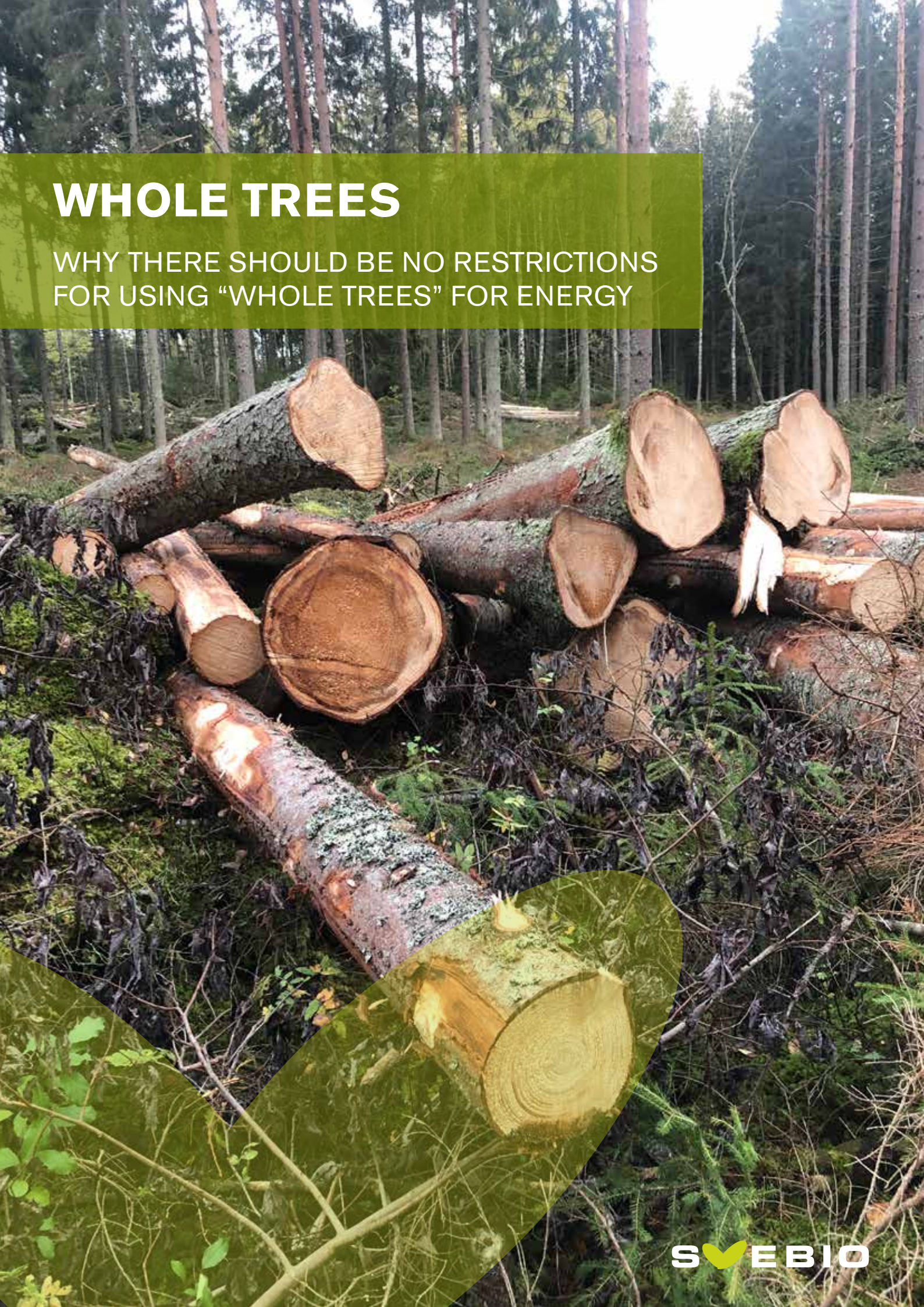
WHOLE TREES

WHY THERE SHOULD BE NO RESTRICTIONS FOR USING “WHOLE TREES” FOR ENERGY



SVEBIO

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Whole trees – Why there should be no restrictions for using "whole trees" for energy

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Summary

A regulation restricting the use of “whole trees” would do great harm to the current use and future development of bioenergy from forest biomass. It would cause unreasonable delays in the replacement of fossil fuels and thus unnecessary emissions of carbon dioxide. It would also increase the administrative burden for suppliers and users of forest-based biomass, increase the cost and reduce the supply of renewable fuels. Furthermore, "whole trees" and "stemwood" are categories without clear definitions.

