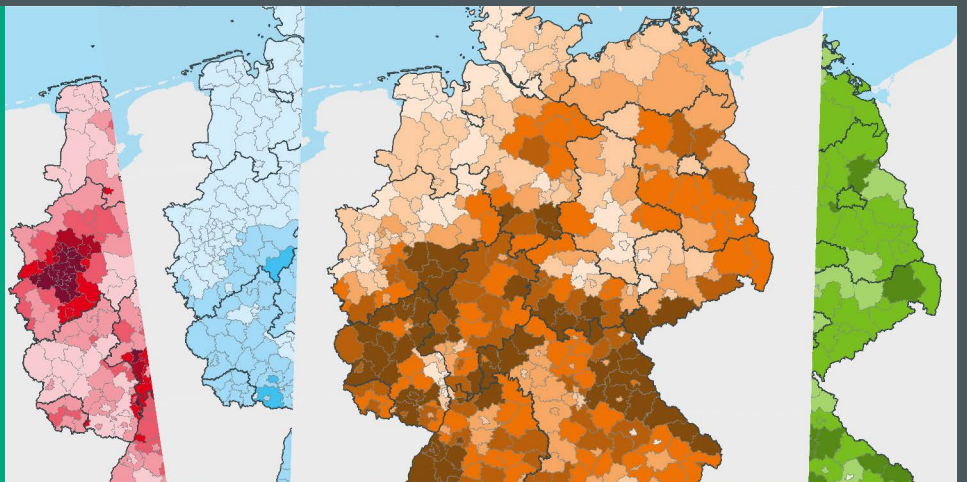THÜNEN

Thünen à la carte

Multitalented forests: raw wood as an ecosystem service

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Multitalented forests: raw wood as an ecosystem service

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Timber production, climate and nature protection or recreation: forests provide a wide range of benefits to society, many of them as public goods without a market price. The German Federal Government with its Forest Strategy 2020 aims at integrating the value of these ecosystem services into political decision-making processes – also by using economic valuation. A model of the Thünen Institute now facilitates this.

REGIONALISING ECONOMIC VALUES OF FOREST SERVICES: THE REWALE MODEL

The ReWaLe model developed at the Thünen Institute can be used to determine and map the values of essential ecosystem services of the forests in Germany according to their spatial distribution. In particular, the model evaluates the monetary benefits of the production of raw wood, of the forests' contribution to global climate protection, of recreational services as well as of services for nature conservation and landscape protection, which arise both through regular forest management and through the establishment of separate protected areas.

The economic value of each of the above-mentioned forest services is determined by means of an inherent valuation function. Each function is a mathematical description of the relationship between the respective service and its value from the demand side's point of view. A simple example is the relationship between the sustainably usable amount of raw wood and the revenue that can be generated from it. The function is determined empirically, in the above example by analysing market data such as prices for certain wood species and assortments.

The model is implemented in a geographic information system (ESRI ArcGIS). It requires a variety of input data, e.g. on landscape and land use, forest structure and population density. These input data are geo-referenced and are stored and managed in a number of geo-databases. The main data sources are land cover models such as CORINE, environmental and biomonitoring programmes such as the Atlas of German Breeding Birds (ADEBAR) and the Federal Forest Inventory, official statistics and results of population surveys carried out as part of ReWaLe and earlier Thünen projects.

