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Swedish University of Agricultural Sciences

Faculty of Forest Sciences

SUMMARY

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Who is lying about Swedish forests?

Summary of presentations from a webinar on 23 June 2021, arranged by the Swedish University of Agricultural Sciences (SLU). The webinar background is the increasing amount of "alternative facts" about Swedish forests that has started to circulate in connection with the ongoing national and EU level debate about forests, forestry, and forest policy.

This document is a translation of the written summary of the oral presentations, which was distributed in connection with the webinar. Only links available in English are included.

Environmental monitoring at SLU and open data

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SLU has a mission that is unique among Swedish universities. In addition to education and research, we are also commissioned by the Swedish government to conduct environmental monitoring[1].

Environmental monitoring collects data about the country's forests, agricultural land, water, and species using scientific methodology. Data are used for analysing environmental state and developments. In this way, SLU supports governmental agencies, industry, and international agencies with a scientific basis for decisions supporting sustainable use of natural resources.

SLU works in twelve thematic programs[2], which are related to the Swedish environmental goals, global sustainability goals, and other international environmental collaborations.

[1] Environmental monitoring and assessment | Externwebben (slu.se)
[2] https://www.slu.se/en/environment/programmes/

There is a general saying that "in Sweden we have a system" and, in fact, Sweden has had a robust system for monitoring forest resources and forest environmental conditions for a long time. The core of the system is the National Forest Inventory, which you will soon hear more about.

Another important part of the Swedish system is repeated national forest scenario analyses, which are conducted every 5-10 years by the Forest Agency and SLU. National Forest Inventory data provide the basis for such analyses, which are carried out with the help of forecasting models[3] in order to project the development of forests and the resulting output of ecosystem services, given different assumed scenarios.

Everyone is familiar with weather forecasts, which are usually conducted with a time horizon of a few days. In forest scenario analysis the time horizon is typically 100 years, to assess the long-term sustainability of different forest policies. The most recent analysis was conducted in 2015 and the next analysis will be presented in 2022.

Further, the National Forest Inventory and the closely linked Swedish Inventory of Forest Soils[4], is the basis for Sweden's reporting of greenhouse gas emissions for the Land Use, Land-Use Change, and Forestry sector, and thus a part of Sweden's annual reporting of greenhouse gas emissions[5] under the climate convention, compiled by the Swedish Environmental Protection Agency.

Lastly, I will say a few words about work with open data: SLU develops various national maps that are openly available for download, sometimes through the map services of the Swedish Forest Agency. The maps are widely used in the forest sector, mainly for operational decisions by industry and agencies.

All the data of the National Forest Inventory are openly available and quality checked, and further it is possible for users to specify their own analyses, interactively. In recent years, investments in open data have had an effect. SLU attracts many national and international users who appreciate that data are openly shared[6]. Our interactive analysis services are used not least by researchers, who increasingly discover the usefulness of data from the National Forest Inventory.

I now leave the floor to Göran Ståhl, who will shed light on the difference between research results and official statistics.

[3] The Heureka system | Externwebben (slu.se)
[4] Swedish Forest Soil Inventory | Externwebben (slu.se)
[5] The greenhouse gas inventory | Externwebben (slu.se)
[6] https://www.slu.se/en/Collaborative-Centres-and-Projects/the-swedish-national-forest-inventory/listor/sample-plot-data/

The difference between research results and official statistics

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We are in the middle of an intensive debate about Swedish forests, forestry, and forest policy. In the debate, research results are mixed with results from environmental monitoring and stakeholder opinions. Sometimes one may wonder if there are any basic facts about the Swedish forests that can be respected by all stakeholders, since so many alternative facts are being circulated in support of different stakeholder positions. In my talk, I specifically would like to point out the difference between research results and Swedish official statistics.

It is well known that different researchers sometimes arrive at different results. This may be due to many factors, e.g. that they have conducted their studies in different areas, with different methods, or that they have formulated their questions slightly differently. Sometimes it is only over time, and with recurring peer review and discussion, that research results converge towards facts and knowledge. Consequently, it is sometimes easy to find research results that support different views, especially in new research areas such as the role of the forest for climate change. What should a non-expert trust?

It turns out that Swedish authorities have been pondering similar issues for a long time. In Sweden (like in the rest of the EU), therefore, there are rigorous regulations regarding the compilation of official statistics[7] about the conditions and developments in different parts of society and the environment. Official statistics are produced for providing trustworthy general information, in-depth investigations, and for research. The official statistics are governed by legislation and rigorous procedures to ensure the quality and objectivity of the data and information produced. The official statistics are comprehensive and nationwide, in contrast to research studies that are sometimes restricted to case study areas.

Official statistics are available for a number of areas that are perceived to be particularly important for societal planning. They may concern gross domestic product, unemployment, education, or the state and change of forests – which we obtain from the National Forest Inventory. The National Forest Inventory thus is subject to the rigorous routines of official statistics to ensure the quality and objectivity of data.

