FORSYS

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This Short Term Scientific Meeting was undertaken to investigate the options available in progressing the development of a MS Excel-based Decision Support System (DSS) and to introduce the main concepts of DSS development to a beginner in this field of research.

Finland is a country with a high proportion of private forest ownership. It also has a long history of DSS development and application in all aspects of forestry. It was therefore chosen as an appropriate location to learn about DSS development.

The specific aims of this STSM were as follows:

- To gain experience of Finnish DSS systems in order to compare the level of development of the Irish MS-Excel based system
- To seek input on the development of the existing Irish system in terms of the type of information input, the level of functionality and usefulness of outputs
- To compare the relative advantages of internet based systems and MS applications (including levels of functionality and user-friendliness)
- To discuss how the objectives of forest owners can be written into a DSS, how quality control can be introduced and the value of optimisation components

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The management and State involvement in forestry in Finland differ significantly in comparison to Ireland. In Finland there is a long history of State subsidies for the production of management plans for private forest holdings. Although it is expected that this situation will change in the coming years, the prevailing system provides a level of access to information for owners that has never existed in Ireland. Currently in Ireland, private owners in receipt of State financial aid for forestry development are required to produce a management plan from year 4 to year 10 where the plantation exceeds 10 ha for conifers and 5 ha for broadleaves. Thereafter, a management plan is required from year 10 to year 20. These early management plans are very basic in nature and after year 20, there is no requirement nor incentive for the production of management plans for small private holdings.

Background to PSFM

The Irish Government requires that forest owners in receipt of State funding demonstrate the practice of SFM through adherence to the framework described in the Irish National Forest Standard, The Code of Best Forest Practice and the suite of six Environmental Guidelines. The research project Practi-SFM was initiated in 2001 to develop a user-friendly multi-resource inventory and decision support tool to produce operational SFM plans for private forest owners (Barrett et al. 2007).

The Irish system, Practi-SFM (PSFM), is currently based in MS Excel. This makes it very accessible and user-friendly but has implications in terms of its further development and poses coding problems as newer versions of MS Excel emerge. The input data for the system comprise of plot level timber and non-timber data. The non-timber inventory protocol was developed using best practice and the methodologies selected reflected the criteria and indicators as outlined in the Irish National Forest Standard (Barrett et al. 2007).

Input data is processed to produce inventory statistics and a range of possible management options is generated. The user selects from British Forestry Commission Yield Models, Irish Dynamic Yield Models or a user defined method. The planning horizon is 10 years with operations scheduled into five two-year periods.

The user manually selects a single management option or a range of management options for each unit in the forest. While this allows the user a great deal of flexibility and control over the system, it is acknowledged as being quite laborious and may not result in the most effective management option for that unit or may not contribute to the overall goals for the management of the forest. The simulation is then run and produces an output sheet detailing the production assortments per period for each stand and a range of summary tables for the forest.

A goal analysis tool allows the user to view how selected options are affecting a range of parameters (for example, total volume production, total area of retention, balance between softwood and hardwood area, deer cover rating). Within the goal analysis tool, the selected options can be changed, again at stand level, to achieve a better balance across the goals.

There is an option to include a map of the property which can be used to display the selected management options. This is a useful feature in that it gives the user the possibility to create a visual map of proposed operations. It is possible to change selected management options by selecting the stand from the map interface.

A financial analysis tool provides information for the manager/owner on the costs associated with the selected plan across the range of forest operations indicated, as well as outlining forest level costs and income from timber sales, grant aid, etc.

Phase two of this project seeks to further develop this tool to include a communication interface and to build in a level of optimisation in the decision making process.

Introduction to Finnish DSS

DSS have been used in all aspects of Finnish forestry for many years.

MELA was one of the first systems to be developed and has been used widely since the 1980s. This system has separate growth simulation and optimisation tools and can be used at national, regional, company or forest level. While MELA has been updated several times, it still requires a high level of expertise by the user. To counter this, several more recent systems have been developed which utilise the output of MELA and facilitate user interaction for various purposes.

SIMO is a forest management planning tool and is the result of a research project between the University of Helsinki and industry partners. Funding was provided by TEKES, the Finnish funding agency for technology and innovation. One of the objectives was to build a system that was extendable and modifiable (Rasinmäki et al. 2009). SIMO was developed using open source software and is controlled by command line input. While considered more user friendly than MELA, a level of user expertise in XML is required, however, there are plans to address this through the development of a user-friendly interface.

This system has been developed commercially and is offered as an adaptable tool for all aspects of forest management – its structure means that additional functionality can be added depending on the requirements of each user. It is envisaged that the move away from State-subsidised forest planning for private owners will create a requirement for adaptable and flexible private forest planning systems.

Aspects of the SIMO system that may offer direction in the development of the fledging Irish system include the structuring of the system to reflect a separation between the data and the models that operate on it, thus ensuring that the system can be extended to include new data sources and new forest management objectives.

In Finland, Internet services have been used for browsing draft forest plans, updating maps, completion of felling reports, etc., for some time. The MESTA system was developed to broaden the use of the Internet in forest planning and to address the requirement for multi-objective planning.

MESTA is an internet-based planning system which allows users to compare a number of alternate forest plans by selecting a range of goals and applying a threshold acceptability level to them. The system then displays graphically how each plan performs in relation to the selected goals (Pasanen et al. 2005).

The advantages that the MESTA system offers is that it demonstrates to users the interactions between various (often contradictory) goals and how compromise is reached re ‘threshold acceptability levels’ to achieve an acceptable plan. It is a step back from optimisation in that the users are setting threshold levels for various goals and attempting to achieve an acceptable balance. The value of MESTA is clear in participatory planning processes where stakeholders have quite diverse objectives in forest management.

MESTA is a good example of a system that matches the objectives of owners with an understandable and usable forest planning support system and has some similarities with the goal analysis tool in the PSFM system.

MONTE and Arborex were two more DSS that were introduced. Both offer visual manipulation facilities for users and are flexible and adaptable systems.

Summary

Discussions with Finnish experts suggested that the major difference the between PSFM and standard Finnish systems is the planning level – the current focus of the Irish system is at stand level as opposed to a holding level which is the norm under Finnish conditions.

Another area for thought it the possibility of developing different user interfaces for the program depending on the output requirements of the user – the manager will need full access and functionality while the forest owner may wish to view decisions made and their implications for the property and income levels.

It was generally acknowledged that MS Excel is not an ideal environment for a DSS but its advantages in being user-friendly and transparent were also noted.

While several of the most recent Finnish systems include some reference to multi-objective planning, it was suggested that the norm in forest management is to focus on the traditional idea of 'best practice' which reflects sustained timber production and standardising income. It was indicated that there has been little call for anything else by private forest owners. While the same can be said of forest owners in Ireland, the majority of Irish timber is sold into markets where third party certification of SFM is required. The inclusion of non-timber data in the PSFM program will be a useful tool for owners when seeking certification at the maturity of their crop.

It was suggested that one method of advancing the PSFM program to introduce optimisation at the stand level where one option per stand will be selected based on a utility function. This would take into account the weighted objectives of the owner for the forest as a whole and would simplify the planning process. Such a system could be developed with LP or more appropriately with heuristics to take account of spatial constraints.

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