The impact of current and possible alternative forest management on forest service values can be simulated by varying input data via input masks. The calculations are usually carried out at municipality level. The results are then aggregated at district level (i. e. NUTS 3) and visualised by maps.
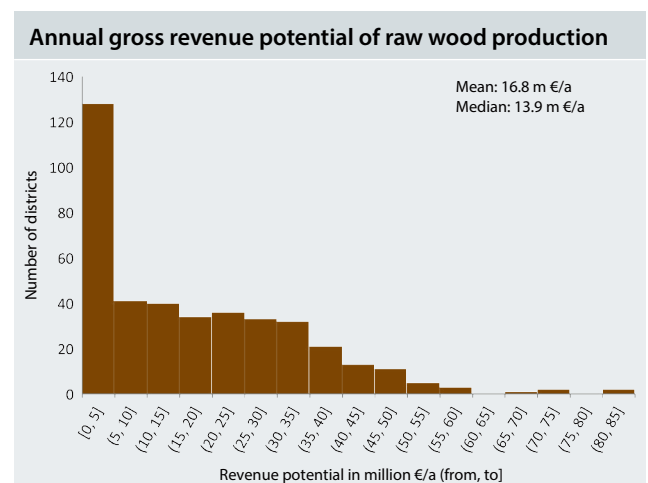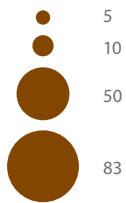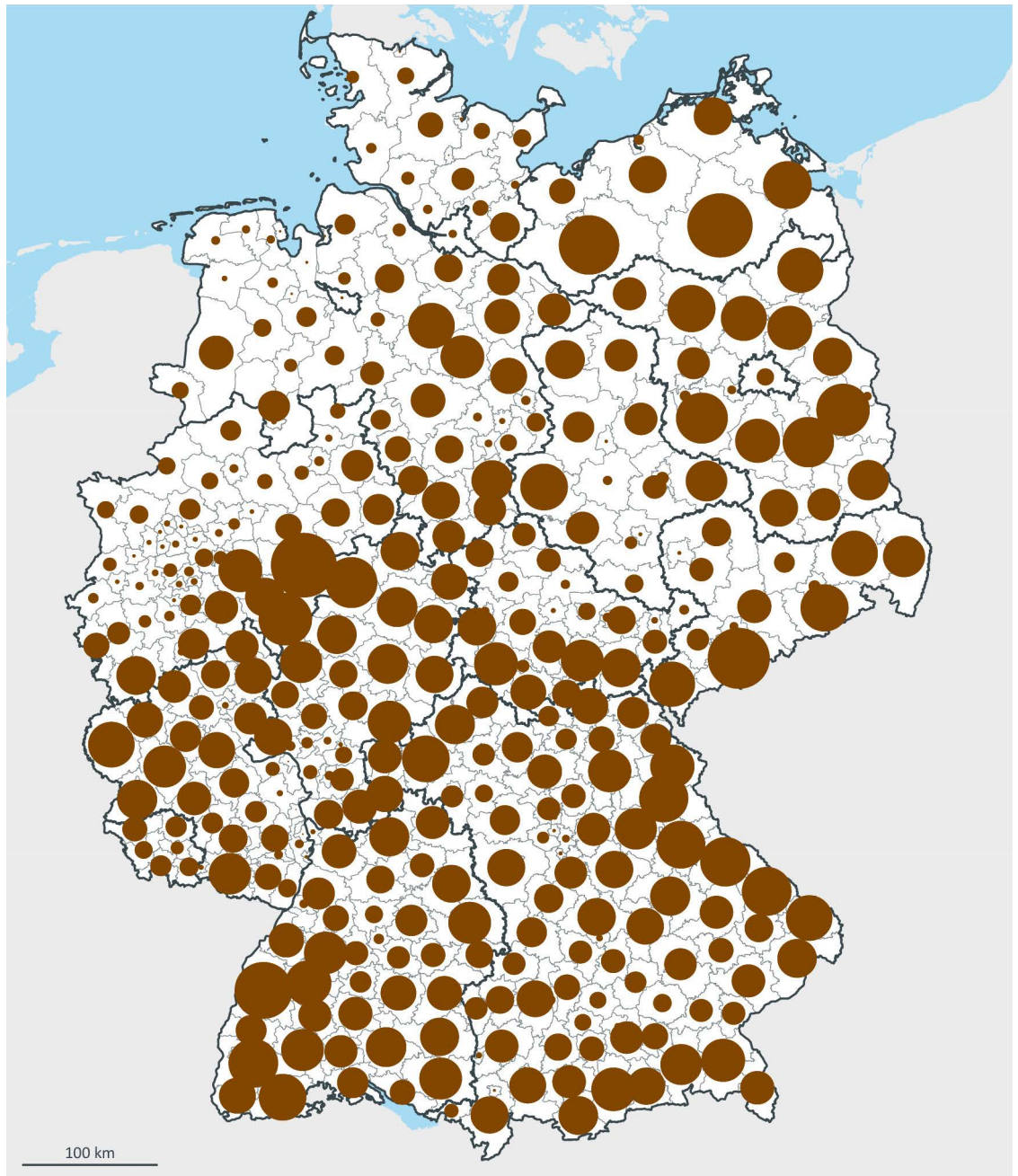

