Forest Management Planning

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Content

Data collection about privately owned forests in Sweden

1. Short background about Swedish forestry

The forest covers 55 % of the total land area in Sweden. The forest area is 28 million ha according to FAO´s definition. According to the national definition (potential yield higher than 1 m3sk/ha and year) the area is 23 mill ha, of which 0.95 mill is formally protected from timber production, and another 1.850 mill ha are voluntarily set aside by the forest owner (Skogsstyrelsen 2007).

Half of the forest is owned by 410 000 private persons owing 254 000 holdings. The average holding size is app. 50 ha. Private forest companies has 25%, and other owners 25% (the state, communes, the church, others). The privately owned proportion is higher in southern then in northern Sweden. Most private forest owners have other sources of income for their living. Of the owners 38% are women, and 37% do not live close to the holding (Swedish Forest Agency 2006).

Timber production is and has been since long the main use for most of the forest. Sweden is sparsely populated. Nine million people means 2 ha of forest an average, even if the population in clustered. Biodiversity, recreation, carbon sequestration, hunting, berries and mushrooms are important uses. Also, and growing, is the use of wood for production of energy. Reindeer herding occurs in the northern parts of Sweden.

Data about the forests are gathered for different purposes and by different organizations. The forest owners which focus on timber production

2. The national forest inventory

2.1 Aim

The main purposes with the national forest inventory (NFI) are to provide data for planning of the use of the forest resources at the national and regional level, for monitoring of the environment, and for research. The long-term perspective is combined with issues of current importance. The state of and changes in forest resources, such as the structure, growth and cuttings are thus in focus. To the NFI is also connected the Forest Soil Inventory (MI). All land cover types are included, with an emphasis on forest land.

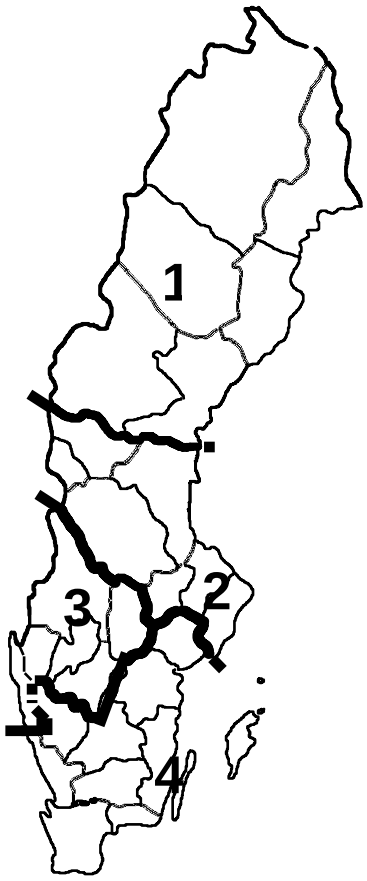
2.2 Use of the data and the results

Data and results are used by authorities, i.e. Swedish Forest Agency, Swedish Environmental Protection Agency, Sweden’s County Administrative Boards and others. Data and results are also used by political organizations and official reports, by researchers, and for education.

A third group of users are the forest companies, forest owner associations and other forest organizations. Also other users of the forest are helped by information from the NFI, such as hunter associations, reindeer herders.

The Swedish NFI presents its results in many ways. An extensive analysis are given in an annual publication (Skogsdata). Standard tables, charts and maps based on mean values from the latest 5 years are presented, but Skogsdata also include a thematic analysis (i.e. growth and removal, young forests, protected forests, damages). Results are also given on the webb (www-nfi.slu.se, www.skogsstyrelsen.se, www.scb.se, www-sml.slu.se/sk/skeng.htm), and on request from any organization or person, in tables or as figures via the telephone.

The results from 1983 to the present are easiest to handle and the fastest to present, but many results can be shown and compared as far back as 1923.



Data from the NFI are used for consequence analysis for management scenarios for the future. The Hugin-system are used for calculations for hundred years. Data are also used together with information from satellites to make thematic estimations for different areas.