In a market economy, demand and prices will allocate raw material to its best use. The different values are reflected in different price levels and the market creates natural cascading of the wood according to its end use value.

1. BACKGROUND

The recently adopted Renewable energy directive RED II recast (EU 2018/2001) has a restriction on using stemwood of saw-wood and veneer wood quality for advanced biofuels, as this feedstock is not included in Annex IX A. The rest of trees are not excluded, and are included in “other cellulosic material”. There is no restriction against using stemwood in the sustainability criteria for forest biomass for heat and electricity in article 29 of RED II.

The EU Commission has however indicated that it wants restrictions for using “whole trees” for energy in the Biodiversity Strategy, and in the consultation on revision of RED, the commission asked if “it should only be possible to use feedstock that does not have higher added-value in nonenergy sectors”. Leaked presentations from the Commission include a proposal to restrict the use of stemwood over a diameter of 10 cm. JRC, on the other hand, did not analyse or propose restrictions on “whole trees” in its report. The JRC report, however, includes an analysis of the use of “coarse woody debris”(harvesting residue) and also covers the issue of salvage logging wood extensively, and furthermore mentions landscape care wood.

We expect some sort of regulation of whole trees or stemwood in the coming proposal för a revision of the Renewable energy directive. It is important that such regulation is based on relevant information about how wood and bioenergy markets function, and about different categories of wood and fuels.

There is no definition of the term “whole trees” in RED article 2. Our interpretation is that the Commission, or parts of the Commission, wants to restrict the use of stemwood to include all stemwood, thus widen the exception for stemwood indicated in Annex IX A, and apply this restriction to all use of biomass, also for heat and electricity.

The consequences of this measure would be very large, for two reasons:

- Much “stemwood” or “whole trees” is used for energy today, and restrictions would have a big impact on the current supply of biomass for energy.
- To distinguish between acceptable wood and restricted wood would require new control systems and cause administrative burden and increased cost for the fuels.

The direct consequences would be less substitution of fossil fuels and higher emissions of fossil CO_2.

2. WHAT IS A TREE?

There is no generally accepted definition. Wikipedia has this description:

Although "tree" is a term of common parlance, there is no universally recognized precise definition of what a tree is, either botanically or in common language. In its broadest sense, a tree is any plant with the general form of an elongated stem, or trunk, which supports the photosynthetic leaves or branches at some distance above the ground. Trees are also typically defined by height, with smaller plants from 0.5 to 10 m (1.6 to 32.8 ft) being called shrubs, so the minimum height of a tree is only loosely defined.

Defining "trees" and "shrubs" is an important issue for forest inventories. Different countries use different definitions for counting biomass in trees. An international project, COST Action E43, looked into harmonizing these methods. One report, published in Silva Fennica 2009, "Common Tree Definitions for National Forest Inventories in Europe", gives a good overview of the difficulties: www.silvafennica.fi/pdf/article463.pdf

These are some of the findings in the project's report:

Shrubs are by FAO defined as woody plants between 0.5 and 5 m, but the distinction between shrubs and trees can vary between 5 and 7 m in different inventories. Defining shrubs and trees according to species is difficult as some species occur both as shrubs and trees (with a single trunk), e.g. Salix Caprea in northern Scandinavia. The minimum diameter for including trees in the inventory as trees varies considerably, from 0 to 12 cm diameter at breast height (usually defined as 1.3 m above ground).

The report concludes:

Summarizing, the classification of woody plants into trees and shrubs as required for the application of forest and other wooded land definitions as well as growing stock definitions is inherently complicated.

If EU wants to limit the use of "whole trees" there must be a clear definition of "trees", distinguished from shrubs and other woody plants, like short rotation coppice, and what is included in "whole trees", if the definition includes also dead trees, etc. The above-mentioned report also discusses the different parts of trees as well as the issue of living and dead trees.

What is a tree, and what is a shrub? Willows, like Salix caprea and Salix petandra, are species that can be both.

In a recent document from EU Commission the term "healthy whole trees" is used. This implies that the Commission now realizes that restrictions cannot be used for all "whole trees". But still, there is a need to define "trees", and also what is meant by "healthy" and "unhealthy" pertaining to trees. The following discussion will illustrate that this is not easily done.

