BUILDING A BIOBASED SOCIETY WITH ATTENDANT PROBLEMS

Henrik Teleman

You wrapped the blade with sticky, insulating tape in masculine black that 'vulcanized'– a manly material, unknown to my academic family. In the south of Sweden you hardly played ice hockey – there was nearly ever ice. Hockey sticks made of wood were used for *land* hockey. We're talking now about the end of the 60's and beginning of the 70's. Wait a minute – was it really made of wood? No, not just wood, it was made of *ash*. My next hockey stick was made of some kind of plastic.

For the last couple of years, the words 'biobased society' have been popping up, especially in the world of research policy. Until then, the mantra was 'sustainable cities'. Most people seem to be in agreement that there will be about nine billion people (9,000,000,000) in the world in 2050. If nine billion people are to live like we do in Sweden, the carbon content in each GNP-dollar has to decrease 130 times in order not to destroy the climate. Around the turn of the last century, people were talking about factors five and ten, in my view completely realistic goals. But a factor of 130? The de facto progress made today is eaten up by increased consumption and vacation trips to more and more distant places.

The question is what will hit us first: a climate crisis, overexploited biotopes, or lack of raw materials with resulting armed conflicts, where peak oil more than most other shortages will send extreme shockwaves into the economic systems. With the most recent global economic depression in mind, we can also imagine a general systems collapse. The latter may have benefits as well, as economic declines tend to be good for the environment in general and the climate in specific.

China is buying up land and mines in Africa and is trying to ensure its access to food and raw materials for the future. It is not difficult to believe that the producers of raw materials in general and those of renewable raw materials in specific will be tomorrow's winners. None the less, you can catch a whiff of desperation today from the Swedish forest companies. No increase in newspaper subscriptions in Asia nor

improvement in the world economy can compensate for the decline in newspaper reading in Europe or its collapse in the USA. Currently the activity circulating around more or less 'smart' wood based products is at a feverish level. Some of them have a longer way to go before becoming products, while others are already here, such as various types of textile pulp. It is no less than a sign of a new world order when the Indian textile giant Aditya Birla bought the Swedish Domsjö Fabriker in 2011. To a great extent, viscose can replace cotton, the latter causing severe environmental stress. The problem is that more new materials and products are necessary in order to maintain the need for Swedish wood fiber. The warning light is blinking ever stronger and faster as the newly created composite materials are in fact not selling. They are not used for real products, since they are easily outcompeted by their fossil-based rivals. The possibility of long-term declining pulpwood prices is also under discussion…

In reality we have already been in a biobased society. The hockey stick doesn't go so far back in time but I myself live in a house which until it was renovated in the middle of the 60's was more or less completely biobased. The house, built in 1895, is a child of the marriage between the rural society and early industrialism in Sweden insofar as the standing timber logs in the walls were sawed. (Ten years earlier the logs would have been lying and would have been cut with an axe.) The logs are joined with dowels, the beams are fixed with wooden bolts and the roof was covered with wooden shingles. The total amount of iron used in the construction cannot be more than a few kilos. The rural society's production of functional objects was based on a deep, fundamental knowledge of the characteristics of wood from various species of trees, as well as on their properties due to how they had grown. For example, birch is tough and hard, good for furniture, while oak is used for frame beams or various exposed places in a barn, resinated fir is good for window material, tree forks for ribbing, the angle between root and tree cut out carries and stiffen joist floors. Through different physical procedures in living trees, their material properties could also be refined and improved. And – ash wood was best for hockey sticks. The list needn't stop at construction material: clothes were biobased (linen, wool), as were tools, and people warmed themselves and their homes with firewood.

The world population is growing – we in the western world don't need to get a 'better life', but many others do – while at the same time our finite resources are insufficient to meet the growing needs. In order to ensure reasonable material conditions huge amounts of biomass will have to be produced in all possible forms. One major problem for the development of the biobased society is the understanding of nature in general, and particularly of the forests.

When business and many leading politicians – somewhat generalized – now claim that it will be 'business as usual', although we'll get around in electric cars instead of petrol driven ones, the environmentalists have by tradition concentrated on keeping nature as untouched as possible, perhaps picturing for themselves nature as being in some way "good" (I do not wish to belittle their importance in opposing nuclear power or criticizing poisonous emissions, and so on.) The conflict between production and preservation is greatest for the forests, which many people consider more basic and untouched than arable land. Few things cause such an uproar as when areas in the forest full of mushrooms disappear after a clear-cutting, although there is hardly a forest which is not the result of deliberate cultivation in Sweden.

Many people consider nature as something good, even morally right, with great inherent value. But nature is completely amoral – it merely exists, regardless of how it looks. When we humans have totally ravaged our earth and only cockroaches and rats are left, this is still nature. This nature is not particularly pleasant – *we* wouldn't like it and it couldn't nourish us. A rich and diversified flora and fauna – what we consider to be 'good' nature – is 'good' insofar as it is good *for us.* If we use nature in order to survive, or even to have a good life, it is 'good' if this use does not affect other things that are important for humans. If we poison things that our own species is dependent on for survival, as we to a great extent already have done regarding air and water, or if we wipe out whole stocks of fish, this is counterproductive, no question about it.