[7] Official Statistics of Sweden (scb.se)

The producers of Swedish official statistics – several authorities coordinated by Statistics Sweden, where SLU and the Swedish Forest Agency produce official forest statistics - experience that a critical border is being crossed when stakeholders ignore or deny official statistics in favour of their own opinions or results from individual research projects. For example, this happened last week when an EU Commissioner and researchers from EU's Joint Research Centre claimed that Sweden's official statistics about forest fellings are incorrect, since their results from an individual research study showed something different. We will return to this.

At this seminar, we will show examples of official statistics from the National Forest Inventory, which we hope that you will be interested in learning more about. It should be noted, however, that the results of the National Forest Inventory could be interpreted and assessed in different ways. Whether or not a certain development is good or bad is often interpreted differently by different stakeholders. However, the basic official statistics remain fixed and are obtained from the National Forest Inventory.

Thus, in conclusion, research often gradually converges to facts and knowledge through recurring studies, peer review and discussion. Individual studies may be misleading. The official statistics in Sweden are produced to provide a firm baseline that different stakeholders may form their opinions from. It is subject to rigorous routines for quality assurance and objectivity. The results of the National Forest Inventory are part of Sweden's official statistics.

I would now like to give the floor to Jonas Fridman, who will tell more about the details of the Swedish National Forest Inventory.

What is the National Forest Inventory and what official statistics do we deliver?

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As Göran and Anna-Lena previously have said, much of the official statistics about forests are produced through the National Forest Inventory, which is also responsible for the data collection. Over 100 years ago, the big forest-related question in Sweden, and in many other countries, was whether or not the raw material from the forests would be sufficient for the needs of the growing forest industry. To bring clarity, a decision was made by the Swedish parliament that a National Forest Inventory should start in 1923. By then, Norway and Finland had already started their inventories.

The map in the figure shows how the statistical sample was selected; the forest was inventoried along sample strips. The results from the first National Forest Inventory were presented in 1932 as a state public report and attracted a lot of attention, not least in media.

For almost 100 years, the National Forest Inventory has collected data and presented statistics about Sweden's forests, with continuously improved and more efficient methods. However, the basis is the same: a sample of the forest is inventoried with methods that provide high statistical precision to be able to report information for individual counties and, of course, for the whole country. Currently we have about 55 people in 16 field teams across the country who perform the data collection. SLU has also helped many other countries to set up similar inventory programs, for example, Iceland, Canada, Albania, Laos, and Denmark.

What type of statistics does the National Forest Inventory produce? The name of the statistical area is "state and change in Sweden's forests". Here is an example[8] where we can see the development of the growing stock volume from about 1.7 billion cubic meters in the 1920s to over 3.5 billion cubic meters today. I can mention that the area of forest land in Sweden is largely unchanged compared to the 1920s, about 28 million hectares.

What then led to this increase of the timber stock? It is shown in the next figure[9] how growth and drain have varied since 1955. The drain is separated into fellings and natural mortality, for example due to storms, insect infestation or fire. The equation is simple: if growth exceeds drain, the growing stock volume and thus the carbon stock increases.

I also want to take the opportunity to show this figure[10] on annually felled area according to the National Forest Inventory, where no abrupt increase occurred after 2015 as researchers from EU's Joint Research Centre has claimed. Håkan Olsson will tell more about this soon.

The National Forest Inventory produces statistics not only from a raw material or carbon stock perspective, but also from a biodiversity perspective. Here is an example[11] on how the age of forests has changed since the 1920s. There is a sharp decrease in old forests since the 1920s, but

[8] Figure 1.7 on page 61 in https://www.slu.se/globalassets/ew/org/centrb/rt/dokument/skogsdata/skogsdata_2021_webb.pdf
[9] Figure 1.12 on page 68 in https://www.slu.se/globalassets/ew/org/centrb/rt/dokument/skogsdata/skogsdata_2021_webb.pdf
[10] Bild 4.8 on page 161 in https://www.slu.se/globalassets/ew/org/centrb/rt/dokument/skogsdata/skogsdata_2021_webb.pdf
[11] Figure 2 on page 18 in https://www.slu.se/globalassets/ew/org/centrb/rt/dokument/skogsdata/skogsdata2014_webb.pdf

also a clear increase from the mid-1990s until today. In this figure, we may find part of the explanation for today's Swedish forest debate: depending on which reference year we compare the current situation with, the conclusions will be different, and thus the answer to the question whether or not the state of forests today is better than before. However, I would like to repeat what Göran just said, to comment whether or not a specific development is good or bad is not the task of the National Forest Inventory. Our task is to produce and deliver official statistics as a basis for this type of assessment by different stakeholders.

I will end by showing the website of the National Forest Inventory[12] where all quality-assured official statistics that we publish can be found. Here you will also find information about how we work, what methods we use, documentation of field instructions, databases, publication lists, and links to interactive tools for producing statistics based on data from the National Forest Inventory. There are also links to remote sensing products such as the SLU Forest Map, where data from the National Forest Inventory constitute reference data.

I now leave the floor to Håkan Olsson, professor of forest remote sensing at SLU.