Sweden has a long tradition of planning at the regional level. This type of plan is the result of the analysis of different management alternatives (and not optimization, the forest has many owners). The analyses are based on sample plot data from the national forest inventory and since 1985, the Hugin-system (Bengtsson et al 1989, Lundström & Söderberg 1996) has been used. Calculations are done for timber balance areas (see figure 1) and separated among private forest owners and other owners (mainly companies and public owners). Calculations are done for 100 years in 10 periods. National analysis was done 1985, 1992, 1999 and 2003. Special analyses have been done between these dates, including detailed analyses for some areas. There is work going on with new national analysis.

Figure 1. *Timber balance areas in Sweden.*

2.3 Organization

The Swedish National Forest Inventory (the Swedish NFI) is carried out by the Department of Forest Resource Management, Swedish University of Agricultural Sciences in Umeå. The funding comes also from Swedish Environmental Protection Agency.

The NFI was established in 1923, whilst the MI commenced in 1962. Since 1983 there has been a strengthened organization between the Swedish NFI and the Swedish Forest Soil Inventory. This umbrella organization is called The Swedish National Inventory of Forests (RIS). RIS covers everything from forest and soil quality to biodiversity monitoring and assessment of forest and soil carbon stores.

2.4 Design

The inventory is done as a systematic sample plot inventory. The sample plots are clustered to tracts, which each take a day of work (or a half-day in the southernmost parts). The tracts for five years are distributed in a systematic pattern over the country. The country is divided in five regions (Figure 3) and the pattern is denser to the south. One fifth of the tracts are inventoried each year. There are 4 - 12 sample plots on each tract depending on where in Sweden and if permanent or temporary. But there might also be sample plots in between these plots – for stump or regeneration inventory.

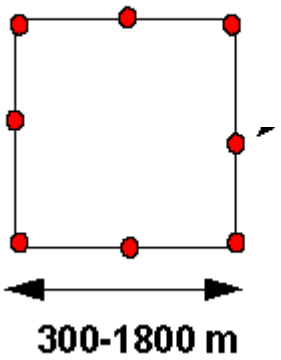


Figure 2. *Schematic tract with sample plots.*

About two thirds of the plots are permanent and one third temporary. Each year 11000 sample plots are inventoried. All types of land are included in the survey, but the most detailed information is gathered on the forest land.

The permanent sample plots are 314 m2 in size, the temporary 154 m2. There are also additional smaller sample plots in plant forests. Totally only 0.0006 % of the forest area are measured (150 ha).

The precision of the estimated figures can be calculated (Chuan-Zong & Ranneby 1992, Toet, Fridman & Holm 2007). Extensive estimations for smaller regions - such as municipalities and water catchment areas - require modified methods of field sampling (denser sampling net) and/or use of remote sensing techniques.

Figure 3. *Regions in the NFI.*

2.5 Performance

The annual field work is carried out by about 40 field workers in 16 teams. Another app 16 employees are responsible for other parts of the organization - preparatory work, finishing work and analysis and presentation of collected data.

Efficient inventory work is dependent on properly carried out preparatory work. The field crews need maps and aerial photographs with, for example, area boundaries delimited, in order to orientate themselves. Furthermore, the crew receives a description of each permanent plot showing the position of trees at the preceding inventory.

A comprehensive range of equipment is used by the crews, which requires regular servicing and sometimes additional equipment.

Regular excursions and training exercises give the field crews the opportunity to practice making the inventories as standardized as possible.

Data collection is carried out during the period May to October. Crews carrying out an inventory of temporary tracts consist of two to three persons. In the case of permanent tracts, the crews consists of three persons, one of them has specialist training from the Swedish Forest Soil Inventory.

2.6 Measured variabels

The inventory cover five different blocks of variables: area, growing stock, flora & fauna, site, and stumps. It is neither useful nor possible to make a full list of all variables in the following text.

Area: Land class, nature protection class, distance to road, surface structure, stand maturity class, performed and suggested management activity, residue, stand area, seed trees, damages by moose, basal area, mean height, stand age, tree species composition, owner category.

Growing stock: diameter at breast height and tree species for all living trees, dbh and height for dead trees, reason and period for death, coordinates on permanent plots. On sample trees also height, crown height, damages, tree class, crown defoliation, age. If stand height is less than 13 dm enumeration of all plants and main crop plants.