The conflict exists in the relation nature – culture, when we alter nature and limit its 'free' development and often its biodiversity in order to increase the production of things we need or think we need. *We are soon facing the challenge of feeding nine billion people. Virgin land and nature untouched by human intervention could perhaps feed some hundred million people.*

In the last few years, forest and wood industries have adopted climate issues as one of their most important concerns. Wood and how you use it bind carbon dioxide, firewood is carbon dioxide neutral, the forest is a carbon sink – but in that case, the forest must be growing, not be a preserve with a high percentage of fully grown or dying trees and so on.

If we start to examine the arguments more closely, we find it difficult to get answers. In Swedish forests, much of the carbon dioxide is bound in mycorrhiza. Badly carried-out felling on land with bad carrying capacity or sloppy soil scarification leads to large, fast carbon dioxide emissions, something I never see the forest industries commenting. They want to cultivate as intensively as possible with the help of artificial fertilizers. Preserves are supplemented with spruce plantations regardless of

the fact that it was these same plantation monocultures which suffered worst during the storm called Gudrun in 2005.

At the same time, the Swedish Society for Nature Conservation ducks the question of how we should go about increasing the production of biomass. Instead, it wants to increase both the preserves and the so-called nature forestry – a forest management method which causes the forest companies to froth at the mouth. They comment on the need for renewable raw materials by saying that the number of people who eat too much is greater than the number who eat too little, and we must eat less meat. It isn't difficult to think that they are making things easy for themselves, while at the same time it isn't hard to understand the arguments for good biodiversity. Biodiversity creates not only a forest which is pleasant, it also provides ecological robustness and a wealth of species that we can develop new, exciting materials from.

The industrial forestry's spruce plantations were, due to the storms in 2005 and 2007, a very bad affair economically for many of us Småland farmers: the recurring attacks of the spruce bark beetle and the fir root rot did nothing to cheer us up, either. Nor is it certain that the dominant practice of clear-felling gives me as a forest owner a better economic gain in the long term. The forest industry claims however that it yields 40% greater volume than selection felling. At the same time, untouched nature and good biodiversity do not feed and warm the billions of the world – pristine nature is not the same as social sustainability.

What is a biobased society? In the first place, it is naturally not just a question of wood. It can be linen, wool, and so on. Very roughly, we could claim that it is a matter of molecules, fibres, fuel, timber/wood and other things. Fibers can be used for paper, packaging material, insulation, plastics, clothing and much more, like nanofibre, for instance. Today, we can make window panes out of wood, even if this is only at the development stage so far. We can also burn wood, gasify bio residues, and make diesel from the residues of paper production. We build various things from timber. Many other products are made from wood, such as medicines. The spruce trees that are destroyed by root rot are sent to Norway to be turned into vanillin.

Ever since the Virserum Art Museum began to work with everything that can be made of wood I've heard industrial and university people say that wood must become an engineering material. By this they mean that construction wood must be calculable in the same way as steel. The answer has up to now essentially been glulam, something we have been able to produce for over a hundred years. The sawn timber industry delivers the same products since its inception in the end of the 19th century: beams, crossbars and boards. The material in the products – spruce and

pine – is the same with one remark: as the classification of timber to be sawn now is being phased out, we can assume that the strength and form stability of the finished product will deteriorate. To a great extent, research is directed towards a greater use of wooden materials, to its strength and to more efficient production (both in the forests and in the sawmills). Research on materials or products that function in another way or which are grown in a different manner, or have another 'content' is barely mentioned in contexts of wood-mechanical industry. To a certain degree, cross-laminated timber can be considered an exception.

It is perhaps not so strange that proactive research is seen primarily on the paper and pulp side – that is, with the chemists. The major part of earnings and research is traditionally found here, in the forest industries. While a modern paper mill has little in common with the rag-based production of the 19th-century, a sawmill is in reality only a very modern version of a large farmer´s sawmill – something which probably is the reason for the different cultures regarding research and development.

Today in a modern factory, my complete house could be cut out in a couple of hours or so. It would only remain to put it together like an assembly kit, very strong with dowels and no messy nail plates. The right type of wood for the right job. The right fibre in the right place. CAD and CNC are great things! At the Hamburg Housing Expo in the autumn of 2013, a five-story building called the Woodcube was exhibited. The walls of the house are 30 cm. thick and are completely made of wood, supplemented by two wood fibre mats. The various layers of wood have thin channels to give the walls more insulating air. The building completely lacks sealing layers – instead, it takes in and gives out moisture. In order to avoid the traditional glue used on cross-laminated timber (CLT), the walls are held together by beech dowels which are first dried to a 5% level of moisture and later swell up in the walls. The lack of all-covering layers of glue naturally allows moisture mobility, a necessary condition to prevent water from condensing inside and causing damage. The risk of harmful emissions also decreases. It is clear that the Woodcube is a much stronger house than a normal lightweight construction that is taped together with nail plates of various types.