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Some additional facts about the Swedish National Forest Inventory (not reported during the webinar)

The inventory consists of a statistical sample of plots on which field teams measure and assess a large number of biophysical features linked to trees and stands, bushes, ground vegetation, soils, and management, including whether or not trees have been felled on the plots. Each year the inventory comprises about 6000 permanent plots and 4000 temporary plots. Thus, over a five-year cycle, about 50,000 plots are visited, out of which 30,000 are permanent, i.e. they are being recurrently visited as a means for improved estimation of changes. In addition to the 50,000 plots, an additional 50,000 plots are visited solely for estimating fellings in order to improve the precision of estimates of drain (i.e. fellings and mortality).

National Forest Inventories are conducted in a large number of countries, and in the EU all major forest countries have inventories similar to the Swedish National Forest Inventory. Collaboration between them is ensured through the European National Forest Inventory Network[13] (ENFIN).

[12] The Swedish National Forest Inventory | Externwebben (slu.se)
[13] http://enfin.info

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Why do EU researchers and Swedish authorities arrive at different felling areas?

Håkan Olsson, Professor of forest remote sensing, e-mail: Håkan.Olsson@SLU.se , tel : +46 90 7868376

I will say a few words about the study, and article in Nature last year, where researchers at EU's Joint Research Center (JRC) alerted about a sharp increase in fellings in Europe after 2015, especially in Sweden and Finland. The results seem to be due to a data series that is not comparable across time, which makes the study misleading. The study was again referred to recently when it was supported by an EU Commissioner during his recent visit to Stockholm.

The article was published in Nature on July 1, 2020[14]. Among other things, the article claimed that the area of clear-cuttings in the EU had suddenly increased by an average of 49% during the period 2016-2018 compared with the period 2011-2015, and that a major portion of this increase took place in Sweden and Finland. It was also concluded that this was likely due to an increased use of wood as a raw material, that could have a negative impact on Europe's CO_2 balance, and that a common European satellite-based monitoring system was needed to monitor forest resources.

The JRC researchers' article provoked reactions. The Swedish Forest Agency and SLU immediately posted a joint announcement on the web that the data did not match Swedish statistics, neither with the National Forest Inventory's data on felled areas (which instead showed a decrease of 8% between the two periods), nor with the Swedish Forest Agency's data on harvested wood volume.

The JRC researchers had used a data series on annual change in tree cover, worldwide, that was developed by a research group at the University of Maryland (UMD) in the USA[15], distributed as the "Global Forest Change" data layer on the Global Forest Watch (GFW) website[16]. We received confirmation from the responsible researcher at UMD, who had produced the data series, that his data could not be used for the type of analysis of change over time that the JRC researchers had made. The reason is that satellites and methods have developed over time and thus become more sensitive, so that more changes, e.g. thinnings, have been mapped as clear-

[14] Checcherini G. *et al.* 2020. Abrupt increase in harvested forest area over Europe after 2015 | Nature
[15] GLAD | Global Land Analysis & Discovery (umd.edu)
[16] https://www.globalforestwatch.org/

cut areas during recent years. Since the time series was not harmonised across time, it should not be used as proposed by the researchers at JRC.

The reactions have also been strong internationally; 33 researchers from 13 countries wrote an answer to Nature where the conclusions by JRC's researchers were questioned[17]. The responsible researcher at UMD was a co-author of this article. It took almost 10 months for Nature to publish the critique, and during this time another article questioning the results was also published in Nature[18]. However, researchers at JRC continue to claim that their main conclusions are correct, although they have now modified their estimates[19].

The Swedish Forest Agency has compiled statistics from several different Swedish authorities on time-series that are related to wood harvests, none of which point to any rapid changes around 2015. Further, the Swedish Forest Agency annually also maps all final fellings from satellite data, using manually supervised methods. A compilation of these data agrees well with the data from the sample plots of the National Forest Inventory.

On April 28, 2021, GFW posted a clarification that their data series are not comparable across time[20]. It tells that the method for change analysis has improved significantly in 2015 and thus become more sensitive. Recently, the diagrams on GFW 's website, that show a decrease in tree cover over time, have also been marked with a warning text that tells that data are not comparable across time.

Swedish, Norwegian and Finnish researchers have conducted a (so far unpublished) study in which the change maps from GFW are compared with 120,000 sample plots from the Swedish and Finnish National Forest Inventories. This analysis shows that the proportion of thinnings that are also registered as changes in GFW increases from a few percent to close to 20% after 2015. Since we have about 350,000 ha of thinnings per year in Sweden, this may explain much of the changes that researchers from JRC have interpreted as increased clear-cut areas[21].

[17] Is forest harvesting increasing in Europe? | European Forest Institute (efi.int)
[18] Quantifying forest change in the European Union | Nature Vol 592 E13-E14.
[19] Reply to Wernick, I. K. et al.; Palahí, M. et al. | Nature.
[20] How Tree Cover Loss Data Has Changed Over Time | GFW Blog (globalforestwatch.org)
[21] Harvested area did not increase abruptly – How advancements in satellite-based mapping led to erroneous conclusions | Zenodo