Site and flora & fauna: latitude, altitude, soil moisture, soil texture, soil depth, bottom layer, field layer, shrub layer, tree layer, slope and exposition, SI, fodder for fauna, moose fecal.

The age of the sample trees is counted from annual rings on a bore core obtained from the stem at breast height. In the laboratory the annual ring increment is measured using precision instruments. The information is stored in a Microsoft Access database. The estimation of the growth of the Swedish forests is based on this information.

The type of ground vegetation is roughly assessed according to16 field layer and 6 ground layer categories which form the basis of the site index classification. A total of 267 species and groups of species are assessed. For 71 of these, the amount of coverage is recorded. In addition, a detailed assessment of soils is carried out by the Swedish Forest Soil Inventory.

Soil sampling, if possible to a depth to one meter, is performed by the Swedish Forest Soil Inventory. From the sample, a number of attributes are assessed, i.e. the type of soil, mineral texture, type of humus, degree of humification and thickness of the humus layer. Samples are obtained from different soil horizons, which later on are analysed with regard to their pH value, nitrogen and carbon levels, degree of base saturation, heavy metal content etc.

The plot's soil moisture and surface water flow are assessed, as well as its inclination and typographic position. A site index is determined to estimate the site quality class. In addition, the effects of forestry and other human activities are assessed.

The position of the plot is described, partly with regard to administrative boundaries, partly with regard to its location in relation to elements in the landscape, such as roads, fields and

lakes. Also, north and east coordinates together with altitude are recorded. The positions of all plots are located using GPS.

Briefly, inventory work is carried out as follows:
The field crew navigates to the sample plots with GPS, in which each plot position are stored. The position of permanent sample plots is discretely marked. It is very important that the position of the permanent plots cannot be identified by the public, landowners etc. On permanent plots the position of each tree is registered. Temporary sample plots are marked with a tree stick.

A great deal of information is collected for each plot. Strict rules covering how each component of the inventory should be carried out are described in the Field Inventory Manual. Hand-held computers are used to record the data obtained in the field. The data collected are continuously sent to the department in Umeå on CD (Figure 2).

Several routines are used to check the reliability of the data. Some data are checked in the field in the hand-held computers. Further checks are made at the department before the data is finally stored in a database.

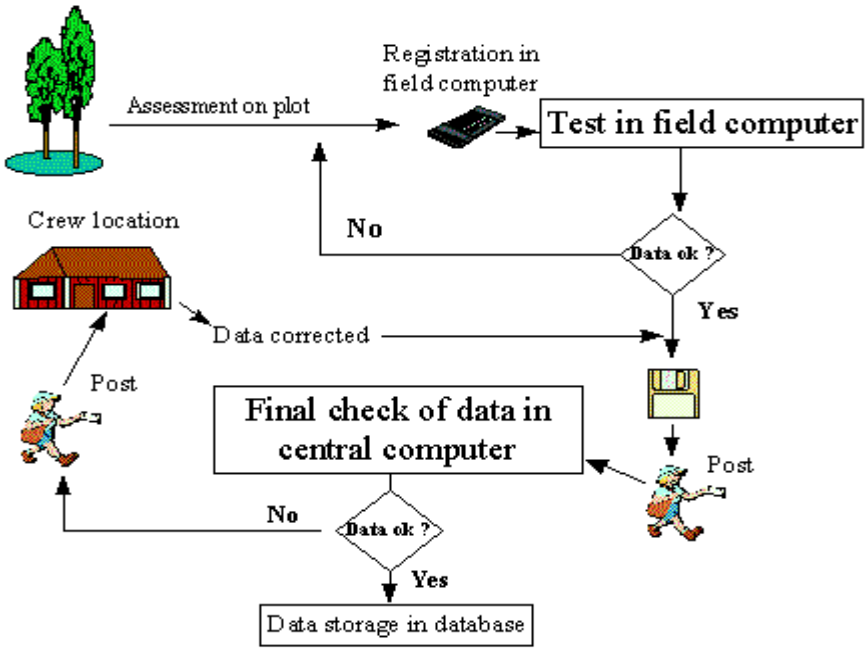


Figure 4. *Flow of data from the field to the data base*.