The Woodcube in Hamburg, like many examples in Germany, Austria and Switzerland, can cause a Swede to hang his head. How is it possible that things which are tried out with no prejudice, and are even common in these countries, are so unusual and revolutionary in our own? The lack of innovation spirit in Sweden applies not only to technical and sustainable solutions beyond practice of today, but also to a high degree to design. Sweden is the second largest exporter of forest and wood based products in the world. How does our wood architecture rank? Making use of the cultural

heritage of wood should be the same as making use of a sustainable and economical possibility. In Canada, the province of British Columbia has taken the first step by passing the First Wood Act, which states that wood as a construction material should always be the first alternative when erecting publicly financed buildings. In addition to Canada's being the number one export nation in forest and wood-based products in the world, it also takes care of 'the wood culture'. Individual municipalities can then adopt the law. Something municipalities also outside the province is doing today.

Our possibilities to make calculations today exceed many thousand-fold those we had in the sixties, the golden age of the art of engineering. That goes also for our ability to understand and control growth processes. We can culture human tissue in order to heal burns, but, we have basically nothing more advanced coming from the forests than a 2 inch x inch beam. A biobased future must mean that we make full use of the possibilities of many different types of tree species, from the molecular level to the construction phase. We must be able to control the pattern of growth so that we can achieve the best properties, which can even imply that we once more use tree forks when we want curved or bent forms that are naturally strong. We do all this to save finite resources. The biobased society will be both high- and low-tech, with a high level of knowledge and high technical precision, but nature will do the job. The goal will be to do as little as possible with as short transportation distances as possible. The knowledge about the use of wooden materials passed down from our forefathers – can today be reached by calculation. Nanofibres *and* wattle and daub.When lack of raw materials and above all *the lack of energy* becomes acute our industrial society will be forced to change, not the least in our way of looking at and organizing production. Wood should not only be an engineering material, but an *intelligent* engineering material in the same way as cultured human tissue.

This means a paradigm shift for forestry as well, whose future character is difficult to plan considering the long rotation periods. The only thing we know with certainty is that much will always be good. But old 'truths' don't always hold true – an example is the tale of the birch tree, a scourge in the 60's and 70's but attractive pulpwood today. Prices are also climbing now for aspen pulp. At the same time forest researchers believe that climate change makes it extra precarious to put all one's eggs in a single basket. The biobased society will demand both as large volumes and as wide a choice of material properties as possible. In the long run, this will give greater economic value and, especially, a larger biological diversity in the forests. At the same time that the production conditions must be used optimally regarding the type and care of trees, some forestry practices will look more and more like gardening in order to be able to deliver wood with special properties. Especially the need for production

of precise qualities will lead to more people engaged in the forests. The well-tended family forest can easily become the song of the future.

Because the step to the bio based society is so great, the picture of it is vague. Despite the intensity of the discussion the vision is non-existent. We must realize that the sustainable, bio based society means a shift of paradigm. It looks different and functions differently. The production of biobased products will not be sufficient to replace the fossil wastefulness. The biobased society must be a sparing society.

In order for researchers to know what to focus on, they need images. They must *visualize* the biobased society. Regarding industry, it's a question of moving on and going beyond the production of wood, pulp and paper, in order to visualize a new way of living. Totally new business models must be created. It will no longer suffice for the forestry industries to employ only foresters, workers, chemists and engineers and work with minimal communication budgets.

While working with Virserum Art Museum's fourth big exhibition on wood and sustainability – WOOD 2013 – we were struck by the lack of ability of the majority of actors to communicate and present current research. They had demonstrators but couldn't lend them out since they had only one! One wonders how research will ever be able to connect and anchor with reality?

In this connection, industry and research are also approaching a paradigm shift. The Bauhaus School must have been the world's most successful institution of higher education in relation to its budget, the number of staff and the number of students. During its existence between 1919 and 1933, the school moved from Weimar to Dessau, and on to Berlin. The story ends with the Nazi takeover. Together with Russian constructivism, it answered to the demands and possibilities of modern times: industrialization, urbanization and the social state. In the "good society" everyone would have the right to a modern, light and practical home. In principal there is no building construction in the world today, which doesn't in one or another way relate to the functionalism which originated in the Bauhaus School. But Bauhaus was not merely an engineering school – it was just as much a school for art, architecture and design, with a strong orientation towards social welfare thinking. Today we are facing equally large challenges. The sustainable society's – our version of the Bauhaus ideas – must be transcending many borders and gathering together not only engineers but also social researchers, politicians, artists and architects. And why not ordinary, everyday citizens?

The work on the biobased society begins by asking, maybe not the right questions, but at least questions about the society of the future in a broad, transboundary, and – in particular – open and curious way.