In another document, the Commission mentions the possibility of restricting use of wood with a bigger diameter than 10 cm. This also raises the question if this would only pertain to stems, or if also thick branches should be included. These can not be used as sawwood but possibly as pulpwood although this is not the practice.

3. WHOLE TREE USE IN THE FORESTRY SECTOR

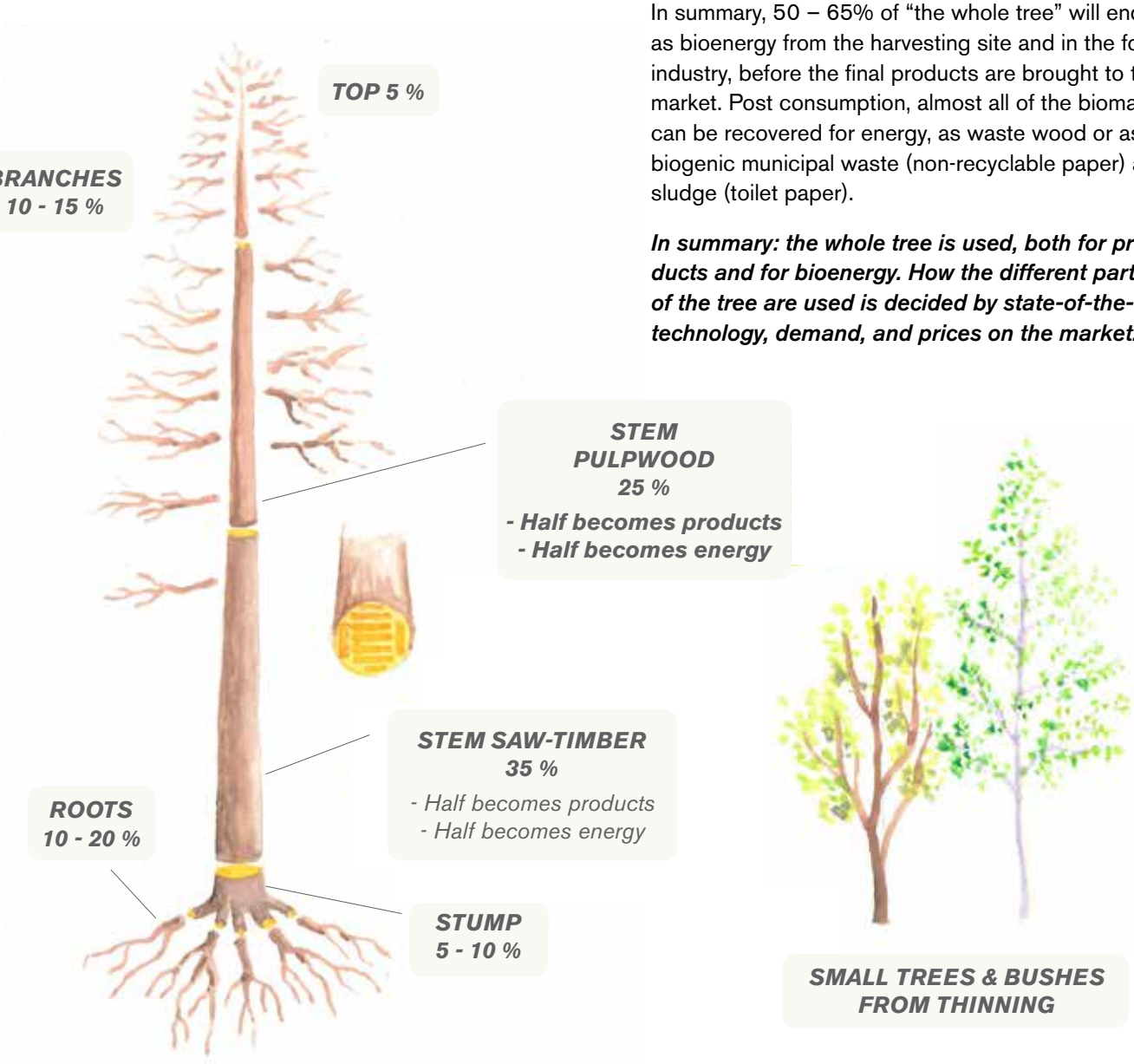
The whole trees are, of course, harvested in forestry. There is no way to harvest only parts of the tree.