3. Forest management planning

3.1 History of forest planning

The Swedish Forest Agency began forest management planning in the 1930´s when aerial photos became available. The planning work became more systematic during the 1960's. It was mandatory for all private forest owners to have a management plan according to the Forestry Act between 1983 and 1993. This was largely the result of the forest industry's inability to obtain sufficient amounts of raw timber. A lot of private forest owners had high marginal taxes (>70%) on incomes from the forest and were unwilling to sell timber. Forest owners with management plans had proven more active (and supplied more timber).

Subsidies were available to the Swedish Forest Agency for production of forest management plans. The production of plans was integrated with a national programme the General Forest Inventory of all private forests. From 1983 to 1990, the Swedish Forest Agency produced plans for approximately 700 000 ha per year. Forest plans covered 90 % of all private holdings by 1993 (plans not older than 15 years).

The plans were produced with rough subjective methods, i.e. estimations rather than measurements.

There where criticisms of these plans for many reasons. The quality was low in the description of the stands (subjective estimations, with no or few measurements) as well as in the management proposals (based on subjective assessment and not analysis). This was made obvious by the development of a new planning system (The Forest Management Planning Package, Jonsson et al 1993) designed for forest companies with large holdings. This system demonstrated the need for changing forest management practices in company forests.
The system was also demonstrated on a few private holdings and that showed the low quality (Eriksson, 1990). The management proposals were much based on ideas of high volume production and not efficient resource or capital management.

The programme was a considerable expenditure for the state in the form of subsidies. According to nature conservationists, the programme also placed too much focus on timber production and too little on nature conservation. At the beginning of 1990's the forest management plans became voluntary again, and planning activities fell to less then 200 000 hectares annually. Sweden adopted a new Forest Act from 1994, where the general idea was to give equal weight to production and environmental goals.

Environmental consideration was included in the forest management plans, and different variables were assessed for this purpose. The Swedish Forest Agency and the forest owners' association, Södra in the southern part of Sweden and head quarter in Växjö, developed a system called "Green Forest Management plans" in 1995. This system has generally speaking been widely adopted since then, but not by all.

For each stand a long-term production and/or environmental goal is formulated in one of four classes and the assessment of forest production and nature values are reported. These are PG - production goal with general nature conservation consideration, PF (or K) - production goals with reinforced conservation consideration, NS - nature conservation goals where management is needed to sustain the conservation value, and finally NO - nature conservation goals where the forest should be left untouched. The balance between these goal classes is specified on estate level. In a "Green Forest Management Plan" 5 % of the forest area should be in goal class NS/NO, another 5 % in PF, and 90% in PG. Holdings of less than 20 ha have

no requirements regarding balance. A Green FM plan is required within 5 years for certification from FSC (Forest Stewardship Council).

Other organisations may make different demands. The forest owners' association, Norra Skogsägarna with the head quarter in Umeå (Eriksson J pers comm) call their FM plans "Ecoplan" (eco from both ecological and economic) and consider 5 % NS/NO the central part and put less emphasis on another 5 % PF.

Since 2003 a Forest and Environment Declaration is required according to the Forest Act (Swedish Forest Agency 2006). The owner must have information about his or her forest. These data are both forest data for stands such as area, age, if regeneration activities are required, and environmental data: area with broadleaved hardwood, nature reserves, protected biotops, wetlands with special value, the presence of archaeological sites, and other valuable areas. This regulation makes at least a simple forest management plan necessary. The information is for the benefit of the forest owner and there is no plan within the Swedish Forest Agency for a follow-up of the regulation.

An official forest policy report 2006 (SOU 2006) suggested mandatory forest management plans. In the election a new government was elected and they have a different view. Also, they will probably withdraw the regulation about the Forest and Environmental Declaration from 2008, and change the definition of forest land to be in accordance with the FAO-definitions.

Forest planning systems have generally been available for the private forest owners since the 1980s, and to some extent before that time. Most of the systems offer little guidance to the owner for making economic management decisions, but some professional systems include possibilities for economic optimisation. This is the situation today, despite the possibilities for sorting the data, printing of pedagogic maps, updating the information with annual growth, changes in stand boundaries, and completed management activities.