Annual gross revenue potential of raw wood production

Mean: 16.8 m €/a
Median: 13.9 m €/a

Figure 1: Frequency distribution based on 2016 price data in 402 districts and independent cities

Map 1:
Spatial distribution of
the annual gross revenue
potential or raw timber
production in million
euros based on price
data of 2016

5
10
50
83

Source: Thünen Institute

100 km

RAW WOOD PRODUCTION AS AN ECOSYSTEM SERVICE

The valuation of raw wood production aims to reflect the benefits of this ecosystem service from the perspective of society as a whole. Therefore, the valuation is based on the revenue potential. In contrast to the marketing revenue, the revenue potential comprises the entire biological production including the wood remaining in the forest. It is calculated from the sustainably usable increment and amounted to approximately 7.1 billion euros gross for the whole of Germany in 2016, i. e. without deduction of harvesting costs (in contrast, the marketing revenue was around 6 billion euros gross). For the valuation within the framework of the ReWaLe model, the gross revenues are relevant, since expenditures for timber harvesting are also financed from

the ecosystem service „raw wood production" and benefit the national economy (see scheme page 5).

Figure 1 shows the distribution of revenue potential in the districts and independent cities. About one third of all districts (n = 130) have a relatively low revenue potential of up to 5 million euros per year. These are mainly the north-west of Germany, the Leipzig-Magdeburg axis, the industrial conurbation between Mannheim and Wiesbaden, and the independent cities – i. e. regions that tend to have few forests. In thirteen districts, on the other hand, the absolute revenue potential is more than 50 million euros per year. They are located in low mountain regions such as the Black Forest, the Spessart, the Sauerland and the Erzgebirge (Ore Mountains), but also in the north-east of Germany, as Map 1 shows. The high
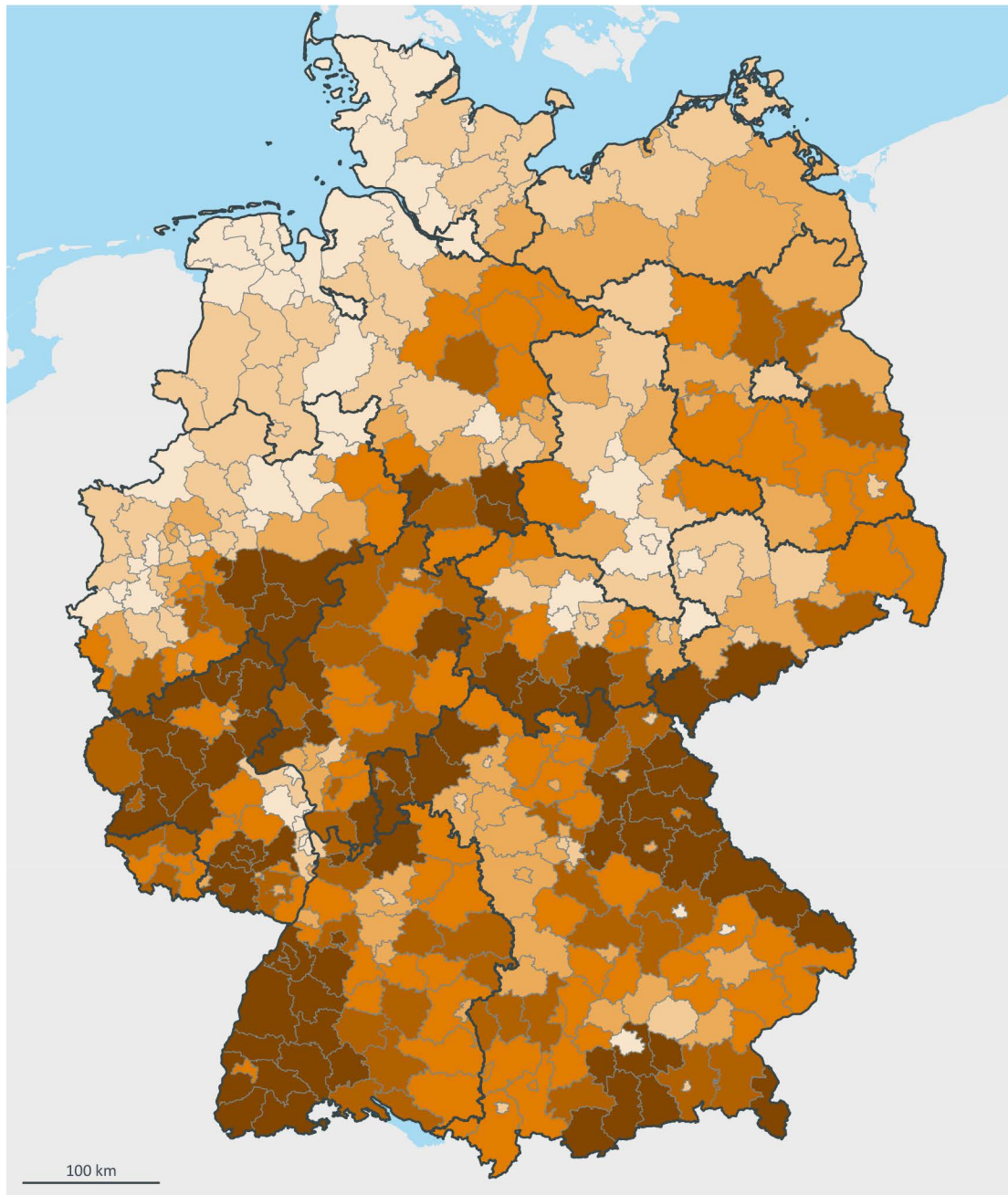
Map 2:
Spatial distribution of the annual gross revenue potential of raw wood production in 1,000 euros per km² of district area

