Computer software requirements in Forest Management

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COFORD
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Foreword

The management of forest operations from establishment through to harvesting has always been a complex task. The fact that the Irish forest estate is disperse adds to the challenge of efficient planning and management. However these factors increase the possibilities for the use of information technology (IT) to aid the forest manager. Today, forest management not only involves economic management but also incorporates the principles of sustainable forest management and certification.

With the advent of computers, the World Wide Web and dedicated management software the task of forest management can be made somewhat easier; but there is a lack of information on the requirements of both growers and foresters and on the suitability of internationally available software for Irish conditions.

This COFORD funded survey is the first extensive study exploring the software and decision support needs of both the forester and grower at this crucial time in forest planning. Much useful information has been gathered. This publication will direct future software developments and training initiatives in the forest sector. Furthermore, IT will continue to be high on the COFORD list of priorities. We will ensure that future projects will optimise the capabilities of IT to enhance the industry's competitiveness.

David Nevins

Chairman

September 2000

Acknowledgements

The completion of this study would not have been possible without the help and support of a large number of people.

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Finally we must thank the approved foresters, and members of the farm forestry community for their willing participation in the research survey.

1 Introduction

Commercial forestry in Ireland is still in its infancy. Nonetheless, as a result of government incentives for private growers over the last twenty years, a large area of private forest is now approaching the age of first thinning. Although the requirement for forest management computer software has been negligible to date, the steadily increasing number of private growers (the majority having no formal forestry training) will soon be faced with long-term management decisions regarding their plantations.

The main barriers to many private growers and foresters using computers and information technology as decision support tools in forestry, are believed to be cost and lack of computer skills. These problems need to be addressed. It is important for Irish forestry that private growers take an interest in, and play an active role in, the long-term management of their forests (Wall and Ní Dhubháin, 1998). Intuitive software can help to achieve this by providing management support in an efficient and easy-to-use manner.

Unfortunately, as development costs are sizeable and the number of potential customers relatively low, the unit cost of specially developed forest management software would be high. Most growers and foresters in Ireland would therefore find it difficult to justify the cost of expensive customised software. Market research is necessary to determine the perceived value and potential market in Ireland for suitable forest management software.

While specialised software for forest management is available from a host of companies throughout the world, its apparent scarcity in Ireland lies in the fact that it is not readily available to potential users. In the absence of international standards and codes of practice, such software is often developed on a project specific basis, or is designed to cater exclusively for specific data or region specific data models. These may be offered locally or advertised internationally on small-scale websites, but are generally not released into the public domain as 'off-the-shelf' software.

There is, therefore, a need to identify what forest management software is available internationally and evaluate this software in the context of Irish forestry.

2 Project objectives

The project had two objectives:

1. To determine the perceived value and potential market for forest management software in Ireland as well as gather information as to the functions that forest management software would be expected to fulfil.
2. To identify what forest management software was available globally and to establish the relevance of such software for Irish forestry.

3 Methodology

3.1 Methodology Employed

The primary objective of the project was to assess the perceptions and potential market for forest management software in this country. Surveying was deemed the most appropriate method to obtain such information. The forest management community is very diverse, but the population could be divided into three categories:

(i) prominent farm foresters;

(ii) approved foresters;
listed and defined by the Forest Service as approved forest companies and competent persons. Approved foresters are recognised by the Forest Service as having sufficient academic qualifications or experience in forestry as to be capable of successfully establishing and managing a forestry plantation to accepted standards.

(iii) farm foresters
as defined by the Forest Service, are those farmers who are also engaged in the practise of forestry. (At the time of this survey there were approximately 8,000 farm foresters in Ireland.)

Different survey techniques were employed for each of the three categories above, as the information to be obtained from each survey varied slightly. The prominent farm forester group acted as a pilot study for devising the other two surveys. The results from this survey are not therefore presented. A total of four prominent farm foresters were interviewed during November 1999. The survey took the form of unstructured interviews.

A total of 30 approved foresters were interviewed between November 1999 and January 2000. These interviews consisted of both structured and semi-structured sections.

The final group, the farm foresters, were contacted by mail at the beginning of November 1999 and a total of 355 completed questionnaires were received by January 2000. The full methodology employed is presented in appendix I. Questionnaires and frequencies for the farm forestry and approved foresters groups are presented in appendices II and III.

The second objective of this study was to identify forest management software available globally. The sources of information accessed included Irish and British forestry publications as well as the World Wide Web. The World Wide Web search concentrated primarily on information sources based in Britain, the United States, Canada and New Zealand.

4 Results

Some of the key results have been extracted from the surveys and are presented in the following sections. The first section (4.1), summarises and compares survey results regarding computer ownership and usage between the two groups - farm foresters and approved foresters. Subsequently, results from these two different groups are dealt with independently (sections 4.2 and 4.3). Finally, the results of the forest management software search are presented in section 4.4.

4.1 Computer Ownership and Usage

The difference in computer knowledge between the two groups was considerable, with 42% of the farm forester group claiming to have no computer knowledge as opposed to 16% in the approved forester group (see table 4.1).

Table 4.1 Computer knowledge, ownership and usage for Farm forester and Approved Forester groups.

		Farm forester group	Approved forester group
		%	%
Computer knowledge	None	42	16
	Beginner	33	17
	Intermediate/advanced	25	67
Received training		N/A	57
Ownership	Owns	39	77
	Has access	14	16
Usage	Daily	48	47
	Weekly	28	27

A similarly large difference is evident between the two groups for those who classed their computer knowledge as intermediate/advanced. As might be expected, computer knowledge, training and ownership all rate higher for the approved forester group. However, usage of computers, be that daily or weekly is almost identical for both groups.

For both groups the computers being used are mostly modern, with 52% of farm forester and 70% of approved forester respondents using 'Pentium' PCs. Almost half of the approved foresters who already own computers intend to upgrade within the next twelve months. Within the farm forester group, 31% of those not yet owning a computer expressed the intention to purchase one within a year.

Knowledge of which type of computer operating system was being used was very high, at 77% among the farm forester group and 87% among the approved forester group. For both groups the most popular operating systems were Windows '95 and '98.

4.2 Farm Forester Survey

4.2.1 Computers and farming

Only 17% of respondents use a computer for farm management. Interestingly, half of the respondents who use their computers for business, state that they do not use their computers for the management of their farm.

In terms of software used, the most popular application used by farm foresters is Microsoft Word ™ (a word processing application). Microsoft Excel ™ (a spreadsheet application) is also very popular, with some farmers also using Microsoft Access ™ (a database application). The Microsoft Office suite of applications is by far the most popular package used. Twenty nine percent of respondents who own computers use a software package to keep farm accounts.

4.2.2 Details of forest plantations

Among respondents, the mean plantation size was 22 ha. This is considerably larger than the national average of approximately 8 ha and is due to the heavier weighting of a couple of very large forest areas (>400 ha) that were included in the survey. An interesting finding is the relationship between computer ownership and size of plantation, with the mean plantation size for those farmers who are also computer owners increasing to 36 ha. Conifers were the most popular species in plantations, with 66% of respondents' plantations consisting of at least 60% conifers. Knowledge of the proportion of broadleaves to conifers in plantations is important when designing forest management software (for example, for yield models).

4.2.3 Distribution of forest sizes

The distribution of forest sizes is presented in figure 4.1

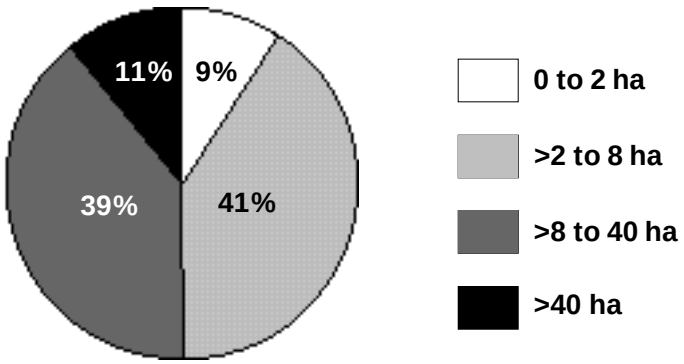

Fig. 4.1 Distribution of forest sizes among farm forester respondents.