The trees consist of stems, branches, leaves/needles and roots. The stem is cut, leaving a stump, that is usually not harvested today but contains useful biomass. The stem is usually cut into saw-wood (the lower thicker part of the stem) and pulpwood (the upper thinner part of the stem). The top of the tree, branches, and small trees at the harvesting site may be harvested for energy – usually this slash is sun-dried and chipped at roadside. This slash may contain thin stems which could be defined as "whole trees".

The income of the harvest is typically divided in: saw-wood 70%, pulpwood 28%, and energy wood 2%. The demand for saw-wood drives the market. Bioenergy harvest is a low-paying marginal activity that is never the main purpose of the harvest.

When a tree is harvested at a final cut, about 50% of the biomass in the tree is taken out of the forest as saw-wood and pulpwood. Half of this wood will also become bioenergy feedstock as by-products in saw-mills and pulp mills (bark, sawdust, shavings, chips, black liquor, tall oil). When harvesting residues are collected an added 20% biomass can be recovered. If the stumps are harvested yet another 15% can be added. In summary, 50 – 65% of "the whole tree" will end up as bioenergy from the harvesting site and in the forest industry, before the final products are brought to the market. Post consumption, almost all of the biomass can be recovered for energy, as waste wood or as biogenic municipal waste (non-recyclable paper) and sludge (toilet paper).

In summary: the whole tree is used, both for products and for bioenergy. How the different parts of the tree are used is decided by state-of-the-art technology, demand, and prices on the market.



4. STEMWOOD FOR ENERGY FROM COMMERCIAL FORESTRY

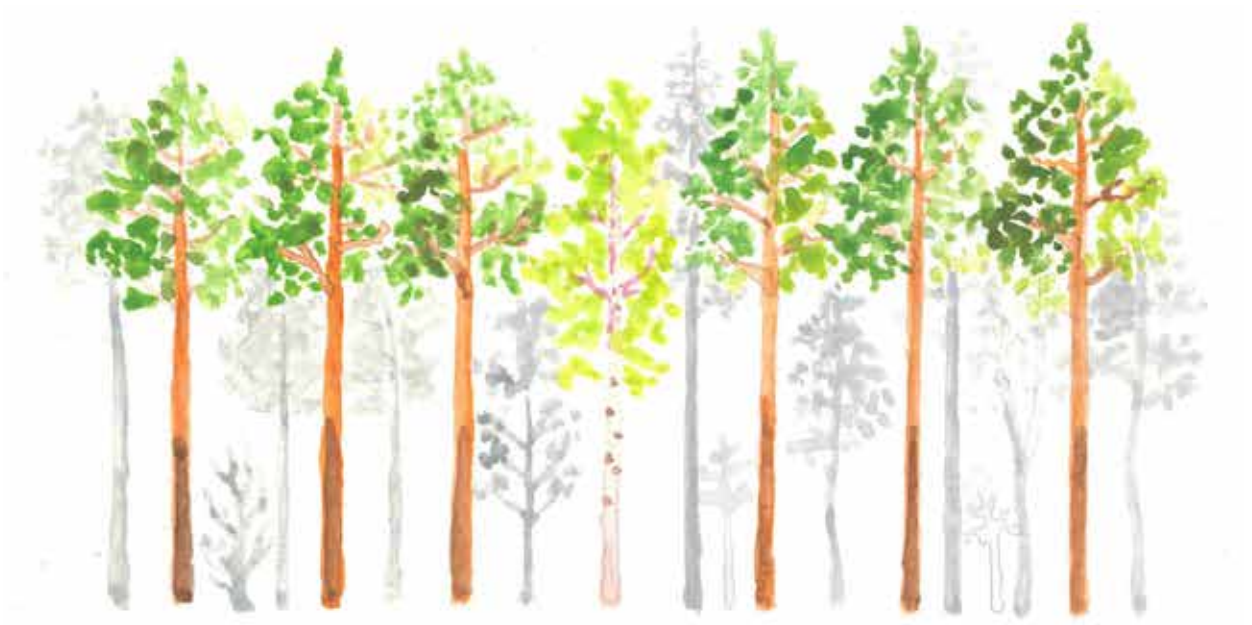
4.1 THINNING

In managed forestry, thinning is a practice to increase the value of the final timber by removing a certain percentage of the growing trees at intervals (2 – 3 times during a rotation) to make room for the best trees to develop into valuable sawlog trees. Damaged trees and weak trees can be removed, as well as good trees. In Swedish pine forestry moose cause considerable damage to young trees by eating shoots. Broadleaf trees can be damaged by deer reaping bark. Such "browsing damage" results in quality loss and produces wood that cannot be used as sawlogs.