3.2 Kind of planning, purpose, time scale

Planning should be normative, i.e. help the owner to achieve his/her goals within the frame of the Forestry Act and other rules set by society. The planning process needs sufficient, accurate data and should ideally be based on extensive analysis and the comparison of the outcomes of management alternatives. In real life, plans for private forest owners are often based on subjective data and management proposals. Also, there is a need to identify the goals of the forest owner and to adopt the plan to fit them. Many (most) owners lack clear ideas concerning their goals. Therefore much work is needed in this area.

FM plans for private forest owners are generally speaking aimed at helping the owner to utilize the forest in an efficient way, and to help him/her take decisions about forest management activities. Timber production is in the focus. A delineation of stands and a description of each stands are essential, and suggestions on management activities for the planning period. A description of the forest owner's goal is included in the plan and a basis for the management suggestions. The suggestions on average aim at economical thinking and efficient resource management. On the same time nature conservation and considerations to other uses are more important even if not accepted of all private forest owners.

Green FM plans are a means of implementing the goals of both the forest owners' association, Södra, and the political goals implemented by the Swedish Forest Agency of setting aside a proportion of forest land for conservation.

During the 1980's the FM plans were aimed at both more intensive timber production and higher supply of round wood for the forest industry. This was based on experience gained during the 1970's. In Älvdalen 2000, the establishment of forest management plans led to increased activity (Svensson 2002) when compared to the previous years. Clear cuts, soil scarification and cleaning increased 150-200% and precommercial thinnings and thinnings increased 400-500%. Also, the forest management plan resulting in many forest owners transferred their holding to another person.

FM plans in Sweden are made with a 10 year planning horizon. On the strategic level, a longer planning horizon is necessary. The long term judgements are made by comparing total cut volume during the 10 year planning period and growth, also considering clear cut area and age class distribution. In general long term optimization is not done. There is no direct link between the regional planning level and the management planning for a private forest holding.

FM plans should be updated every year and revised after a few years. This is not done in most cases, but organizations making plans offer this service as an option, and it might be more common in the future, especially if web based techniques are used.

Forestry and therefore forest management planning in Sweden, has been and still is primarily focused on timber production. Timber production is important for the country and has a strong tradition. The last decades have seen a trend towards nature conservation, but during last few years the interest in production has increased again.

There are of course uses other than production and nature conservation. Reindeer herding is important for the Sami people and there are cultural heritage values for the Swedish people as well.

3.3 Planning activity

Approximately 4 million hectares have FM plans that are less then 10 years old (Table 1). The dip in planning activity 2005 is in a large part the result of damage from the storm "Gudrun" in January 2005 that felled 50 million m^3 of forest.

Table 1. *Area (1000 of ha) of field data capture for green plans (Ragnar Spross, pers comm)*

Year	1997/98	1999	2000	2001	2002	2003	2004	2005	Sum
Area	460	540	830	630	550	480	440	140	4080

Management plans are most often produced by timber buying organizations (Table 2). The planning work is done by their employees, or often by contractors hired by these organizations. The main purpose for these organizations is the provision of services. It is their objective to help the forest owners make decisions regarding where to cut, with the ultimate goal of buying the timber. Another reason is to impose nature conservation strategies on the forest owners.

Table 2. Organizations proportion of planning market (Ragnar Spross, pers comm)

Organization	Type of organization	Market share
Forest Owner Association		49 %
Swedish Forest Agency		31 %
Skogssällskapet	– forest mgmt org	4 %
Sydved	– round timber buyer	4 %
Others	– companies, buyers	12 %

The area certified is 3.4 mill ha (>1 m3/ha, year) with group certification according to PEFC (PEFC 2007), and 0.45 mill ha (>1 m3/ha, year) with group certification according to FSC (FSC 2007). The latter figure also includes some areas owned by others than private persons.

