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Planter's guide - a decision support system for the choice of reforestation material

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A new web-based tool will help the forest owners and nursery managers to select reforestation material for the right planting site. The new programme "Planter's guide" will replace the existing "Val av skogsodlingsmaterial". The motives for the replacement, and the content of the tool will be shortly described here.

Reforestation material is big business in Sweden. In 2006, 332 million seedlings were sold from Swedish nurseries. Sixty percent were Norway spruce, and 35 % were Scots pine. A smaller part of the produced and sold seedlings were lodgepole pine or broadleaves. Of the spruce seedlings, 49 % originated from seed orchards. Corresponding figure for pine was 78 %. The remaining part originated from unimproved stand seed.

The choice of genetic origin of the seedlings has important implications for the growth in the forest. An inoptimal choice can easily make the forest owner loose ten or more percent in total yield over a rotation. A choice of seedlings with inappropriate hardiness can also lead to a total failure of the regeneration.

It is a delicate task to find the most suitable material for the right site. There are some typical questions which has to be answered in the practical forestry: Which reforestation material is recommended for my particular site, and why? If I possess a certain seed lot, or origin of seedlings, where should it be planted? How can I balance the risk of poor hardiness with growth potential, considering the trade-off between hardiness and growth in northern Sweden?

These questions can be tricky to answer only from the literature, since recommendations vary along latitudinal and altitudinal clines. The web-based tool can however give immediate answers, not only of which material to choose, but also of the expected growth potential and survival.

From Val av tall to Planter's guide

The first prototype of the tool dates back to the mid 1990's, when Bengt Andersson constructed "Val av tall i norra Sverige" (choice of pine for northern Sweden), an Excel-programme. The programme became publicly available on the web in 2000, and was extended and improved in the following years (Ericsson, 2001). The construction and maintenance of the programme has been in the hands of Tore Ericsson, but since 2003, no major revisions of the programme were made until the construction of the new interface in 2007.



Figure 1. The interface of the old version "Val av skogsodlingsmaterial"

The new programme "Planter's guide" has used the entire content and data structures of the former "Val av skogsodlingsmaterial", but more functions have been added and the interface is completely renewed.

There are at least three major reasons for the construction of the new version: 1) The old programme was difficult to update and edit. The programme was constructed as a continuous Javascript code, and important seed orchard data was embedded in strings. Revisions of the content was very dependent on the programme constructor, and we foresee more frequent updates in the near future, since many new seed orchards are taken into production.

2) The development of the web and the computer environment has increased the demands for standardized format of programmes like this, in order to facilitate for programme makers, editors and IT administrators. The new program is based on the dotNET platform, and is uniform with other calculation tools on Skogforsk's web.

3) There was a demand to improve the usability of the programme. It was originally made to suit the needs of seed managers, and worked very well for that specialized target group. However, there is a demand for access to the information from other users, such as forest owners or forest servants responsible for silviculture. During our workshops with users, we have also learnt that there is a need for a more user-friendly version also among the expert users.

So what is the programme doing? Simply explained, it uses response functions of height growth and survival to photoperiod and temperature sum (Rosvall et al., 1998). Since the photoperiod and temperature sum are functions of latitude and altitude, these are easy to estimate if we know the coordinates of the reforestation site. The functions are based on 40 years of research on how growth and hardiness is affected by provenance transfer. The gains of seed orchard material is calculated with respect to basic genetic gain, clonal origin, seed orchard location, pollen contamination and selection gains. The programme presents an index for each material, which compares the overall production with that of a local, unimproved provenance. An index of 110 is thus a 10 % gain over a rotation.

The programme

Let's look at the programme. It is part of "Kunskap Direkt", a web-based knowledge system in silviculture, targeted to forest owners and their advisers (Hannerz et al., 2005). The main programme (Plantval) is presented in Swedish, but there is also an English version (Planter's guide) with some restrictions.

The first step is to select species (Scots pine, Norway spruce, lodgepole pine or birch). This is a delicate task in itself, but not covered by the programme.