All the trees that are removed are "whole trees" by definition. At early thinning, the trees are quite small and usually left at the site to decompose. At second and third thinnings, many of the harvested stems can be used as pulpwood, or even saw-wood. But much of the material can also be used as fuelwood to be chipped. It may not be economical or feasible to sort the different stems, and all may be used for energy, especially if the trees are young. A relatively large share may also be broadleaf trees suitable as fuel, but less in demand as pulpwood. Being able to sell the trees from thinning as fuelwood improves the economy of thinning operations, gives added income to the forest owner, and improves the quality of the forest.

A definition prohibiting the use of whole trees would make thinning operations less profitable and have adverse effects on the productivity of forestry, the quality of saw-wood, and the income of forest owners.

Thinning in young birch stand. The birch wood may be used as pulp wood or energy wood depending on prices and local demand. Slash is left on site.



Thinning is made to favor valuable trees for future production of high-quality sawlogs.

Grey = harvested trees and shrubs.

Colored = remaining trees.

4.2 SALVAGE WOOD/DAMAGED WOOD

At final felling the forester will discover that many trees are damaged and cannot be sold at full price. A common damage is rot, which is usually only detected after the trees are felled. Other damages can be scars on the trunks, splinted wood (e.g. damage by wind or snow and ice), fire damage, crooked stems, dry stems from insect infestation, and the above mentioned browsing damaged trees. There is also always a certain percentage dead, dry trees (natural decay or "self-thinning").

These stems will be sorted in a separate pile and sold as energy wood. A certain share of rot can be accepted for pulpwood. Trees affected by fire cannot at all be used as pulpwood, because the ash is detrimental to the process. Some burnt wood can be used as saw-wood but needs to be handled separately.

4.3 TREES DAMAGED BY BARK BEETLE

In the last years, infestation by spruce bark beetle has killed large amounts of trees all over Europe. Often, a relatively small group of trees are affected and die at each site. But attacks appear in the whole forest landscape. The trees need to be removed, to slow down the spread of the infestation, and for safety reasons. This wood can often not be used as saw-wood or pulpwood, but has to be used as biomass fuel. To take care of the trees is a costly operation, as the stands of infested trees are usually relatively small in volume.

Damage by rot is not detected until the trees have been cut down. Spruces are more affected by rot than other species.

Bark beetles have caused much damage all over Europe during the last years. Trees need to be removed to stop spread of the insects.

The amount of salvage wood varies considerably between years. Sweden can be seen as show-case:

- In the earliest years of this century, Sweden was hit by two very forceful storm systems with hurricane force winds: "Gudrun" (on 9 January 2005) and "Per" (on 14 January 2007). The Gudrun storm in a few hours took down the equivalent of a whole year's Swedish forest harvest. Very large volumes of wood had to be salvaged within a short period of time. Most could be used as saw-timber or pulpwood, but much was also damaged and had to be used for energy.
- In 2014 and 2018, Swedish forests were affected by large forest fires of a magnitude that hadn't been seen for many decades. Much of the burnt and charred wood had to be used for energy for quality reasons, although some could be used as saw-wood.
- During the last years, infestations by bark-beetle has produced large quantities of salvage wood. Similar insect infestation occurs at uneven intervals.
- In 2021, heavy snowfall in middle north Sweden has produced very large volumes of splinted wood.

4.4 SPECIES AND LOGS THAT THE INDUSTRY DOESN'T BUY

The forest industry is specialized and prefers to buy wood of certain species. Some sawmills only use spruce, others only pine. Pulp mills today use a wider array of species than earlier, but some species are not in demand. Certain species may contain unwanted acids or have other unwanted properties. Another example of unwanted material is logs with too large diameter, as the sawmills cannot handle them. Too crooked stems cannot be sawn, and can cause problems in the debarking units at pulp mills. Freestanding spruces get so many knots that they are ill suited for making construction wood or furniture wood.

All of these categories are "healthy whole trees". Restricting their use as biomass for energy would result in losses for the forest owners and cause problems to dispose of the wood.

Examples of discarded wood. Crooked stem. Splinted stem. Insect infested stem. Fire damaged, charred stem. Rotten stem.