≤ 6
> 6 to 12
> 12 to 18
> 18 to 24
> 24 to 30
> 30

Source: Thünen Institute

absolute numbers come about because these areas are densely forested and some of them also have an above-average size, such as the district of Mecklenburgische Seeplatte.

The share of forest area in the respective districts is an important, but not the only influencing factor for the regional distribution of the revenue potential of raw wood production. The share of the different tree species, their increment and their respective timber prices are also taken into account.

Map 2 shows the annual revenue potential per square kilometre of district area. The different sizes of the districts do not play a role in this representation. Here, regions such as the Bavarian Forest, the Black Forest, the Spessart, the Sauerland and the Erzgebirge

stand out with particularly high figures because these areas are not only densely forested but also home to a large proportion of high-yielding tree species such as spruce and oak. In the pine-dominated northeast, on the other hand, the revenue potential is lower, even though the area is densely forested. This is because the timber price of pine is significantly lower compared to spruce and oak.

OUTLOOK

The results of the ReWaLe model make it possible to systematically compare regional values of different forest services from a pan-economic perspective. With such comparisons, spatial hot spots of services and optimisation potentials can be identified, in

Procedure for determining and valuing regional raw wood production
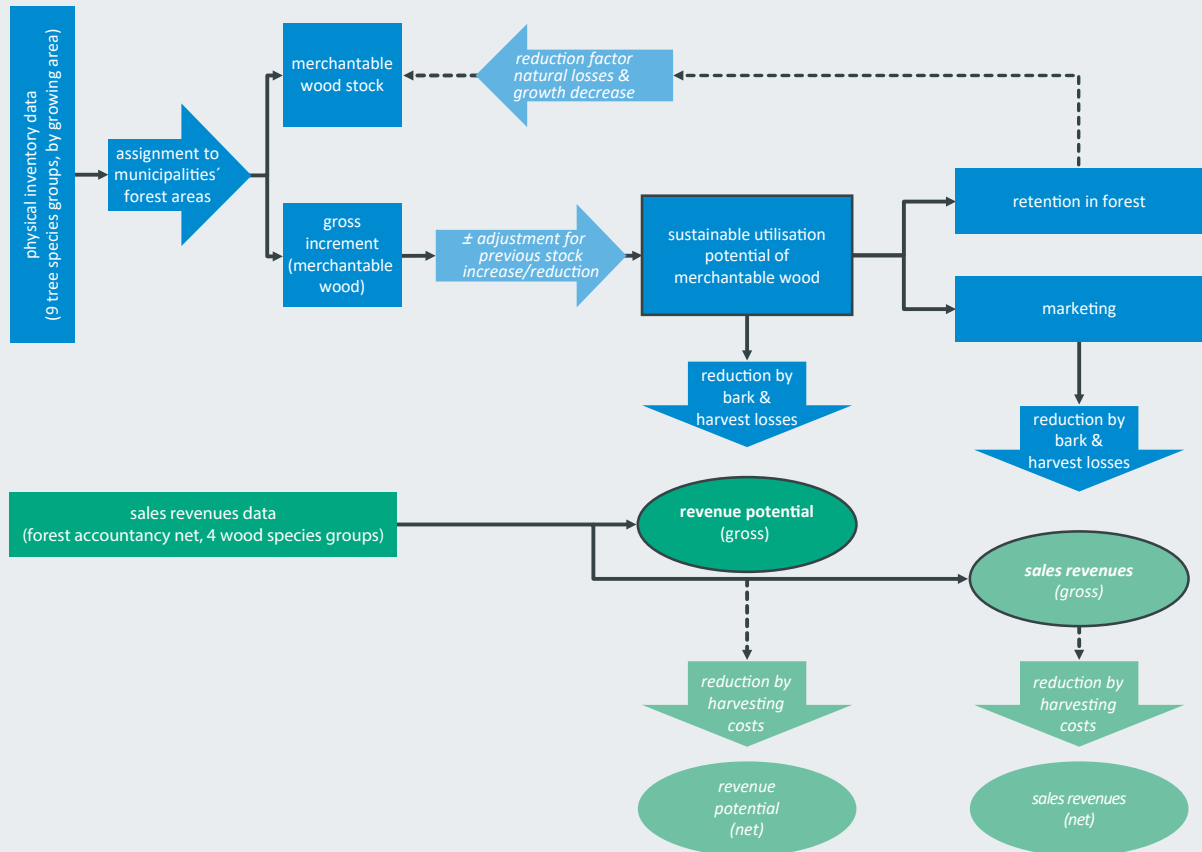