4.2.4 Distribution of age classes

The age profile of the forest plantations is presented in figure 4.2 below. Almost two-thirds of the respondents' total forest area is between 4-12 years old. As first thinning approaches for these plantations, there will be an increasing pressure for management plans and consultancy.

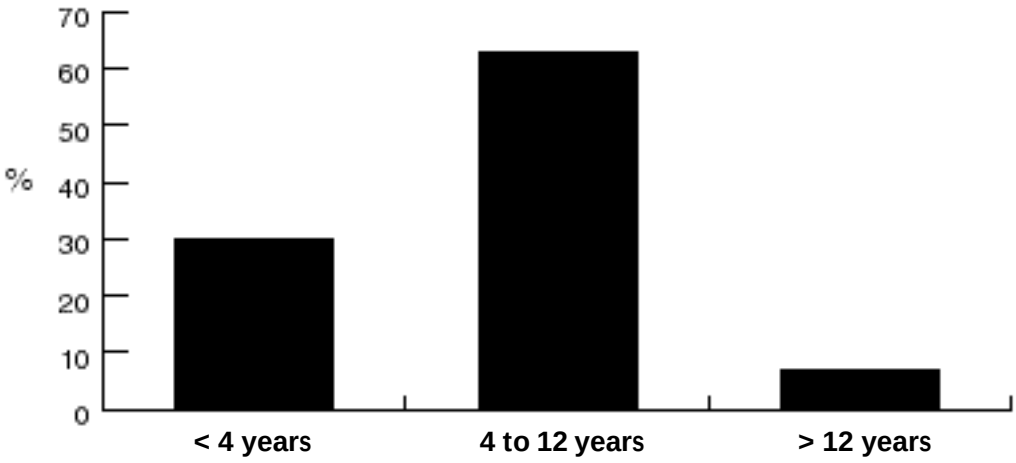

Fig. 4.2 Distribution of forest age classes among farm forester group.

4.2.5 Farmers' role in forest management

In total, 62% of farmers indicated that they play an active role in the management of their forests. Those farmers who indicated that they do not play an active role considered that lack of time was the single biggest reason. Lack of management skills, among other reasons, was also mentioned as a deterrent. Only 17% of farmers surveyed have had any formal training in forestry. Generally such training took the form of short, one-day courses held by Coillte or Teagasc.

4.2.6 Use of computers in forest management

At the time of this survey, only 5% of all farm forester respondents used a computer for any aspect of the management of their forest. Even among the group who owned computers, only 12% were using their computer for forest management. Participants were queried as to the aspects of forest management that could be most usefully included in a software package. Figure 4.3 provides a breakdown of the responses to this question. Results are presented using a weighted scoring system and suggest that farm foresters greatest requirement lies in the financial aspect of forest management, with investment appraisal and cash-flow analysis scoring highest. However, the other aspects of forest management also scored quite high, suggesting that a broad software package would find most favour with farm foresters.

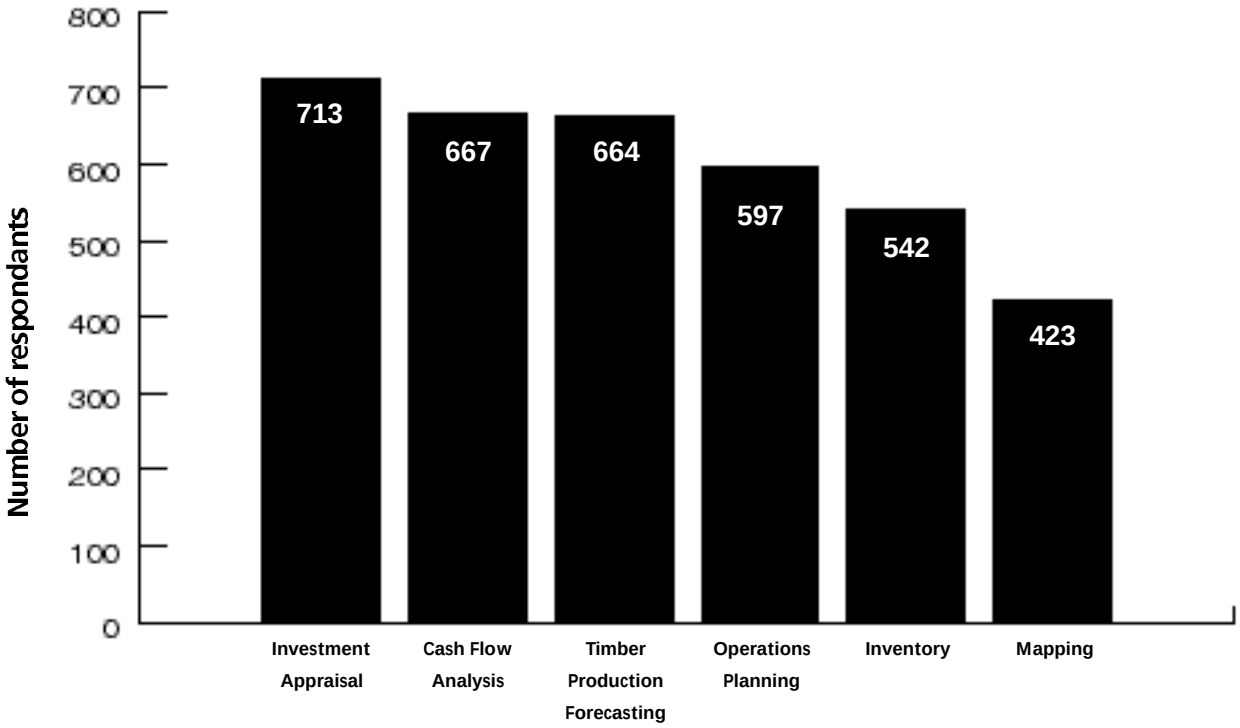

Fig. 4.3 Farm foresters preferences for a computer package.

4.2.7 Interest in specialised forest management software

In total, 44% of farm foresters indicated that they would use specialised software for forest management if it was available. However, among those who own a computer, interest in specialised software was even greater at 63%. This shows a strong relationship between computer ownership and stated willingness to use forest management software. Reasons for not using forest management software included (in order of frequency):

- lack of interest in computers;
- difficulty;
- holdings too small to justify use of software;
- insufficient knowledge of forestry and/or computers;
- inconvenience and lack of time.

4.3 Approved Forester Survey

Details of computer ownership and usage among the approved forester group are presented and compared with farm foresters' responses, as outlined in section 4.1.

4.3.1 Forest management

The mean size of forests being managed by each approved forester was 400 ha. In total, 81% of the forest area being managed by approved foresters consisted of conifers. In addition, almost 60% of the total forest area under management was under 4 years old as outlined in figure 4.4. This suggests that approved foresters are predominately involved in forest establishment.

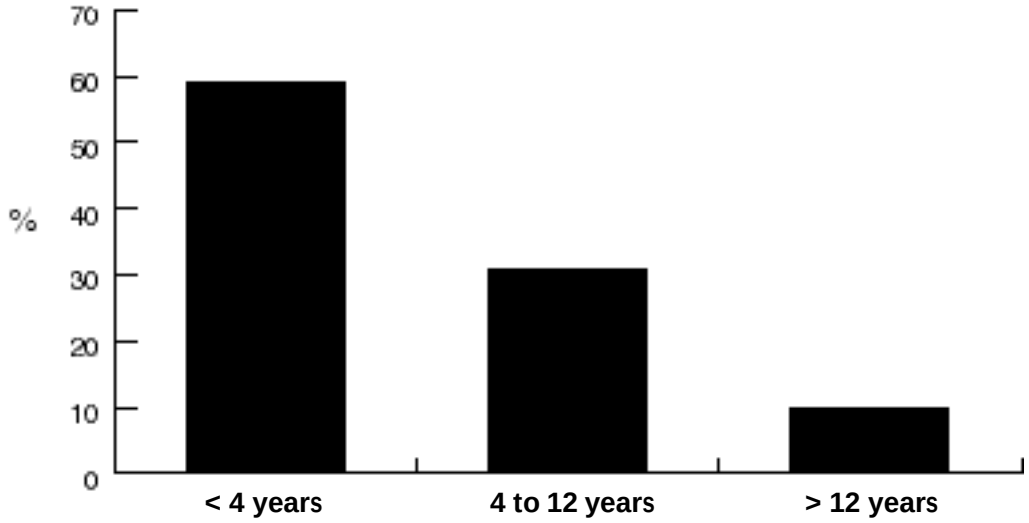

Fig. 4.4 Age profile of forest plantations managed by approved foresters

4.3.2 Required functionality from forest management software

Participants were queried as to the aspects of forest management that could be most usefully included in a software package. Figure 4.5 provides a breakdown of the responses to this question. Results suggest that approved foresters have most interest in the planning aspects of forest management, with mapping, investment appraisal and operations planning scoring highest.