CLASSIFICATION OF DISCARDED WOOD

Most Swedish commercial wood is measured and classified by the independent company Biometria, collectively owned by the forestry companies and forest owners. This is Biometria's classification of discarded or downgraded wood: (our simplification and translation)

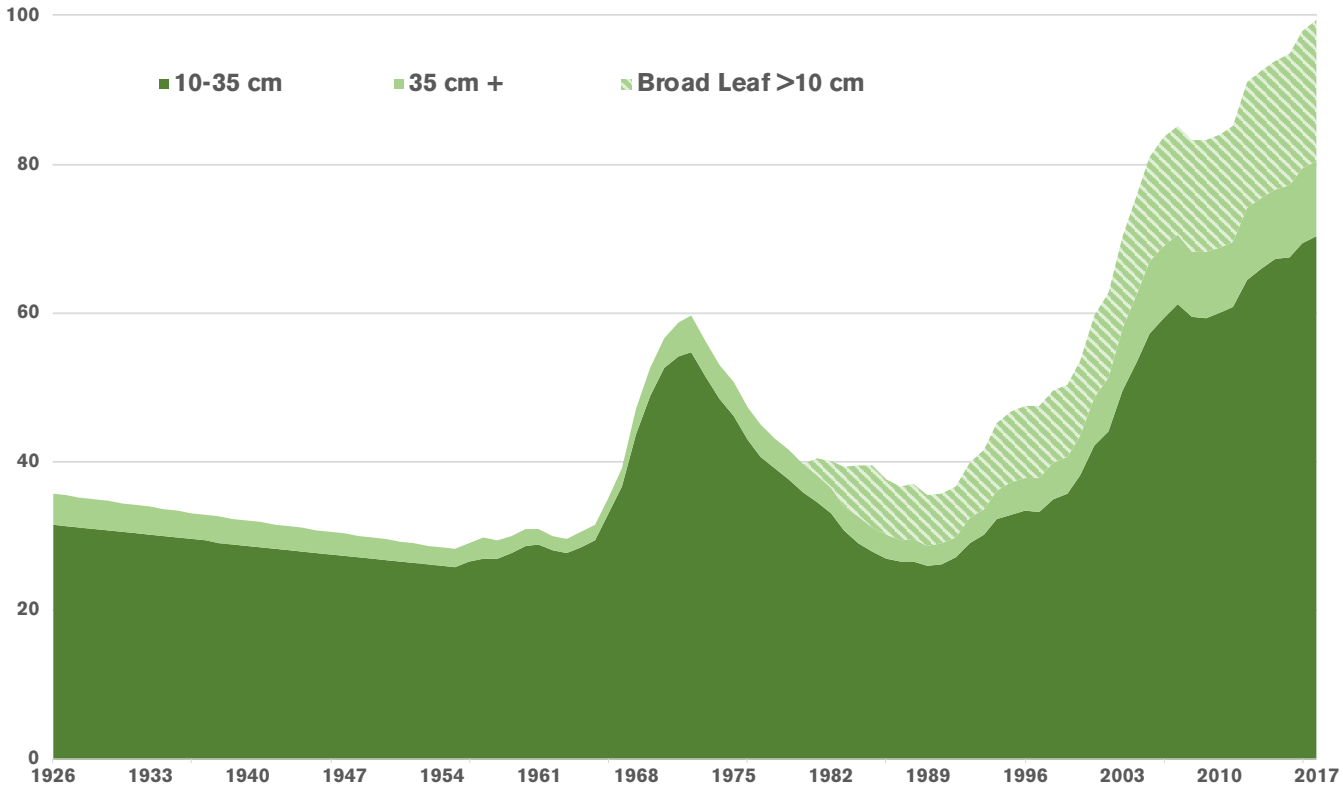
1. **Wrong species or assortment: including dry and insect infested.**
2. **Crooked: giving too large loss at sawmill.**
3. **Rot: too large share of stem affected.**
4. **Diameter: too small or too large diameter.**
5. **Length: too long or too short.**
6. **Quality: knots, splinted, scarred, etc.**
7. **Damaged at harvest.**
8. **Polluted: char, soot, plastic, sand, metal, etc.**
9. **Damaged at storage: rot.**

LEAVING COARSE DEAD WOOD IN THE FOREST – *THE SWEDISH CASE*

The above listing of discarded wood doesn't imply that all of this wood should be taken out of the forest as biomass for energy. The forest legislation stipulates that a certain amount of coarse dead wood should be left in the forest after harvest operations. The new forest law in Sweden, implemented from 1993 and with a clear environmental target alongside the production target, has resulted in increased volumes of coarse dead wood in the Swedish forests, despite increased harvests and increased use of forest residues for bioenergy.