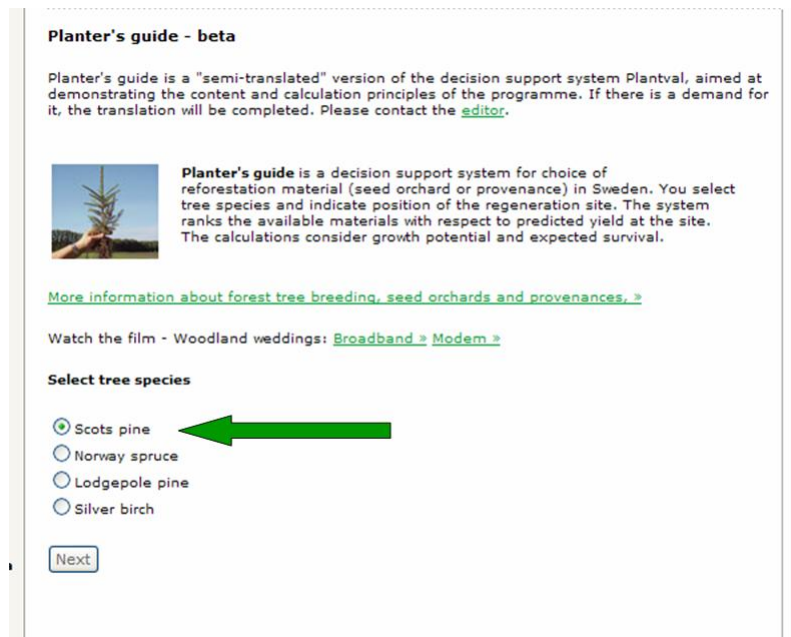


Figure 2: The first step in Planter's guide is to select tree species.

Let us assume that the aim is to plant Scots pine. The next step is to identify the coordinates of the reforestation site. We have learnt from our workshops and test groups that this task needs to be simplified. Many forest owners do not know their coordinates, for example their latitude. Therefore, we use a simple map function, where a click in the map gives sufficient information both about the latitude and the altitude. These, and the derived temperature sum, are thereafter possible to adjust more in detail. The temperature sum can naturally vary depending on the specific conditions of a site. Therefore, it might be suitable to reduce the temperature sum for e.g. harsh north slopes, or increase it for warm southwestern slopes.

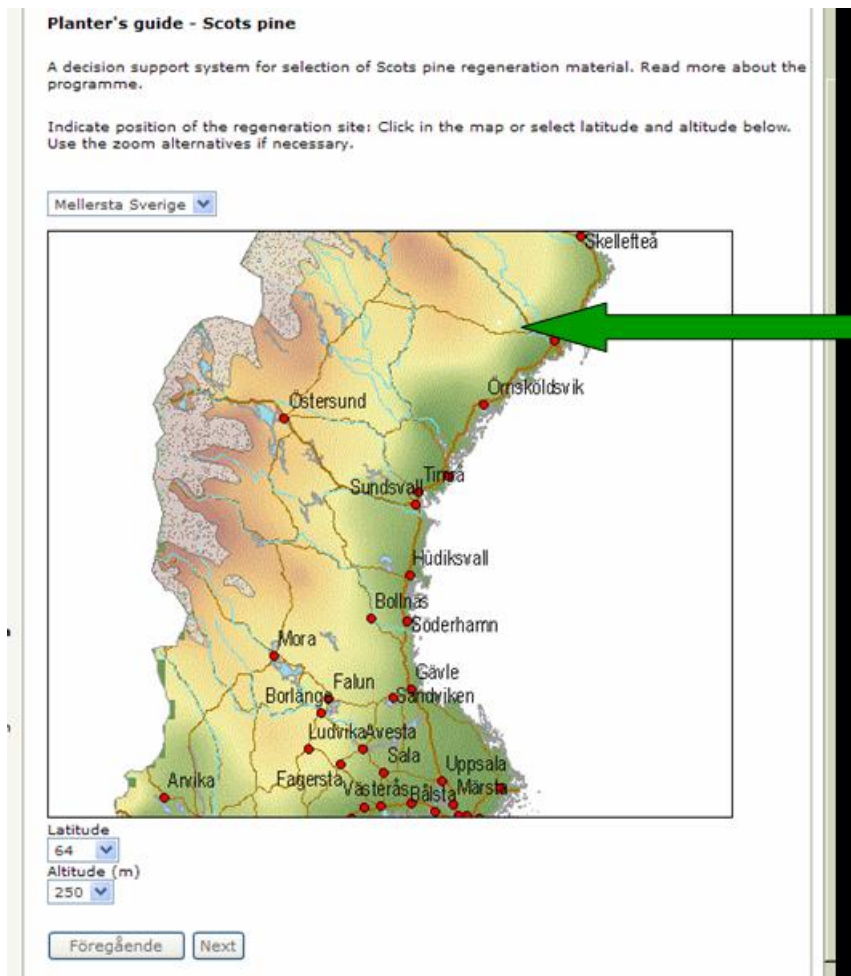


Figure 3: The second step is to find the coordinates of the reforestation site, which is done by clicking the map. The map includes a database with altitude information.