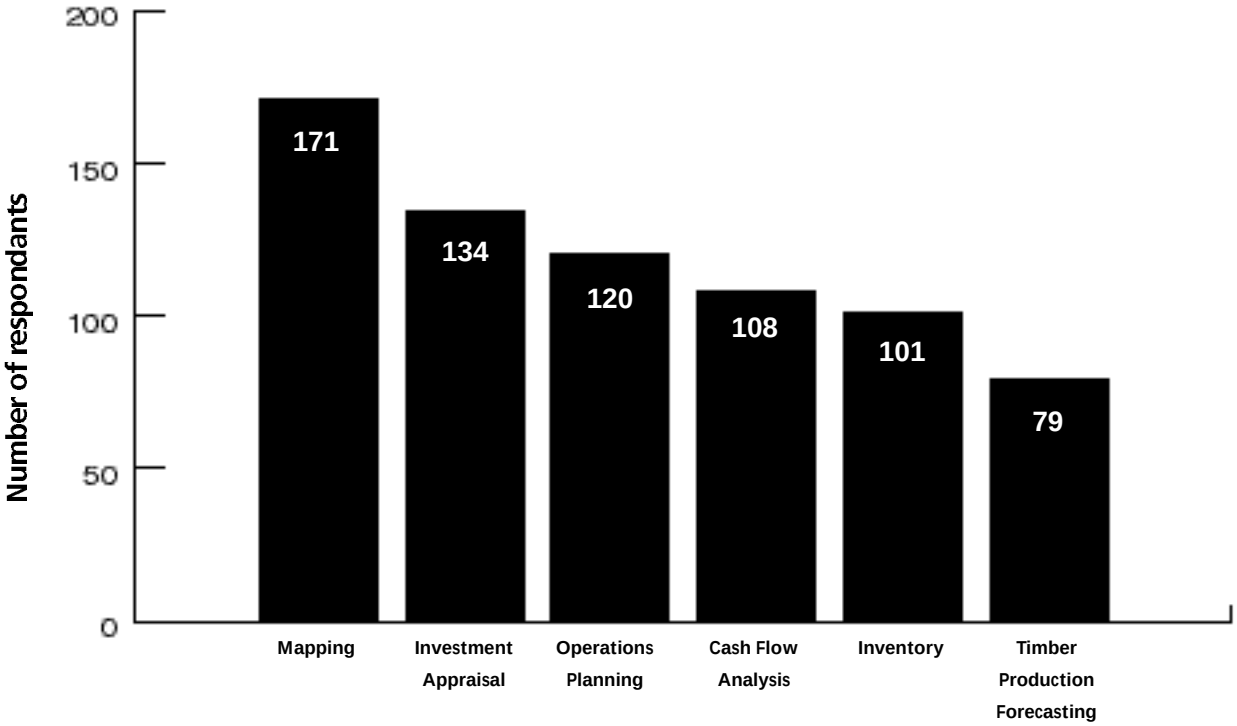

Fig. 4.5 Approved forester preferences in a computer package

It could be suggested that the relatively low interest in timber forecasting may have been due to the fact that the majority of forests that respondents were dealing with had yet to reach the timber harvesting stages of their rotation.

4.3.3 Use of computers in forest management

Over 85% of respondents regarded geographical information systems (GIS) as being essential to forest management. Most are familiar with GIS concepts and have seen a GIS in operation. However, only one third have ever used a GIS and only 13% own a GIS package. Of this 13%, the software ArcView ™ and MapInfo™ were equally represented. Despite the perceived importance of GIS, two thirds of respondents are still calculating figures for their forest operations by pen and paper. Only one third use a computer for calculations (mainly using Microsoft Excel ™ spreadsheets), while 64% do not perform any checks on their calculations (mainly citing lack of time). Only 10% ever derive statistics from their figures. Nonetheless, 93% of approved foresters indicated that they would use specialised software for forest management if it was available.

4.4 Existing Forest Management Software Search and Evaluation

4.4.1 Applications identified

Following a search of the World Wide Web and a publication review, a large number of forestry software applications were identified. Although the search was worldwide, language barriers directed the search towards English speaking nations with developed forest industries such as the United States, Canada, Australia, New Zealand and Britain. Over sixty forestry applications were identified and thirty one were selected for review on the basis of relevance to this project. Of these, approximately half are commercial, while the other half are the products of research projects carried out by universities and forest authorities.

4.4.1.1 Commercial applications

The commercial applications are, for the most part, easy to install, well presented, easy to navigate and offer comprehensive, integrated functionality. However, many of these applications are over-complicated and expensive, as a result of efforts to provide as many customers as possible with a flexible, 'one-stop shop' solution for forest management. Like most commercial software, the functionality offered is explained well, but the underlying algorithms/coding used to achieve the results are treated as confidential, proprietary information.

4.4.1.2 Non-commercial / research applications

The research applications tend to have a narrow focus and provide just enough functionality to achieve the desired results. In general, greater emphasis is placed on the underlying data used to achieve the results than on the application architecture used to process the results. Non-commercial applications (as a result of they being mostly publicly funded) offer much more underlying information and are often made available for free. Few offer the type of comprehensive, integrated functionality required for commercial forest management.

4.4.2 Suitability of the software in an Irish context

A small number of the applications came close to providing the functionality required for particular areas of forest management as carried out by forestry professionals in Ireland. However, none succeeded in meeting these requirements without some modification. Those packages that were considered most suitable for Irish requirements are detailed in section 4.4.3 For a full list of all the applications identified in the study please refer to appendix IV.

4.4.3 Evaluation of forest management software

Woodplan (Badenoch Land Management)

This package offers a full suite of forest management software and probably offers the closest match to what is required by approved foresters in Ireland. Woodplan suffers from a low reputation among some Irish forestry professionals as a result of poorly received early releases. The new Windows release has attempted to tackle these problems.

Functionality: Data storage for individual stands of trees;
A mapping system;
A forecasting and valuation module;
A module for recording harvesting operations and timber felled;
Valuations for standing timber;
Landscape modelling tool.

Cost: Commercial, price not available.

Suitability: Approved foresters and farm foresters.

Woodstock & Stanley (RemSoft Software)

This company offers two applications (Woodstock and Stanley) which integrate to provide inventory and management decision support software. Woodstock appears to work independently of growth models, leaving users to calculate and input growth forecasts. It uses sophisticated linear programming techniques to produce optimal management strategies and then outputs the results in a variety of report formats. These results are readily integrated into Stanley, where they can be interpreted spatially using maps produced by ArcView™ GIS software. These two applications combine to offer an attractive package. However, the reliance on ArcView™ GIS software for mapping will increase the cost of this package.

Functionality: Woodstock - Forest modelling system;
Stanley - Produces spatial harvesting plan.

Cost: Commercial, price not available.

Suitability: Approved foresters.

Assisi Forest 98 / Assisi Inventory 2000 (Assisi)

Assisi Inventory 2000 allows tracking of trees, fallen trees, vegetation and regeneration data. This software can store and compile raw inventory data into volume and value estimates using a variety of user-definable volume equations and user defined grades. Assisi Forest 98 uses inventory data produced from Assisi Inventory 2000, together with a schedule of management actions, to design harvest strategies and estimate tree growth, volume and cash flow. Probably the most important feature of this software is its ability to incorporate third party modelling and form equations. This increases its viability in an Irish context. Assisi applications integrate to provide a substantial application worthy of consideration.

