included in the output.

Reports generated by NAFIDAS can be stored remotely in the NFI database instead of locally on a user's computer, where they might not be accessible to others. This facilitates quality control and reproducibility. Also, reports can be organized into projects and they can be shared with other users for collaboration.

Instead of saving the report as a whole, only the parameters that de-

fine it are stored. Previously generated reports can be loaded back into memory and the table is recalculated. Thus, every result is always based on the most recent data status.

## Metadata

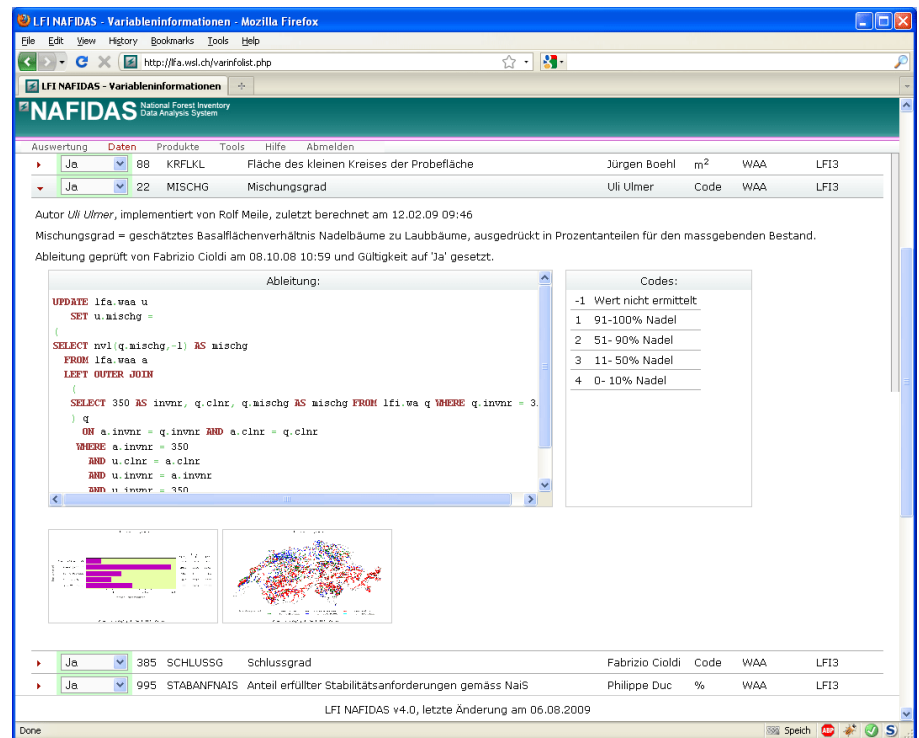
All data collected in the field, acquired through aerial photo interpretation and from other sources, such as GIS data, is stored centrally in the NFI's relational database (raw data). Variables deducted from this raw data (derived data) are also stored along with additional information such as the statistical procedure to calculate it. It is completely transparent to the users of NAFIDAS who, when and how each variable was created and how its values are distributed (screenshot 2). Furthermore, the dependencies between variables can be recorded and thus tracked. In this way, changes to parent variables can be propagated to all child variables (screenshot 3).

## Architecture

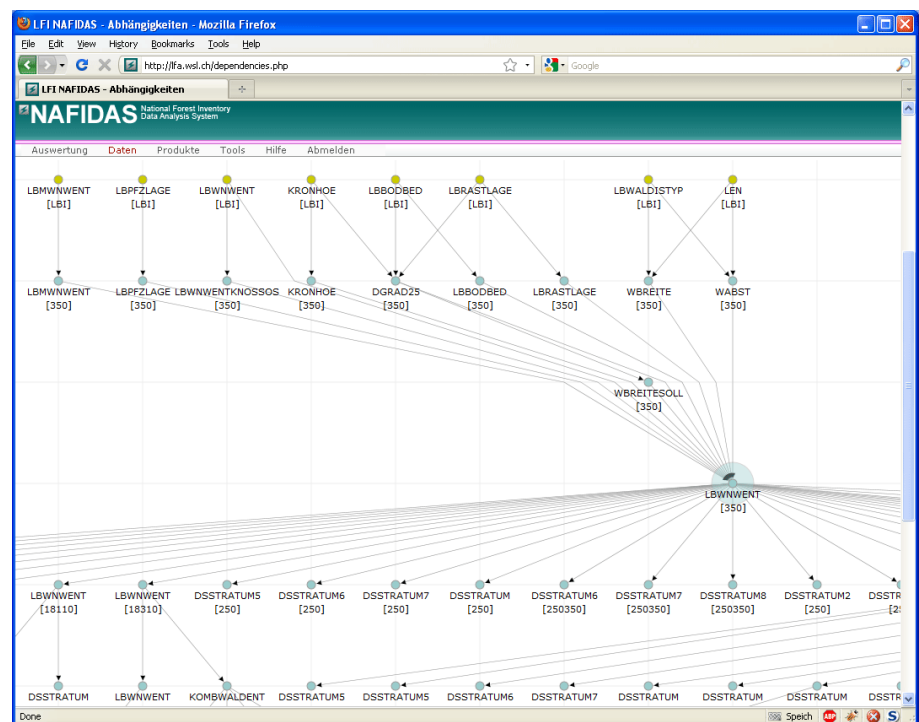
The system is based on a client/server architecture with multiple tiers, where the user interface, the application logic, the statistical analysis and the data storage are functionally separated and distributed over several computers. The user interface runs in the browser on the client's computer, the Oracle database on one dedicated server and the web application and the statistics software SAS on another. This setup has several key benefits. First of all, resources such as computers, data, information and program features can be shared. Secondly, each component can be extended and managed independently. Finally, tasks and loads are balanced leading to a more stable and reliable system.

## Outlook for 2010

It is planned to make a large number of result tables accessible to the public over the NFI web site in the languages German, French and Italian starting in spring 2010. Therefore, creation of multilingual output is currently being implemented into NAFIDAS. To produce all these reports, the system is



Screenshot 2: NAFIDAS displaying information about derived data in the NFI database. This includes in particular the SQL statement that created the variable.



Screenshot 3: Visualization of the dependencies of the variable LBWNWENT. Variables are arranged according to hierarchy. Derived variables in green, raw variables in yellow at the top.

extended to support batch calculation and direct storage of results including the complete tabular data and not only the parameter sets.

NAFIDAS is continuously being developed further to respond to new user demands and to cope with new inventory data and methods. Special attention has to be paid to keep alive

the treasures of old inventory data as part of a changing system.

For reasons of security, maintenance and user support, NAFIDAS is only accessible over the WSL intranet. It requires you to login with a user name and a password. External access is only possible over a VPN connection.