Once the coordinates are fixed, we are given the results. The first view presents seed orchards in descending order with respect to index. Survival is also given in this view. The index is the product of height growth and survival. Thus, it is understood that a high-index-material with low survival has a high growth potential, and vice versa.

A click on the button shows us a view with stand seed, i.e. unimproved provenances. This gives us a chance to compare the seed orchard alternatives with transferred stand seed. The local provenance has an index of 100, by definition. In the example case, index will be increased by transfer from more northern latitudes. The reason is that survival is higher for those provenances. The index from southtransferred provenances is still far below those of the best seed orchards.

Planter's guide - Scots pine

A decision support system for selection of Scots pine regeneration material. Read more about the programme.

Adjust the values if needed and press CALCULATE for a new calculation

Regeneration site: latitude (°N)

Altitude (m)

Temperature sum (daydegrees °C): calculated

Adjustment

Adjusted

No.	Seed orchard	Index	Överl.	Select
T8	Dal	122	77	<input type="checkbox"/>
T1	Alvik	120	83	<input type="checkbox"/>
T2	Alvik	119	85	<input type="checkbox"/>
T5	Pålberget	119	84	<input type="checkbox"/>
401	Hortlax	116	83	<input type="checkbox"/>
T4	Moliden	116	83	<input type="checkbox"/>
T6	Pålberget	116	83	<input type="checkbox"/>
1	Skaholma	116	83	<input type="checkbox"/>
T7	Slåttholmen	116	81	<input type="checkbox"/>
4	Skatan	116	80	<input type="checkbox"/>
125	Våge	116	80	<input type="checkbox"/>
123	Klocke	115	84	<input type="checkbox"/>
406	Bogrundet	115	80	<input type="checkbox"/>
10	Östteg	114	78	<input type="checkbox"/>

Figure 4. The results are first given in a simple view with seed orchards ranked by index. Survival is also presented in this mode. By clicking the buttons, it is also possible to see results of transferred provenances, or a more advanced view with more detailed information about the orchards.

There is also an advanced view with more information, such as age of the seed orchard, yield translated to site index, and an indicator if seed orchard is old enough to produce seed.

In the simple view, it is also possible to open up more information about each seed orchard. Information presented here is a map of recommended use, technical information about the orchard, and data about who owns the orchard. The owner is thus an indicator to where seedlings can be purchased.

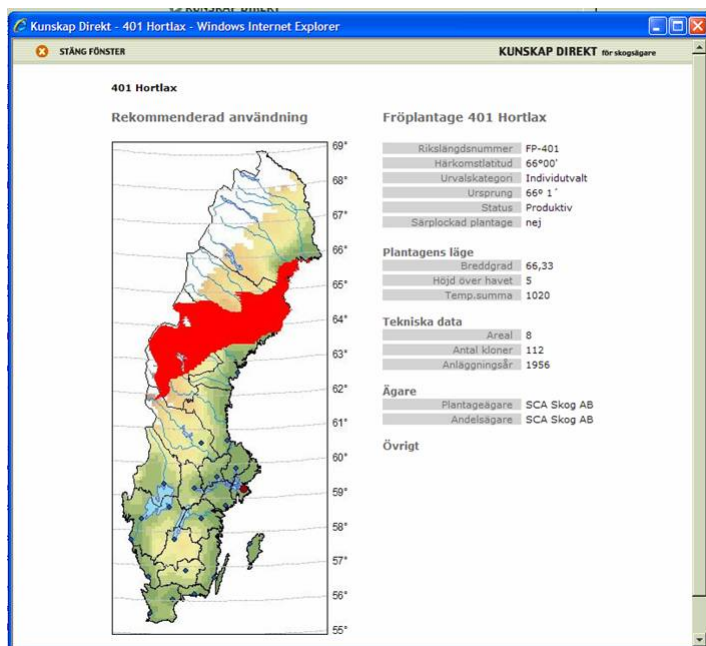


Figure 5. Separate windows shows information on recommended area for planting, technical information, and information about ownership of the seed orchards.

In the simple mode, it is also possible to click the checkboxes of the materials we are particularly interested in. In a format familiar to many shopping sites, these seed orchards are compared in a new window.

The tool that is present on the web now is a beta version, which will be tested and revised during the autumn 2007. We also plan to add more functions, such as a simple "translator" to yield in cubic metres, and a visualization of the effects of transfer with respect to growth and survival.

The address to the tool is www.kunskapdirekt.se/plantersguide.

References

- Ericsson, T. 2001. Knowledge system for choosing regeneration stock. Skogforsk, Resultat nr 19, 2001. 4 p. (In Swedish with English summary.)
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