Note: Assisi software is built using the Assisi Forest Object Library. This is a library of programmable objects that can be assembled into new forestry simulation programs. This eliminates the cost of reprogramming forestry functions that are common to many operations. This object library is sold separately and was not evaluated during this study.

Functionality: Timber and growth mortality based on models;
Volume calculation for both standing and harvested timber;
Grading of harvested timber;
User defineable management plans;
Cash flow analysis.

Cost: Commercial, licensed on a per system basis.

Suitability: Approved foresters .

NED Software (USDA Forest Service)

This is an 'expert' forest management system being developed by the USDA Forest Service to aid resource managers develop goals, assess current and future conditions and produce sustainable management plans for forest properties. The software comprises a number of stand-alone modules that have been released separately into the public domain over the past two years. These are now being integrated into one all-inclusive package due for release this year. As it is an 'expert' system, it relies on local expertise from the North Western United States and will provide prescriptions only applicable to that area.

An assessment of three of the component modules already available clearly suggests that the integrated version of NED will be an excellent package. It is the most powerful package to have been identified in this study, and will be available free of charge for download over the Internet. NED should be investigated further to assess the potential to integrate Irish 'expert' information into the application engine.

Functionality: Three modules assessed

- Forest Stewardship / Management Planning Guide. An informative module on the concept and process of forest management.
- Stand Inventory Processor and Simulator.
- Evaluation of species / Habitat matrices.

Cost: Free of charge.

Suitability: A similar system based on an Irish 'expert' system would prove very useful to approved foresters and farm foresters, as well as many other interested parties.

FORVAL (Mississippi State University)

Functionality: This program is designed to help appraise investments in forestry. It deals with financial criteria such as Net Present Value (NPV), Rate of Return, Annual Equivalent Income, Benefit/Cost Ratio, Soil Expectation Value and a Future Value Option for projecting the value of a single cash flow at a future date. It will also calculate monthly or annual payments, pre-commercial timber value and projected stumpage price.

Cost: Free of charge.

Suitability: Approved foresters and farm foresters.

SVS Stand Visualisation System (USDA Forest Service)

Functionality: This is a graphics application designed to depict various stand conditions comprising a number of strata e.g. trees, shrubs and felled trees. It was developed as part of a research program to aid communication of silvicultural treatments and forest management alternatives. The software also provides tabular and graphical summaries of stand information before and after treatment. Functionality is limited.

Cost: Free of charge.

Suitability: Approved foresters.

Softree - Terrain Tools (Natural Resource Software)

Functionality: This is an easy to use mapping package. It includes functions to produce quality output without the complexity of similar products. It accepts GPS data and coordinate files such as ASCII or DXF which are standard formats available from the Irish Ordinance Survey.

Cost: $179.

Suitability: Approved foresters.

Fors/Map (Forest Resources Systems Institute)

Functionality: This is a mapping facility customised with enhancements for forestry and natural resources. Fors/Map offers all of the functionality one would expect to find in a quality mapping program.

Cost: $695.

Suitability: Approved foresters.

4.4.4 Other interesting software

This study also identified other interesting forestry software, which although not directly applicable to practical forest management, could prove useful for educational purposes.

Forestry Compendium (CAB International)

Functionality: This is a silvicultural reference tool that provides both the knowledge and means to select potential trees for trials in plantation, agro-forestry and natural forest systems. Module 1 is currently available and concentrates on species used in tropical and subtropical climatic areas in the Asia-Pacific region. This forms part of an on-going project to develop a Global Forestry Compendium due for release in August 2000.

Cost: $995.

Suitability: Forestry Compendium can be used as an operational decision-support tool by forest managers, as a reference guide for researchers and forest planners and as an educational and training tool for workers, teachers, lecturers and students.

Woods of the World CD (Forest World)

Functionality: This is a multimedia database of detailed information on 910 wood species and products, covering 95% of traded wood types. It allows examination of the common names, common uses, distribution, environmental profile, physical and woodworking properties and mechanical values of all these wood types. It covers all important species in North America, Europe, Africa, Latin America and Asia.

Cost: $50 + $3 for shipping and handling.

Suitability: Educational and extension uses.

5 Discussion, Conclusions and Recommendations

The structure of the surveys used for the approved forester group and the farm forester group allowed for a considerable amount of discussion on the required functionality of forest management software. Such comments cannot be assessed quantitatively but rather have been recorded and are presented in sections 5.1 and 5.2, grouped per topic.

5.1 Notable comments from Approved Foresters

5.1.1 Increased professionalism

In many cases the approved foresters felt that computer software would be of benefit merely by increasing the professionalism associated with day-to-day work. It should increase speed and efficiency and enable clear and precise presentation.

5.1.2 Competitive advantage

The approved foresters indicated that they required computer software to enable them to remain cost competitive. Competition is stiff around the country, especially as Teagasc are providing their services free of charge.

5.1.3 Use of spreadsheets

The 35% of approved foresters who used their computers to calculate figures for their forest operations were comfortable with spreadsheet packages such as MS Excel ™. Despite this, the development of flexible spreadsheets and templates for calculations remains a difficult and time consuming task, even for advanced users.

5.1.4 Computer training requirement

Despite the high level of computer ownership, most approved foresters were not completely comfortable using a computer and would benefit from training courses designed to cater for the basic through intermediate levels of usage.

5.1.5 Mapping and GIS requirements

One of the primary concerns for approved foresters was the availability of maps. All concur that an online facility for map referencing, including National Heritage Areas (NHAs), Special Areas of Conservation (SACs) and sensitive water catchments would be useful, though most, if not all, would require new computers or upgrades to run such a facility effectively. Although the benefits of using GIS software are clear (87% regard GIS as essential to modern forest management), such software would require simplification and customisation (reduced functionality) to fit the requirements of the professional forester and would need to be significantly cheaper than current proprietary software.

5.1.6 Software architecture

The learning curve associated with new computer software puts many foresters off the idea of using a custom package. Most foresters were familiar with the Microsoft Office™ environment and suggested that a forest management software package should be based around this suite.

5.1.7 Grant and premium application forms

Grant and premium forms can be time consuming to complete. With the aid of mapping tools and decision support software the time required should be significantly reduced.

5.1.8 Investment appraisal

A high percentage of approved foresters carry out investment appraisal, although each appears to have his/her own way of carrying out such calculations. It is generally agreed that tools enabling calculations such as Net Present Value (NPV) and Internal Rate of Return (IRR) would be extremely useful.

5.1.9 Timber production forecasting

Respondents regarded timber forecasting as one of the least useful exercises for day-to-day forest management and as the least useful module to be supplied with a forest management software package. Despite this, first thinnings are imminent for many clients which results in a need for the drawing up of long-term management plans. Any software that can successfully alleviate the complexity in preparation of such plans would be fully used.

5.1.10 Irish growth models

There was an expressed desire for the release of an Irish growth model coupled with a computer package to derive future yields. The release of either one on its own will have limited use. Until such time as the Irish yield models are released into the public domain, there is a requirement for the British Forestry Commission yield models in digital form. This is being addressed through a COFORD funded project and the Irish models are expected to be available shortly.

5.1.11 Operations scheduling

Operations scheduling didn't appear to be high on the list of priorities for individual forestry consultants and this group didn't have as great a requirement for such a software module. However, those associated with self assessment companies felt that this module would be particularly useful and suggested that it should focus on levelling the flow of work across the entire portfolio and staff resource. It should also highlight operations as they arise and assign a priority status to each. Such functionality may also appeal to those involved with mechanised soil preparation and harvesting operations, as efficient machine scheduling has the potential to substantially reduce costs.

5.1.12 Cost calculations

A module for site costings that managed unit costs per site and per contractor would be useful.

5.1.13 Error checking

Any software developed would benefit from rudimentary error checking, but more importantly respondents would be more content to use tried and tested algorithms rather than their own.

5.1.14 Inventory

As much of the forestry around the country is pre-first thinning, the amount of inventory work being carried out is relatively small. Even as the work becomes more commonplace, only a small number of approved foresters will avail of this work. For the most part, foresters avoid heavy calculations such as those associated with inventories, production forecasting and the associated statistics, because they are time consuming and difficult if not practised regularly. The majority of respondents, however, said that they would take on inventory work if they had a computer application to calculate the figures and generate low level statistics.