3.4 Traditional making of FM plans

Basically traditional methods are still used for making FM plans, even if new technology are introduced in many steps in the work. A simple method is that the planner does all the work in the field. The borders for the holding are bought from the Land survey. The delineation of stands are done on orthogonal photographs and based on what can be seen in the photo and in the field. Stand variables are estimated in the field. The planner walks through the stand to make a judgement about the state of the forest. The planner should try to see most of the stand but do not have time to go through the whole stand in detail. The basal area is often estimated with the relascope on subjectively chosen places in the stands. The numbers of relascope measurements vary. We teach our students to not measure on more then six places in each stand if subjectively chosen points. Most often basal area is measured only 1-3 times, but it also happens the relascope are used on even more then six places in each stand. The tree height, age and diameter at breast height might be measured on (1-3) representative trees in each stand. The height on stands might be based on subjective estimation complemented with direct measurement on the height on one tree in each second stand. The age and just estimated the height

This method is of course not free of errors. The relascope method with 4 measurements gives a mean error of 15-20% in Swedish forests on average (Ståhl 1992, Östberg 2003). Generally there is also a trend towards the over all mean, which means underestimation in dense stands and overestimation in stands with low density. Some stand characteristics were measured with higher precision than others. Usually a high precision is achieved for mean height, mean diameter, site index and tree species composition, a reasonable precision for basal area and stand age, whilst the precision is low for volume and number of stems (Ståhl 1992). He also found that data from small stands had higher precision than from larger.

Other ways of planning is to make the delineation on pictures with a three dimensional sight, or even to use specialists for the delineation and also interpretation of the most important stand variables. Thus the planners work is reduced to checking the delineation and stand data, making new measurements if necessary, and making some additional judgements and measurements.

The planner are often equipped with a PDA with the aerial photo, the borders of the holding and the stands (maybe from an old FM plan), a GPS and a program to handle all the data collected.

Aerial photo interpretations are done in the first step by some organizations (Forest owner associations Norrskog and Norra Skogsägarna). The planners start each season in May with a short training course. The length of this training varies from a couple of days up to two weeks depending on the prior experience of the people. Another example of introduction is to let the unexperienced planner follow an experienced during some days or even weeks.

Some organizations do a follow up of the quality of the plans. Comments, management proposals and other information in the plan are checked before the plan is delivered to the forest owner. Also some organizations make an objective sample plot inventory in some stands. This is to give feed back to the planner, but also to give a declaration of the quality of the data delivered during a season, and the salary to the planner is based on these results.

There is no official standard for what information should be contained in a forest management plan or for standards of quality. Neither is there a formal requirement that the plan be made by a certified person, or a person specifically educated to do so. But in reality those making plans have at least two years of forest education.

Field computers are often used during the field work. Aerial photos and maps with boundary lines for the estate are included, as well as the programmes needed to handle the data and assessments of the planner.

3.5 Forest companies strategic planning

When it comes to big forest owners in Sweden, all forests companies use the Forest management Planning Package (FMPP) for their strategic forest planning (Jonsson, Jacobsson & Kallur 1993). Data collection is done only in a sample (1-2 %) of all stands thus making it possible to make more intensive measurements in the sampled stands. Each such stand is inventoried with 10 sample plots in a systematic grid. Each plot is 314 m^2. The standard error of the volume estimate is 8-10 % on average. In the FMPP single tree are the basis for estimation of growth, management alternatives are elaborated for the sampled stands, but also with regard to each plot, and the system comes up with optimal solution for the whole forest with regard to net income.

This method is not used for private forest holdings because it is not possible to make the inventory on a sample of the stands. It would be necessary to measure in all stands and then the method is considered to expensive. An idea is to use a distance-dependent method instead of sample plots with a fixed radius. Six trees might be sufficient to measure.

3.6 New technologies

During the last decade airborne laser technology and methods has been developed for estimation of forest variables. Today these methods are coming into operational use.
One method is developed by FORAN Remote Sensing AB in Linköping. The Foran Single Tree Laser Method uses ten laser beams per square meter resulting in position, height, crown area and tree species of single trees. The variables are measured and interpreted with high accuracy according to the company (Andreasson 2007-12-17), and used for estimation of tree diameter at breast height and volume of single trees. These single tree data can be combined with data about stand delineation (either from old forest maps, modified with regard to recent cuttings, or from a new stand delineation) to make a stand wise description of the forest. For calibration is it necessary to also have data from field measurements of sample plots. Another

laser method by the same company is StandAverage, in which a lower number of laser beams are used for estimation of stand averages.

Foran AB measured 14 000 ha 2006 and 400 000 ha 2007. The customers are in Sweden, Norway and Latvia (Latvian State Forest, Bergvik Skog AB, Svenska Kraftnät and some forest commons in the county of Dalarna).

