

## Bioeconomy BW

### Diversity increases yield

# The bioeconomy offers opportunities for Baden-Württemberg's forests

**Wood from local forests is an important resource for the bioeconomy. However at present, a large amount of wood is used as fuel for energy production. Greater forest diversity and new wood-based materials have the potential to make the timber industry more sustainable. The bioeconomy can contribute to this by promoting the utilisation of deciduous trees.**

We are in a beech forest on the Swabian Alb, an area in southern Germany known for its rolling uplands, caves and castles. The forest's silvery-grey beech trees grow high up into the sky like a huge colonnade. Woodpeckers are hammering away and the sun is projecting its first warming rays through the bare winter tree tops. On the ground, the first spring flowers – wood anemones, lungworts and liverworts – enjoy the sunlight before the crowns of the trees are once again covered with green leaves and the forest's leafy canopy closes. From an ecological point of view, Germany's beech forests are a valuable treasure. However, from the timber industry's point of view, more the opposite is true. "For the timber industry, beech trees are problem children," says Jürgen Bauhus, professor of silviculture at the University of Freiburg. "As far as productivity and market value are concerned, beech trees cannot keep up with coniferous tree species." Spruces, pines and Douglas firs are used to produce wood materials such as plywood, glued wood, chipboards, paper and pallets. Beech trees usually end up in fireplaces or wood-fired stoves.

Bauhus is extremely hopeful about bioeconomic research. "The bioeconomy offers great potential for forests as it can increase the value of certain forest resources such as beech wood. Quite a few interesting beech products have already been placed on the market," says Bauhus referring to the beech plywood tubes produced by Prof. Dr.-Ing. Peer Haller at Dresden University of Technology, which have the same load bearing capacity as steel tubes, and a laminated veneer lumber called BauBuche manufactured by a company called Pollmeier. According to the company, beech wood is exceptionally strong. Much slimmer structures can be produced and beech wood therefore outperforms coniferous softwood materials.

## The bioeconomy can increase the value of deciduous wood

"We have to develop materials from deciduous trees, such as timber or new wood-based composites from biorefineries. The climate protection performance of forests would then be much higher, and it would be more attractive for forest owners to cultivate indigenous tree species," explains Bauhus. In

addition to replacing steel and concrete in the construction sector, the use of wood or wood components in the chemical and automotive industries is particularly promising.<sup>1</sup>

Those who feel strongly about the bioeconomy should support the establishment of more diverse forests in Baden-Württemberg

Experts largely agree that diversity in forests leads to greater productivity. "In principle, mixed-species stands with a larger number of different tree species are more productive than forests with only a few tree species," says Bauhus. "This is certainly not the case for all mixed-species stands. However, the yield of mixed-species stands in central Europe is around 20% higher than that of an area the same size with only one type of tree." A recent study by Liang et al.<sup>2</sup> compared data from forests around the world and found that a 10% decrease in forest biodiversity leads to a 3% decrease in productivity. Similar studies carried out in Germany point in the same direction," says Bauhus. In Germany, national forest inventories are carried out at 10-year intervals and measure the size and characteristics of German forests at 13,000 matrix points. However, these large-scale inventories do not collect information on the biological diversity of forests.



Wintery beech forest: forests perform a wide range of tasks, including raw material supplier, recreational area, habitat for animals and plants, air pollution control and the binding of carbon. However, forest owners mostly benefit from using forests as raw material suppliers.

© Gunther Willinger

Prof. Bauhus and his doctoral student Felix Storch have set themselves the goal to extract from available data valuable information about the diversity of forests and the influence of harvesting intensity. Storch has extracted eleven variables from the huge amount of data that allow him to draw conclusions about the structural diversity of forests, including the composition of tree species, trunk diameter, deadwood volume, degree of deadwood decomposition and bark diversity. Values such as bark diversity can only be calculated by combining certain basic data.

"Our ultimate goal is to use these structural elements for the many other types of forests as well. This would save us from having to monitor other forest types separately," says Storch. He explains: "An old Douglas fir with a severely torn bark offers a very different habitat to a young Douglas fir with a thin bark." Tree bark is full of life. It not only protects trees against rain, wind, sun and fire, it also provides living space for beetles, millipedes, ants, springtails, mites, mosses and fungi. The structural diversity index derived from the flood of data collected in forest inventories would then allow the researchers to draw conclusions about the biological diversity at a specific matrix dot – that's the theory. To analyse the relationship between structural diversity index and actual biodiversity, Storch relies on information obtained from another huge data collection, i.e. the German

## Biodiversity Exploratories.



Structurally less diverse spruce forest (left) and structurally rich forest with deciduous trees and deadwood (right). "I am interested in the species diversity of our forests and how we can deduce this type of information from existing forest inventories," says forestry scientist Felix Storch, explaining the aim of his doctoral research at the University of Freiburg's Institute of Silviculture.