5.1.15 Forest visualisation software

Most respondents consider forest visualisation software interesting in concept, but not currently required.

5.2 Notable Comments from Farm Forester Group

In the questionnaire mailed to the farm forestry group there was an open section which asked respondents to share any comments they might have regarding the use of computers in forestry. A variety of replies were given and key comments are presented here in order of decreasing frequency.

5.2.1 Cost

- Plantation too small to justify purchasing a computer package.
- Purchase of the software would depend heavily on cost. Grants should be available to small farmers towards the purchase of computer hardware.

5.2.2 Miscellaneous

- Plantation in thicket stage, thus little management at present.
- Would like to see a dedicated forestry website to provide information on various aspects of forest silviculture and management.
- Management company is looking after the plantation.
- Cannot see the benefits of having a software package for forestry, apart from inventory and record keeping.
- Educational programmes should be available for computer such as on CD-Rom.
- Should be able to connect on-line to the Forest Service to enable application for grants and premiums. National forest GIS should be available on-line via a department website.

5.3 Conclusions

5.3.1 Farm foresters

The results suggest that computer knowledge among the farm forester group is divided, with 42% of respondents having no computer knowledge whatsoever. In addition, the farm forester group is split almost evenly in terms of computer access/ownership. Thus, although 53% either own or have access to a computer, 47% do not. Should those respondents who expressed the intention to purchase a computer within the year do so (31%), these figures obviously will shift drastically. The study found that most farm foresters are actively involved in the management of their forest plantations. This is in contrast to results from a previous study of private forest management (Wall and ní Dhubháin, 1998). However, in the study by Wall and ní Dhubháin (1998), active involvement in forest management was classified qualitatively i.e. the actual level of involvement was assessed. In addition, the assessment was made by a third party and not, as in this study, by the forest owner themselves.

Interestingly, regardless of poor computer knowledge or access to computers, results indicate a strong interest in any software solution that would aid forest management. Two-thirds of respondents indicated that they would use forest management software if it were made available. This suggests that farm foresters are a potential market for forest management software. However, the present lack of use of general farm management software indicates that any forest management software would need to offer clear benefits to the user at an affordable price. The main barriers to using forest management software would be lack of computer skills, lack of forest management skills and the belief that forest holdings are too small to justify using software.

5.3.2 Approved foresters

There is a high level of computer literacy and ownership among approved foresters, as well as strong interest in any software solution that would aid professional forest management. Over 30% either use or have investigated the use of currently available forest management software. This group represents a clear market for any specialised forest management software with the predominant feeling among this group being that any software that increased professionalism and efficiency would be well received.

5.4 Forest management software currently available

A small number of the applications identified in this study came close to providing the functionality required for aspects of forest management as carried out by forestry professionals in Ireland. However, none succeeded in meeting these requirements without modification.

5.5 Recommendations

5.5.1 Forest Service Web Site

Considerable interest was shown in the concept of a Forest Service Web site. Suggestions from survey participants as to what might appear on such a Web site are presented in appendix V. Further research as to the user requirements and design and maintenance issues for such a Web site will be necessary.

5.5.2 Integrated forest management software for the Irish market

Numerous excellent forest management software packages are available around the world, but there is no integrated package that can be used directly in the Irish context. Many of the stand-alone packages, with minor modifications, could be used to individually address some of the aspects of forest management in Ireland, but these individual packages would be very difficult to integrate.

The results of this research can be used to determine if an integrated package suitable for the Irish market can be developed from existing software. If no such package can be developed, then the analysis of existing software can be used in the design of specialised forest management software for the Irish market.

Given the relatively small number of practitioners in the forest industry at present, it is difficult to envisage how a commercially developed package could recoup its development costs and still be available to owners of small forest areas at an affordable unit cost. The same would apply to a package designed specifically for professional/approved foresters. It could be argued that one software package would suffice for both groups. However, any such forest management software would have to be sufficiently comprehensive and accurate, to satisfy the professional requirements of the forestry sector, while also being comprehensible and user friendly for the farm forester market. The logistics of the development of such a package might well prove difficult and demand that separate modules be designed to cater for the different aspects of forest managment. Such modules should have the capacity to be integrated so that the user can build a custom application to suit his/her requirements.

To conclude, having a forest management software package available for the forest sector would benefit the entire industry through better, more informed management and coordination of effort. The elimination of waste in the supply chain could reduce time and costs spent on forest management and improve the overall efficiency and professionalism of the forestry sector.

Appendix I: Full Methodology Employed

Prominent Farm Foresters Survey

The overall objective of this survey was to gain an appreciation of the potential demand for, and required functionality of, a forest management software package aimed at farm foresters.

Candidates were chosen for this survey using judgmental or purposive sampling. Knowledgeable members of the forestry industry were asked to provide the names of potential candidates, chosen on the basis of their profile in the industry and their potential early adoption of computer management techniques. These individuals were then contacted by telephone to establish their willingness to participate in the survey. Interviews were held in November 1999. A total of four individuals were interviewed.

The interviews were unstructured. This allowed a free form of conversation where the interviewer probes the general nature of the problem and asks the interviewee relevant questions. The content, sequence and wording of the questions are left to the interviewer's discretion.

Results from this survey have not been included in the quantitative analysis, however, the interviews were used as a method of finalising the questionnaires used in the other two surveys.

Approved Foresters Survey

The objective of this survey was to identify the functionality required by approved foresters from a computerised forest management system and the perceived value of such a system.

Sampling procedure

As the total population of approved foresters is small, it was decided to hold interviews with as many approved foresters as were willing to participate in the survey. A letter was sent to all approved foresters asking them to return a post-paid card to indicate their willingness to participate in the survey. This mailing generated a very good response, with 39 approved foresters responding. Due to the lack of time, a total of 30 approved foresters were interviewed between November 1999 and January 2000.

Survey technique

Approved foresters, as defined by the Forest Service of the Department of the Marine and Natural Resources, are those individuals recognised by the Service as having sufficient academic qualifications or experience in forestry as to be capable of successfully establishing and managing a forestry plantation to accepted standards.

At the time of this survey there were approximately 80 approved foresters in Ireland. Because of the small numbers involved and the extensive nature of the opinions required from respondents, personal interviewing was considered the best method of data collection. Due to the complex nature of forest

management software, and the lack of in-depth knowledge of computers by most approved foresters, use of a questionnaire alone (with its inherent inflexibility in question wording) was seen as impractical.

The ability to explore different aspects of the complex issues involved was seen as a necessity. In this regard the interview again was considered much more flexible than a questionnaire, allowing different questions to be asked of different respondents, where appropriate. Respondents' misunderstanding of questions could also be recognised and rectified in an interview situation.

However, possibly the most important perceived benefit of interviews was that they would enable spontaneity. The respondents could lead the conversation onto relevant, but unexpected topics. The possible disadvantages inherent in interviewing as a method of data collection were not considered serious enough to negate the advantages of this method. The most serious possible disadvantage of interviewing was considered to be distortion of the results due to the personal bias of the interviewer. Every effort was made to minimise the risks of this distortion by simply guiding the interview with comments and questions, and not making judgements on the opinions stated by interviewees during the interview.

Format of interviews

The format used in the survey was that of the structured interview. In a structured interview, the questions, their sequence and the wording are fixed. Questions may be closed (allowing only certain responses) or open (allowing respondents to elaborate on their answers). The questions posed during the first part of the interview were similar to those posed in the general farm forestry questionnaire. However, the second part of the interview involved a discussion of the required functionality of forest management software. It was thought that interviewees would vary greatly in their understanding of concepts and definitions thus it would not be possible to use a structured interview. Furthermore, the issues to be discussed were of such breadth, that an unstructured interview could become so unfocused as to lose its relevance to the research issue. It was therefore decided that semi-structured interviews would give the best flexibility and coverage of the issues. Section D of the approved foresters' questionnaire (computers & forest management) was used as the interview guide during the discussion. (Appendix II).

