MONITORING FOOD PRODUCTION WITH GIS VIA THE INTERNET

Timo Widbom & Mikael Lindholm

Agricultural Research Centre of Finland (MTT)
Data and Information Services
FIN-31600 Jokioinen
Finland
http://www.mtt.fi
timo.widbom@mtt.fi
mikael.lindholm@mtt.fi

Abstract: The management and monitoring of agricultural and environmental resources and the origin of foods are of increasing importance today. GIS have proved to be important tools in solving problems encountered. Advances in the capabilities of the Web language have enabled information providers to include animation and interactive elements in their web sites. These developments have expanded the potential of the GIS world. The Internet Map Server provides a framework for requests and for delivering information to Web browsers from a GIS application on their WWW server. The result is ready access to maps and information anywhere on the Internet.

Keywords: Food production, GIS, WWW, yield estimates

1 Introduction.

Monitoring food production at the agricultural level entails management of a wide variety of data. The basic geographically referenced data elements are: air temperature, humidity, rainfall, solar radiation, soil type, surface-water flow, fertilizers and peticides used etc. When these are known and proper tools are available pests and their activity can be monitored and forecast or yield estimates made for a desired variety of grain. Much effort has been put into developing monitoring systems. In addition improved simulation models for pest management and yield estimates have been published. Geographical information systems (GIS) are powerful tools for linking models to real world data. GIS-based analytical data processing and visualization are illustrative and easy-to-understand means of presenting complicated calculations and forecasts not only to advisers but also to ordinary farmers. Thus, GIS contribute to better decision making on plant protection and yield planning (Tiilikkala et al, 1996).

The recent explosion in World Wide Web use has prompted thousands of organizations to create web sites, taking advantage of the large number of “surfers” who traverse the information daily. Also Intranet use too, is growing, providing organizations with new ways of communicating and sharing

information. Advances in the capabilities of the Web language , HTML, and the implementation of new technology such as JAVA and ActiveX, have made it possible to include animation, sound and movies and especially, interactive elements in web sites. These developments have brought new flexible possibilities to the GIS world. The Internet Map Server is one solution for interactive mapping and GIS use in the WWW. Web authors now have tools for building custom GIS applications and spatially-enabled Web sites that serve a variety of needs via the Internet. The Internet Map Server provides the framework for requests and for delivering information to Web browsers from a GIS application on a WWW server. The result is ready access to maps and information anywhere on the Internet.

We present here MTT's latest results in monitoring and visualizing pest forecasting and yield estimates using GIS and WWW. We concentrate on the techniques and phases by means of which end-users throughout the food production chain (from farmer to customer) can check the quality of an agricultural product, establish the quantity and quality of crops in a certain location or, in the case of farmers, prepare for a pest infestation.

2 Techniques and materials

The monitoring systems are based on large databases and many years of research work. With the powerful GIS techniques, Internet Map Servers, JAVA and sophisticated WWW applications now available state-of-the-art information can be distributed in real time.

In this pilot project pest movement and yield estimates are based on meteorological data and extensive field work by advisers, firms and farmers. Meteorological data are received from a couple of hundred automatic meteorological stations once a day. The data consist of the minimum and maximum temperature, air moisture, wind speed and rainfall of the day and an ID code (X,Y-coordinates). Every night the data are automatically transformed into dBase™ format. DBase™ files are split into files for different variables in which interpolated values are calculated for every grid point (25 km^2) of the mapping system by ARC/Info™ GIS software using Arc Macro Language (AML) scripts. The interpolated values are adjusted for the altitude of the grid points and the long-term average temperatures (Tiilikkala et al, 1996). The long-term meteorological data are obtained from the Finnish Meterological Institute.

The Interpolated data (about 8000 grids) are automatically translated into the SAS™ system for complicated statistical operations, which forms the database for final visualization. The final results are transformed into transparent polygon coverages and are visualized in ARC/Info™ software.

2.1 Out-of-the-box Web Mapping solution

Research institutes and information distributers who want to deliver computer-based information and services are increasingly turning to the WWW as their development and delivery platform, for both intranets and applications aimed at the public at large. In the case of MTT, the Internet Map Server will provide interactive WWW applications meeting the needs of usres. This means that users can choose the information and maps best suited to their purpose.

In the project, once the polygon coverages are built the batch program transfers the polygons to the Internet Map Server, which converts the information so that it is available for Web Browsers.

With the Web browsers' GUI (Graphical User Interface), the user can make a query about a specific variety of grain, soil type and sowing day and thus obtain information about current yield estimates in a specific location. The browser makes a request via the Internet Map server into the GIS data (Figure 1.) The Internet Map server translates queries using CGI scripts, and final maps and results are shown

on the user's WWW browser. The Internet Map Server techniques used at MTT were developed by the Finnish National Land Survey and MTT.

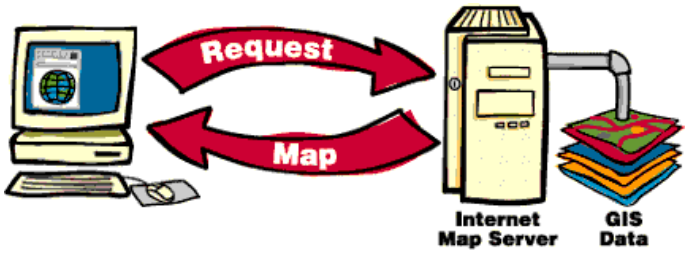

Figure 1. The process of including maps in non-mapping web browser

3 Conclusions

The importance of GIS in agriculture is unquestionable. GIS tools permit the display of crop yield data and factors which may affect crop yield, e.g. soil fertility data, soil types, insect infestations, weed locations, rainfall distributions and the terrain elevation. The GIS tools can also be used in planning to eliminate yield-limiting factors or to prevent accumulation of agricultural chemical waste by avoiding unnecessary applications of pesticides or fertilizers. For such decision-making purposes interactive WWW map server users can take advantage of the benefits of the Web based on non-propietary, flexible and scaleable 24-hour globally accessible standards. Information will also be timely and up-to-date because the info is "live".

4 References.

Tiilikkala, K.& O. Rantanen & T. Widbom & H. Ojanen (1996). GIS-based forecasting and monitoring of pests in Finland. In: (B.J.M Secher & J. Frahm (eds.)) *Proceedings of the workshop om decision systems in crop protection*. SP report no. 15. 97-103. Danish Institute of Plant and Soil Science. Tjele.