© Jürgen Bauhus

While a large number of German National Forestry Inventory experts have been collecting data on German forests for around thirty years, since 2006 three hundred scientists have been collecting data on the biodiversity of German forest and grassland areas. There are three biodiversity exploratories including the Swabian Alb (Biosphere Reserve Schwäbische Alb). This biosphere is divided into 50 grassland and 50 forest areas where everything that creeps, crawls and grows – microbes, fungi, plants, insects, birds and mammals – is recorded. By comparing forest biodiversity data with data collected by the National Forest Inventories in the same areas, Storch is attempting to assess the significance of the newly calculated structural index with regard to biodiversity. The results are expected to be available in summer 2017.

Since the sample areas on the Swabian Alb are located along a utilisation gradient, they also allow conclusions to be drawn on the effect forest management intensities have on structural forest diversity. "There is no linear relationship between forest management intensity and structural diversity. Storch's data show that little to moderate forest management intensity does not lead to changes in structural diversity. It might even lead to an increase in a forest's structural diversity. The structural diversity of a forest decreases only when a certain harvesting intensity threshold has been reached," says Bauhus.

Based on these analyses, recommendations may be developed for appropriate forest management intensities. According to valid criteria, a forest's closeness to the natural state does not necessarily imply the presence of a large number of different tree species, but refers to the similarity of a tree stand to the one that can be expected from the natural conditions of the area under investigation. "The way we once used to interpret closeness to the natural state has led many forests to become far too dense and dark. Lighter forests can provide more living space for many more species," says Bauhus. This is why Baden-Württemberg's wood grouse conservation plan envisages thinning some Black Forest areas and making them more open to light. Bauhus comments: "There is no universal recipe. In some forests it certainly makes sense to thin out trees. In other forests, however, it might

make more sense to reduce forest management intensity in order to promote other elements of biodiversity,” says Bausch who hopes that his research will also contribute to improving existing forest inventory processes and hence forest management.

## Sustainability – for how much longer?

Forestry parameters such as growth and logging show that Baden-Württemberg forests are sustainably managed – at least for the time being. The majority of the region’s forests are still relatively young. They are almost at the peak of what they can grow per year. However, we already use nearly all of the conifer growth and yield. In coming years, our forests will become “more mature”; growth will therefore decrease while demand for wood increases.

From an ecological point of view, the bioeconomy can boost the forest industry by promoting the growth of native tree species such as beech and by increasing productivity through greater diversity of tree species. However, the drawback of the bioeconomy is that increasing utilisation pressure or specific product requirements might lead to the extensive cultivation of non-native species such as grand firs and Douglas firs.

### References

- 1 Bioeconomy Council (2016). BÖRMEMO 05 Wood in the Bioeconomy – Opportunities and Limits. [http://biooekonomierat.de/fileadmin/Publikationen/Englisch/BOERMEMO\\_Holz\\_vorla\\_\\_ufig\\_ENG\\_final.pdf](http://biooekonomierat.de/fileadmin/Publikationen/Englisch/BOERMEMO_Holz_vorla__ufig_ENG_final.pdf) [September 2016]
- 2 Liang, J. et al. (2016). Positive biodiversity-productivity relationship predominant in global forests, *Science* Vol. 354, Issue 6309, DOI: 10.1126/science.aaf8957. <http://science.sciencemag.org/content/354/6309/aaf8957>

---

### Article

13-Mar-2017

Gunther Willinger

© BIOPRO Baden-Württemberg GmbH

---

### Further information

Prof. Dr. Jürgen Bausch

Chair of Silviculture

Tennenbacherstr. 4

79106 Freiburg im Breisgau

Phone: +49 (0)761 203-3677

Fax: +49 (0)761 203-3781

E-mail: [juergen.bausch@waldbau.uni-freiburg.de](mailto:juergen.bausch@waldbau.uni-freiburg.de)

Felix Storch

Tennenbacherstr. 4

79106 Freiburg im Breisgau

Phone: +49 (0)761 203-8628

Fax: +49 (0)761 203-3781

E-mail: [felix.storch@waldbau.uni-freiburg.de](mailto:felix.storch@waldbau.uni-freiburg.de)

► [Chair of Silviculture, University of Freiburg](#)

---

## The article is part of the following dossiers



Biodiversity in crisis

environment

ecology

biodiversity

renewable  
materials

sustainability

bioeconomy