Analysis of results

The answers given to the questions from the general farm forestry questionnaire were analysed quantitatively, and give a representative view of approved foresters' use of computers both in general and in forest management. The discussion on the required functionality of forest management software was analysed qualitatively, with the most cogent points grouped together into functional areas so as to build up an overall picture of the requirements.

Farm forester survey

The main objective of the farm forester survey was to quantify the use of computers and software in modern Irish farming. For those farmers already using Information Technology (IT) as a decision support tool, a second objective was to determine the level of their computer skills and their potential interest in forest management software.

Sampling procedure

As the group of farm foresters was too large for a survey of the entire population, it was decided to examine a statistically valid sample of the total. A previous survey carried out in conjunction with the Forest Service had achieved a response rate of 36% (Wall and Ní Dhubháin, 1998). It was believed that a mail questionnaire about computers and software could only expect half that response level. With this in mind a decision was made to mail 1,500 questionnaires with the expectation that a sample of at least 300 would respond. This level of response would allow statistically valid inferences to be drawn for the population of farm foresters as a whole.

The Forest Service keeps a record of all farm foresters, and when approached, agreed to facilitate the survey. The Forest Service picked 1,500 names and addresses of farm foresters from their database using systematic random sampling and sent the questionnaire and cover letter directly to this sample. In this way the names and addresses of the individual farm foresters were not in any way made public.

Probability sampling was used because of the high reliability, high degree of respresentativeness and high generalisability of the results. Systematic random sampling was used for this survey, which is simple random sampling with a short cut for random selection. As there were no obvious order patterns within the population being sampled (the sample is quasi-random) it can be treated as if the sample were effectively a simple random sample.

The survey was mailed to the sample of farm foresters at the beginning of November 1999. Each survey contained a post-paid envelope to minimise the personal cost to the respondent. Between November 1999 and January 2000, 355 completed surveys were returned, which was considered a satisfactory level of response.

Survey methodology

Farm foresters, as defined by the Forest Service of the Department of the Marine and Natural Resources, are those farmers who are also engaged in the practise of forestry. At the time of this survey there were approximately 8,000 farm foresters in Ireland. Because of the large numbers involved and the straightforward nature of the questions to be posed, a mail questionnaire was chosen as the best method of data collection.

In general, mail questionnaires sample many respondents who answer the same questions. The researcher can measure variables, test hypotheses and make inferences.

The hypotheses to be tested by this questionnaire were as follows:

1. Farmers own/have access to computers and are computer literate;
2. Farmers use computers in farm management;
3. Farmers are actively involved in the management of their forests;
4. Farmers would be interested in using a computerised forestry management package.

Format of questionnaire

Each questionnaire was divided into four sections, each of which aimed to test one of the hypotheses listed above (see appendix III Farm forestry survey – questionnaire & frequencies).

The questionnaire contained mainly closed questions, as these are often easier for the respondent to understand and for the analyst to decode. However, a small number of open questions were included in order to test the veracity of the answers to the closed questions, as well as to give the the respondent an opportunity to make comments which could be analysed qualitatively.

Analysis of results

The results of each questionnaire were entered into a Microsoft Access™ database. Each variable was measured for basic frequency and cross tabulation with other relevant variables. Inferences were then drawn from the data in order to test the four hypotheses listed above.

Existing forest management software research

The main objective of this research was to identify what forest management software is available in a global context, and its relevance in an Irish setting.

Research methodology

The sources of information accessed included Irish and UK forestry publications and the World Wide Web (the search concentrated primarily on information sources based in Britain, the United States, Canada and New Zealand).

Analysis of results

All software products identified were evaluated for forestry content and software design, using the information available from the World Wide Web and directly from the suppliers and users where appropriate. The aspects assessed were as follows:

1. Functionality of the software (input, output, algorithms);
2. Availability & cost;
3. Computer specification required;
4. Host software (and ability to communicate with other software);
5. Potential use in Ireland.

Appendix II:

Approved foresters' interviews – questionnaire & frequencies

Section A: Computer Usage

Q.1 Do you own a computer ?

Ans.1 Yes [23] No [7]

Q.2 Do you intend to purchase a computer in the next 12 months ?

Ans.2 Yes [17] No [10] No Answer [3]

Q.3 Do you have access to a computer ?

Ans.3 Yes [28] No [2]

Q.4 How often do you use a computer ?

Ans.4 Every Day [14]

Once a Week [8]

Once a Month [1]

Rarely [3]

Never [3]

No Answer [1]

Q.5 What do you use your computer for ?

Ans.5 Business [24]

Entertainment [13]

Communication [17]

No Answer [4]

Q.6 What type of computer do you use ?

Ans.6 Pentium PC [21]

Other PC [4]

Apple Macintosh [1]

No Answer [4]

Q.7 Do you know what type of system is on your computer ?

Ans.7 Yes [26] No [0] No Answer [4]

If YES please specify which system:

Mac OS [1]

Windows 3.x [2]

Windows 95 [15]

Windows 98 [7]

Windows NT [2]

No Answer [3]

Q.8 How would you rate your level of knowledge about computers ?

Ans.8 None [4]

Beginner [5]

Intermediate [12]

Advanced [8]

No Answer [1]

Q.9 Do you have formal training in the use of computers ?

Ans.9 Yes [17] No [12] No Answer [1]

Q.10 Do you use a software package for keeping accounts ?

Ans.10 Yes [25] No [3] No Answer [2]

Section C: Forest Management

Q.11 What is the total area of your forest that you are currently managing ?

Ans.11 replies (n) [29] No Answer [1]

≤ 500 ha = 9

501- 100 ha =9

>1000 ha = 9

Mean plantation size = 1,000 acres (400 ha)

Q.12 What is the age profile of your forest plantation(s) ?

Ans.12 replies (n) [29] No Answer [1]

Age (years)	% of total forest area
< 4	59
4 - 12	31
> 12	10

Q.13 What percentage of conifers make up your forest plantation(s) ?

Ans.13 replies (n) [29] No Answer [1]

Mean % by Area 81%

Q.14 Which aspects of forest management are you currently involved with ?

Establishment	28
Maintenance	27
Pruning, brashing, roading, formative shaping	24
Inventory	16
Production forecasting	13
Thinning and clearfell	16
Sales	16

Q.15 Do you have any formal training in forestry ?

Kinnity & Shelton	9
Avondale	3
UCD	15
Oxford	1
Other	1

Section D: Computers and Forest Management

Q.16 What aspects of forest management would be most useful to you in a computer package ?

Ans.16

Rank	*1*	*2*	*3*	*4*	*5*	*6*	*7*	□
Weighting	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*RxW*
Invest Appraisal	*2*	*8*	*8*	*7*	*1*	*0*	*1*	*134*
Inventory	*2*	*4*	*2*	*5*	*7*	*6*	*0*	*101*
Forecasting	*0*	*1*	*2*	*4*	*7*	*13*	*0*	*79*
Operations Plan	*5*	*1*	*9*	*2*	*7*	*2*	*1*	*120*
Cash-flow	*2*	*6*	*1*	*7*	*5*	*3*	*4*	*108*
Mapping	*15*	*8*	*2*	*2*	*0*	*0*	*0*	*171*

Other aspects of forest management regarded as useful by the approved foresters include:

(a) On-line communication with the Forest Service enabling Grant and Premia application and contract status monitoring.

(b) Program to record and monitor site visits and prescriptions.

(c) A full site ledger enabling comparisons between projected costs and actual costs so budget may be tracked.

Q.17 Are you familiar with the concept of GIS

Ans.17 Yes [20] Vaguely [8] No [1]

Q.18 Have you ever seen a GIS in operation ?

Ans.18 Yes [26] No [3]

Of the 26 who said that they had seen a GIS in operation 12 are referring solely to a FIPS demonstration.

Q.19 Have you ever used a GIS ?

Ans.19 Yes [10] No [20]

Of the 10 who said that they have used a GIS before, only 4 own a GIS package and actively use one. These are equally split between ArcView™ and MapInfo™.

Q.20 Would you regard GIS as essential to Forest Management ?

Ans.20 Yes [26] No [2] No Answer [2]

Q.21 Do you have a preference for using 6" maps or 25" plans ?