A certain amount of coarse dead wood must be left at harvesting sites, e.g. by leaving high stumps.

» FIG.1 **COARSE DEAD WOOD IN SWEDISH MANAGED FORESTS**



The total volume of coarse dead wood in the forests has more than doubled since the new forest legislation was introduced in 1993, and is higher than during the last 100 years. Earlier, much of this wood was used locally as firewood. Millions of cubic metres. Protected forests excluded.

Source: Swedish forest inventory.

5. OTHER CATEGORIES OF STEMWOOD FOR ENERGY

5.1 LANDSCAPING WOOD, INFRASTRUCTURE

There is a large potential for production of biomass for energy from different types of "landscaping operations". It can be trees and bushes along roads, railroads, canals, and power lines, as well as wood from parks, gardens and recreational areas. But not least along fields and ditches in the agricultural landscape. Much of this material would qualify as "whole trees". Studies have been made in city landscapes, showing that the quantities of such biomass harvest can be quite large. Often it is hard to sort the wood and to deliver it as saw wood, pulp wood and energy wood, and it all ends up as biomass for energy. It can be a mix of bushes and trees of different sizes. Harvest along roads and railroads is necessary for safety reasons. It is not easy to define which wood should qualify as "landscaping wood".

When new roads or railroads are built, and when cities expand into forested areas, trees are felled without being replaced by new trees. In this case some stemwood may not be suited for industrial purposes.

Clearing along fields and ditches is often necessary, and produces large volumes of energy wood, both trees and shrubs.

Urban areas make up a large portion of the area in developed countries, not least caused by "suburban sprawl". In Sweden, the urban areas are about half the size of cultivated farmland. Much of the urban areas are gardens, parks and recreational areas. A lot of trees are harvested in these areas. They usually end up at the recycling centers to be chipped and used for energy. They can be defined as biowaste, but are at the same time "whole trees".

One example from suburban Stockholm.
The owner of this relatively large lot wanted to fell 45 full-grown pines. A call to a local sawmill resulted in a demand from the sawmill to have the trees x-rayed for nails, a costly operation. This is common practice for lumber from urban areas, as the trees can have nails e.g. from putting up bird houses, tree houses, clotheslines, etc. The nails can cause costly damage to the saw blades at the mill. In this case, the pines ended up at the energy terminal where they were chipped to be fuel.

Energy wood harvested in urban environment to prepare for new building project.

5.2 WOOD FROM CONSERVATION AREAS

Conservation areas often need to be managed to retain their values and qualities. Otherwise certain dominant species may take over. Some full-grown trees may have to be removed, and in other stands thinning will be needed. Glades and other openings may have to be created. The harvested wood is often best suited as fuelwood. A whole tree restriction would make these operations more costly.

Harvesting to reduce the risk for forest fires is a similar category, important in southern Europe. Much of the harvested wood is made up of undergrowth and shrubs, but small trees and dry trees may also be included.

5.3 WOOD FROM SMALL CUTS

Not all forestry is done on a commercial scale. Traditionally, forest-owning farmers have cut a few trees at a time to make firewood for their own use. There is still a need to do this sometimes. It can be small cuts, where the volume of saw-wood or pulp wood is too small to sell it on a commercial scale, but where delivery to a local heat plant is a better option. Land ownership is in many areas fragmented, and in a mosaic landscape with a mix of fields, pastures and forests, there is always marginal areas where commercial forestry is not practiced, but where trees in small stands or single trees can be harvested from time to time.

5.4 WOOD FROM DEDICATED ENERGY PLANTATIONS

An alternative to short rotation coppice production is to grow trees of fast-growing species like poplars or hybrid aspen. This is production on farmland, either in active use or abandoned farmland. Such energy plantations can also be used to break up the monotony of the agricultural landscape, offer protection and habitat to birds and other animals, or be used for carbon sequestration. Around 1990, when Sweden deregulated farming, subsidies were given to such plantations, often for birch. Regardless of the reason, use of trees from such plantations must not be prohibited, either for material production, or for energy.

Pasture protected as natural reserve. Needs to be cleared at intervals to enhance natural conservation value.