A lot research projects running are evaluating the possibilities with laser data. FORAN AB claim (Andreasson 2007-12-17) they could find 93 % of the standing volume on 10000 ha in Älvdalen 400 km NW of Stockholm. There are projects running evaluating the quality of the data from FORAN AB.

The company Dianthus AB have developed and demonstrated a method to automatically delineate stands from colour and texture in digital aerial photos (Walter 2007-12-21). The segmentation is based on raster data. Average stand size should be defined in advance. Dianthus call their method FIMAS (Forest Information Management and Analysis System), are evaluating the method on forest companies Sveaskog AB and Holmen Skog AB.

3.7 Who can contribute to the FM plan

The planner is the most important person as they make most of the necessary measurements and judgements, and propose management activities. Eventually an aerial photo interpreter makes delineations, estimations and measurements. The forest owner decides who or what organization will make the plan and what other values should be considered. The owner also formulates the goals and may provide some data. The public/politicians make regulations, extension service(s), tax regulations and other factors that may influence the design or content of a forest management plan. The authorities provide data via internet (Swedish Forest Authority and the County Administration about valuable biotops, the National Heritage Board about sites of special cultural or historical value, the County Administration may provide data via the internet about nature conservation and in some cases local authorities provide land use plans. The Swedish Society of Nature Conservation makes data available to the local authority/ administration or forest owner, reindeer herders and the appropriate authority have data about areas of interest for their needs, in Ren2000 (Länsstyrelsen i Västerbotten 2006).

3.8 Kinds of documents

The management document includes the name of the estate and the owners' name and address. A description of the goals is sometimes included, even if most owners not have elaborated and formulated a precise goal useful for planning. The planner then often has to fill in his or her interpretation and give a rather general description of the goal. The name of the planner and date the plan was completed are included, and a description of the method for data collection and establishment of management proposals are often included as well. Sometimes there is a statement about the data quality, or rather possibility of inaccuracy. This is followed by a description of the state of the forest in tables, figures and often in text form.

A very important aspect that is always a part of the plan is a forest map showing the identity of and the delineation of the stands and a stand wise description of the forest. The map is often used in conjunction with an aerial photo (ortophoto). Thematic maps of different kinds are often included showing land classes, goal classes and cutting classes of the forest.

The standwise description also includes management proposals. A summary of proposals and their consequences in ha, m^3 and age class distribution is also included, and a comparison of the estimated growth is common. The plan is often available in a digital version.

The plan belongs to the owner! Neither the state, nor the public is given access without permission from the owner. However some data from the General Forest Inventory from the 1980´s and some data bases are in the public domain.

3.9 Variables in the plans

- Stand identity
- Area
- Land class
- Goal class – proposal for balance of timber production and nature conservation
- Cutting class/ tree layer
- Age
- Site index
- Standing volume
- Tree species composition)
- Average diameter (not always included)
- Average height (not always included)
- Stem number (not often included)
- Basal area (not always included)
- Soil moisture class (not always included)
- Terrain class (not always included)
- Management proposal
- Time period (immediately, -5 yrs, 6-10 yrs, sometimes also 11+ yrs)
- Cut percentage
- Cut volume
- Medium, higher and lower level of proposal of cut (not always included)
- Description, comments on both production and nature conservation
- Comments regarding the management proposal

4 Future trends – changes in forestry

The forest industry is very important in Sweden and the demand for bioenergy is increasing. Other uses and interests found in forest lands are also growing or more clearly pronounced and they will become increasing important in future forest management planning. Increasing knowledge of these other users and values will faciliate their inclusion in the planning process.

Another interesting change is that the forest estate prices are increasing since 2004. Prices on average are now over 30 €/m3 standing volume, 50% higher then 2004.

Trends in forest management planning include development of a new generation of planning system (Mistra 2006). This system named “Heureka” will also be applicable for private forest owners. This system provides better problem analysis, more accurate consequence descriptions, and better management proposals that will increase the efficiency of resource management and utilization. All planning requires accurate data. Perhaps the technology for remote sensing will improve and coupled with field measurements make this type of data collection possible for small private forest holdings at a reasonable cost.

There are also research programmes aimed at making forest management plans more flexible, and adapted to the needs of the individual forest owner.

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