Ans.21 In the field 6" [13] 25" [17]

If digital 6" [0] 25" [30]

Q.22 How do you usually calculate figures for your forest operations e.g. costs ?

Ans.22 By Hand [20] By Computer [10]

Of those using computers all 10 use MS Excel and 2 use additional specialised applications. All those using MS Excel are capable of creating custom spreadsheets.

Q.23 Have you ever been approached regarding forestry software before ?

Ans.23 Yes [9] No [21]

5 have tried out Woodplan by Badenoch Land Management

1 uses PC Inform

1 uses GIS software customised for Forestry

2 use calipers with custom software for forest inventory

Of the 5 who tried Woodplan, 1 purchased (regarded as poor investment and not currently used).

Reasons for not purchasing include:

a Too early in development.
b Not enough work to justify such large investment.
c BFC models and lookup poor.
d Difficult interface.

Q.24 Do you ever perform checks on your figures ?

Ans.24 Yes [11] No [19]

Principal reason for not performing checks is the time involved.

Q.25 Do you ever perform statistics on your figures ?

Ans.25 Yes [3] No [27]

Principal reasons for not calculating statistics are:

a Lack of knowledge
b Lack of confidence
c Not often required
d Lack of time

Q.26 Would you use specialised software for forestry if it was available ?

Ans.26 Yes [28] No [2]

Appendix III:

Farm forestry survey – questionnaire & frequencies

Section A: Computer Usage

Q.1 Do you own a computer ?

Ans.1 Yes [137] No [213] No Answer [5]

Q.2 Do you intend to purchase a computer in the next 12 months ?

Ans.2 Yes [86] No [201] No Answer [69]

Q.3 Do you have access to a computer ?

Ans.3 Yes [143] No [156] No Answer [56]

Q.4 How often do you use a computer ?

Ans.4 Every Day [75]

Once a Week [50]

Once a Month [11]

Rarely 38]

Never [150]

No Answer [31]

Q.5 What do you use your computer for ?

Ans.5 Business [124]

Entertainment [55]

Communication [86]

Other [23]

Q.6 What type of computer do you use ?

Ans.6 Pentium PC [96]

Other PC [59]

Apple Macintosh [9]

Don't know [19]

No Answer [172]

Q.7 Do you know what type of system is on your computer ?

Ans.7 Yes [149] No [45] No Answer [165]

If YES please specify which system:

Mac OS [2]

Windows 3.x [4]

Windows 95 [68]

Windows 98 [60]

Windows NT [3]

No Answer [228]

Q.8 How would you rate your level of knowledge about computers ?

Ans.8 None [140]

Beginner [109]

Intermediate [74]

Advanced [11]

No Answer [21]

Section B: Computers and Farming

Q.9 Do you use a computer for any aspect of the management of your farm ?

Ans.9 Yes [62] No [234] Not Relevant [37]

No Answer [22]

If YES please specify which of the following software you use:

Word Processor

MS Word [44] Word Perfect [4] Other [5]

Spreadsheet

MS Excel [36] Lotus 123 [3] Other [7]

Database

MS Access [17] FoxPro [1] Other [7]

Q.10 Do you use a software package for keeping accounts ?

Ans.10 Yes [42] No [213] Not Relevant [35]

No Answer [65]

Q.11 Do you use any specialised farming software ?

Ans.11 Yes [16] No [239] Not Relevant [33]

No Answer [67]

Section C: Forest Management

Q.12 Are you a forest owner ?

Ans.12 Yes [341] No [1] No Answer [13]

Q.13 What is the total area of your forest plantation(s) ?

Ans.13 replies (n) [333] No Answer [22]

Mean plantation size = 53.29 acres (21.57 ha)

Plantation area (acres)	No. of Respondents
Less than or equal to 5	30
> 5 less than or equal to 10	49
> 10 less than or equal to 20	88
> 20 less than or equal to 30	49
> 30 less than or equal to 40	26
> 40 less than or equal to 50	26
> 50 less than or equal to 100	28
> 100 less than or equal to 500	35
> 1000	2

Q.14 What is the age profile of your forest plantation(s) ?

Ans.14 replies (n) [341] No Answer [14]

Age	% of total forest area
< 4	30
4 - 12	63
> 12	7

Q.15 What percentage of conifers make up your forest plantation(s) ?

Ans.15 replies (n) [298] No Answer [57]

% Conifer	No. of Respondants	% Respondents	% by Area
< or = 30 %	58	17	9
31% - 60%	44	12	12
61% - 90%	96	27	37
>90%	100	28	37
No Answer	57	16	5

Q.16 Do you play an active role in the looking after your forest ?

Ans.16 Yes [221] No [103] No Answer [31]

If you do not play an active role, please give reasons:

replies (n) [101] No Answer [2]

Q.17 Do you have any formal training in forestry ?

Ans.17 Yes [61] No [282] No Answer [12]

Generally short, 1-day Coillte or Teagasc courses.

Section D: Computers and Forest Management

Q.18 Do you use a computer for any aspect of the management of your forest ?

Ans.18 Yes [17] No [313] No Answer [25]

If YES, please specify which aspects:

Investment appraisal	[7]
Inventory	[6]
Timber production forecasting	[4]
Operations planning	[6]
Cash-flow analysis	[9]
Mapping	[3]

Q.19 What aspects of forest management would be most useful to you in a computer package?

Ans.19

Rank	*1*	*2*	*3*	*4*	*5*	*6*	*7*	
Weighting	*7*	*6*	*5*	*4*	*3*	*2*	*1*	*RxW*
Invest Appraisal	*55*	*17*	*22*	*16*	*11*	*9*	*1*	*713*
Inventory	*21*	*19*	*18*	*21*	*31*	*7*	*0*	*542*
Forecasting	*24*	*38*	*29*	*20*	*8*	*9*	*1*	*664*
Operations Plan	*28*	*21*	*23*	*24*	*13*	*12*	*1*	*597*
Cash-flow	*27*	*37*	*19*	*18*	*25*	*7*	*0*	*667*
Mapping	*10*	*9*	*16*	*14*	*18*	*54*	*1*	*423*

Other aspects of forest management which would be regarded as useful include the following:

a General info pertaining to species and silviculture

b On-line grants and premia applications (x5)

Q.20 Would you use specialised software for forest management if it was available?

Ans.20 Yes [157] No [119] No Answer [79]

If you would not use forest management software, please give reasons:

	replies (n) [108]	No Answer [11]
No interest in forest management	[6]	
No interest in computers	[41]	
Lack of time	[9]	
Too difficult	[17]	
Too inconvenient	[10]	
Other	[36]	

Among the 'Other' reasons specified are the following:

a 14 believe that their forest holdings are too small to justify using software.

b 9 reckon that they don't have sufficient knowledge about forestry and/or computers.

c 3 reckon that such software would be too expensive.

d 3 reckon that they are too old to start learning about computers.

Appendix IV: Internet search results

1. Appraisals Software for Windows 95/98/NT

http://www.enfor.com/software/appsoft/index.htm
Stumpage appraisal for use in British Columbia, Canada.

2. Assisi Forest' 98 / Assisi Forest' 2000

http://www.assisisoft.com
Forestry simulation program can be used to design harvesting plans.

3. Assisi Inventory' 2000

http://www.assisisoft.com
Forest inventory. Used to store raw inventory data and compile volume and value estimates.

4. CITYgreen Software

http://www.amfor.org/ufc/cgreen/cgad.html
GIS for mapping urban ecology and measuring the economic benefits of trees, soils and other natural resources.

5. EnVision – Environmental Visualisation System

http://forsys.cfr.washington.edu/envision.html
Stand visualisation software.

6. FARMS Pro – Forest mapping software

http://www.nrtech.com/farmspro.html
Mapping software including customised enhancements for forestry. Has ability to create cruise maps for inventory data collection.

7. Forester's Yield Curve Designer

http://atl.cfs.nrcan.gc.ca/lmn/FYCDWEB.HTM
Aimed at assisting forest management planners and field foresters in the development and validation of timber volume yield curves.