5.5 WOOD WITH NO INDUSTRIAL DEMAND

At some locations there is no demand for stemwood, or certain types of stemwood, preferably of thin dimensions. One such example is the Baltic countries, where there is no paper pulp industry. The thicker parts of the stems are in demand from local sawmills, but the thinner parts of the stems cannot be used for pulpwood unless exported to neighboring countries like Finland and Sweden. Consequently, pellets factories have been built to take care of pulpwood quality wood. The only feasible alternative to either pulpwood export or pellets production is to leave the wood in the forest to rot, or to burn it on site, a practice that is still common in North American forestry.

In other parts of the world pulp industry or sawmills have been closed down and demand for wood has decreased. Two examples are Norway and Southeast United States.

If pulp mills are closed down and there is no demand for wood from thinning this will be detrimental for the growth of the forests and for the supply of high-quality wood for sawmills. Restrictions on whole trees will in this case also be negative for the long-term growth of the forests and the up-take of carbon.

In certain areas there is no forest industry at all. One example is northern Norway, where birches make up most of the forests. These birches have traditionally been used as firewood, and today heat plants in the region use birches, which by definition are “whole trees”. This biomass has no alternative use.

The fuelwood used in Harstad comes from nearby birch forests owned by local farmers.

The Harstad heat plant was inaugurated in 2012 and is located in the harbor of the city.

Harstad is a city of 20 000 inhabitants in northern Norway. The heat plant is operated by Statkraft AS and was inaugurated in 2012. It delivers around 45 GWh bio-based heat per year, mainly to large buildings like the hospital, schools and offices in the city. The fuel is delivered by a local biomass fuel company which harvests and collects wood from the surrounding area. Most of it is birch, sold by local farmers and other landowners. There is no other demand for this wood, as there are no commercial sawmills or pulpmills in all of northern Norway. The distance to the nearest pulpmill in Skogn is 839 km by road, and to the nearest commercial sawmill in Namsos it is 758 km by road.

The nearest pulp mill to Harstad, using low diameter wood, is located more than 800 kilometers to the south.

5.6 WOOD USED TO IMPROVE MARKET FLEXIBILITY

The markets for commercial wood and for energy wood fluctuate. The demand for forest products and the prices on wood can vary considerably between years. Demand for fuels for heat plants can vary 25 % between cold and warm winters. In a cold winter, there may be shortage of fuel and high fuel prices, whereas in a warm winter there will be surplus and low prices. Bad harvesting conditions in the forests may also hamper supply short-term. In many cases, it is an advantage to be able to sell and buy pulpwood quality wood for energy purposes. The lowest quality pulpwood will be used first. Both the forest industry and the energy industry are favored by free trade of wood. For the utilities, delivering heat is the primary responsibility. Restrictions on the use of stemwood for energy would endanger the heat delivery when there are no other fuels available on the market.

5.7 STEMWOOD FOR SECURITY OF SUPPLY

Heat plants and CHP:s need to have fuels in storage to safeguard for disturbances in supply of fuels. For long-term storage over several years, stemwood is preferred as it decays slowly compared to woodchips or by-products. For reasons of security of supply, it is therefore important not to have restrictions on use of stemwood. Security of supply will be a more important issue in the future with increasing risks for natural disturbances that can disrupt the supply chains of biomass fuels. Bioelectricity will be of increasing importance in an energy system with a high share of variable renewable power production. Storing biomass is an inexpensive alternative to other energy storage solutions.

Many heat plants have storage of fuelwood ready to be chipped, to safeguard against disturbances in fuel supply, or high heat demand during exceptionally cold winters.

Picture from heat plant in the city of Flen, central Sweden.

6. Conclusion – Let the market decide

In a market economy, demand and prices will allocate raw material to its best use. The different values are reflected in different price levels and the market creates natural cascading of the wood according to its end use value. The suggestion from the Commission that “it should only be possible to use feedstock that does not have higher added-value in nonenergy sectors” is against this background redundant.

Administrative regulation results in suboptimal use of the resources. Restrictions on the use of “whole trees” will disincentivize thinning, small-scale cuts, use of landscaping wood, and the mobilization in general of biomass for energy. This will lead to slower growth in the forests and lower up-take of carbon, lower incomes for foresters, and higher emissions from fossil fuels. Above all, it will lead to new bureaucracy and administrative burdens on both suppliers and users of biomass for energy from forests, and make bioenergy less competitive against fossil fuels.

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