The tree species- and growing area-specific average increment of coarse wood according to the Federal Forest Inventory (BWI) is allocated to the forest areas of the individual municipalities in Germany and interpreted as sustainable utilisation potential. This is evaluated (after deduction of bark and harvesting losses) with timber species group-specific revenue data, which originate from the BMEL's Testbetriebnetz Forst (TBN). The result is the gross revenue potential. (Italics: not considered in the standard variant of the model).

order to support forest policy decision-making processes. Forest ecosystem services for climate protection, recreation and nature conservation will be presented in further editions of the *Thünen à la carte* series.

The model can also be used to analyse the effects of different future scenarios: What would be the consequences for timber production and for the other ecosystem services if the proportion of deciduous trees in the forests were increased? Up to what proportion of deciduous trees is an increase beneficial in this overall view, at what point would it become harmful – and where? Where should forest protection areas be located, and how large should they be? How do the values of the individual forest services in the regions change if the population there increases or decreases?

The model provides answers to such questions. They help the federal government, for example, to align legislation and public funding with the spatially differentiated demand for ecosystem services, so that the potential of forests is better utilised. To support this, the project report (Thünen Report 79)

also contains a concretely elaborated organisational proposal on how the different ecosystem services of the forest could be jointly rewarded through a system of markets, private demand and government payments.

FURTHER READING

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