8. Forestry Compendium

http://tree.cabweb.org/efctext.htm
A silvicultural reference tool to assist in selection of species for trials in plantation, agro-forestry and natural forest systems.

9. Forestry Tools for ArcView

http://www.forsonline.org/forestry.htm
A series of tools designed to make ArcView more efficient and more accessible to the part-time user.

10. Fors/map for Windows – Desktop Mapping System

http://www.forsonline.org/mapfor.htme
Mapping facility customised with enhancements for forestry and natural resources.

11. FORVAL – Timberland Investment Appraisal

http://www.cfr.msstate.edu/fwrc/products/software/forval.htm
Forestry evaluation software

12. GenGym – Generalised Growth and Yield Model

http://www.advancedforestry.com/software/gengym/gengym.shtml
Public domain software written and distributed by the US Forest Service. Available for a limited number of species and provenances only.

13. HSG Software for Wood Supply Modelling

http://data.ctn.nrc.ca/ctn.acgi$search?show&key=3407108
Planning system designed by the Canadian Forest Service to assist in the design and evaluation of long-range timber harvest schedules. Tracks the development of stands through time.

14. LMS – Landscape Management System

http://silvae.cfr.washington.edu/lms/lms.html
An evolving application designed to assist in landscape level analysis and planning of forest ecosystems.

15. NED Software products

http://www.fs.fed.us/ne/burlington/ned/indexb.htm

NED is a collection of software products being developed by the USDA Forest Service. The software is intended to aid resource managers, develop goals, assess current and future conditions and produce sustainable management plans for forest properties. Three modules avalailable:

- The Forest Stewardship/Management Planning Guide
- NED/SIPS – Stand Inventory Processor and Simulator
- NEWILD – Evaluation of Species / Habitat matrices (DeGraaf et. al.)

All of these programs are available with manuals free of charge at the above site address.

16. Organon – ORegon Growth ANalysis and projectiON

http://www.cof.orst.edu/cof/fr/research/organon/

Individual tree growth model developed for southwest and northwest Oregon and the lands of the Stand Management Co-operative.

17. PLANS – Preliminary Logging Analysis System

http://forsys.cfr.washington.edu/plans.html

A set of computer programs designed to assist logging engineers and transportation planners in the development of timber harvest plans for large areas.

18. Remsoft – Woodstock –Forest Modelling System

http://www.remsoft.com/index.html

Remsoft – Environmental Software

Remsoft provides software solutions for forest and wildlife management.

Forest modelling system that can be used in harvest scheduling and wood supply analysis, wildlife management and simulation of forest ecosystems.

19. Remsoft – Stanley – Spatial harvesting block scheduling

http://www.remsoft.com/index.html

Automates the process of developing a spatial harvest plan.

20. SILVAH Software – Silvicultural Decision Software

http://www.fs.fed.us/ne/warren/silvah.html

Silvicultural decision support tool for hardwood stands in the Allegheny plateau and mountain region (US). "Expert" system specific to that region.

21. SmartForest II – An interactive forest visualiser

http://www.imlab.uiuc.edu/smartforest/

A 3-D forest ecosystem simulator provides simulations of visual impact of forest operations over time.

22. Softree – Natural Resource Software – Terrain Tools

http://www.softree.com/products/products.htm

A mapping package.

23. SVS – Stand Visualisation System

http://faculty.washington.edu/mcgoy/svs.html

Software generates graphics to depict various stand conditions.

24. Trema – Tree Management and Mapping Software

http://www.trema.co.uk

Database software for managing forestry and botanical related sample data.

25. TWIGS 3.0 – growth and yield simulation

http://www.snr.missouri.edu/programs/cstwigs.html

Growth and yield simulation program with management and economic components developed for use in the North Central United States.

26. The Virtual Forest

http://www.biology.iupui.edu/v_forest/

An educational CD-ROM aimed at classroom audiences.

27. WinYield for Windows

http://www.forsonline.org/winyield.htm

Timber yield forecasting and planning tool. Allows growth, yield and financial analysis.

28. Woodlands – The System

http://www.woodlandsthesystem.com/Product_Solution_Body.htm

GIS and database software.

29. Woodlot for Windows

http://www.enfor.com/software/woodlot/index.htm

Developed for calculating non-declining even-flow harvest rates.

30. Woodplan Software for Forestry and Estate Management

http://www.woodplan.co.uk

This package offers a full suite of forest management software.

31. Woods of the World CD

http://www.forestworld.com/wow/wow_cd/wowcd_description.html

Multimedia database of detailed information on up to 910 wood species and products, covering 95% of the wood types in trade.

Educational/extension use.

Appendix V:

Approved foresters suggestions for Forest Service Web Pages

Grants & Premium Information

- Up-to-date information regarding Grants and Premiums.
- Changes to species diversification etc.
- Grant information for all schemes including machinery.
- Guidelines for archaeology, fisheries etc.
- Changes to methodology associated with planting guidelines.
- On-line help with regard to filling out forms.
- Explanation on all planting grants e.g. what's involved in woodland improvement.
- Be able to print out application forms in Pdf format.
- Worked examples of cultivation plans and local authority maps.
- Worked examples of new grant procedures (how to apply and fill in forms).

Research Information

- Index pertaining to research findings (COFORD and Coillte):
    - Windthrow;
    - Suitable species and soil types;
    - Diseases;
    - Pests and outbreaks;
    - Pesticides and chemicals and their application;
    - Ecology and the environment;
    - Best forest practice and guidelines;
    - Yield Models.
- What projects are currently being funded (freedom of information).
- Information on grant aid for research.
- New developments.

Reference

- Approved foresters list.
- List of organisations such as ITGA, SIF, COFORD, Teagasc who will provide information and advice.
- FS staff by geographical area with changes highlighted.
- Links to other useful forestry sites.
- Glossary of forest terminology.
- List of contractors per area.
- Booklists for forestry publications (Irish, HMSO etc).
- Up-to-date version of the Green book reference for grants and premiums, simplified with an index would be very useful. Separate printable pages that can be inserted into a ring binder would be preferable.
- Contact persons regarding Fisheries, NHAs, SACs, Sites and Monuments etc.

Pathogens / Pesticides / Application

- Warnings such as pest outbreaks and methods to control the spread.
- New advances in chemicals and pesticides.
- Technical pages on pests and pathogens.

Best Forest Practice

- Best forest practice would definitely be used by foresters across the country.
- Highlights and warnings for silvicultural prescription.

Statistics Information

- Countrywide/countywide forestry statistics as generated from FIPS
- Data relating to investment appraisal such as historic prices, trends, forecasts etc. There is currently no information available.

General Information

- Positive PR. Information encouraging people to plant.
- Lists of contractors and their availability.

• Nurseries and stock.

• Forestry Acts.

• Up-and-coming events, field-days and seminars (FS, ITGA, SIF etc).

• Recommended costs for labour, machinery, etc.

• Press releases.

Mapping

• Sourcing of maps.

• Information related to mapping.

On-line facility to Forest Service

• Processing status of individual grant applications.

• On-line technical query system.

• Should be able to query individual farm forester statistics using a password issued by FS.

Policy

• Policy on forestry (Growing for the Future, fully indexed).

• Policy / personnel / contact numbers for geographical staff.

• Changes to policy in County Councils.

Bulletin Board

• Independent sales and bulletin board.

• Allow advertising.

• Bulletin board for the sale of land and woodlots (mature and semi-mature).

Forest Service General

• Introduction to the Forest Service explaining who they are etc.

• FS news page e.g. what's going on in the planning bill.

Bibliography

Bailey, K. (1985). *Methods of Social Research*, 3rd edition. The Free Press: New York.

Anon. (1996). *Growing for the future – A Strategic Plan for the Development of the Forestry Sector in Ireland*. Department of Agriculture, Food and Forestry: Dublin.

Neuman, L. (1999). *Social Research Methods*, 4th edition, Allyn and Bacon: Boston.

Rex, K. (1999). *Internet Search Techniques: ZDU Student Manual*, Ziff-Davis: New York.

Wall, S. and Ní Dhubháin, Á. (1998). *Management Requirements for Farm Woodlands*, COFORD: Dublin.

For a full listing of the web based information sources used in this study please refer to appendix IV.