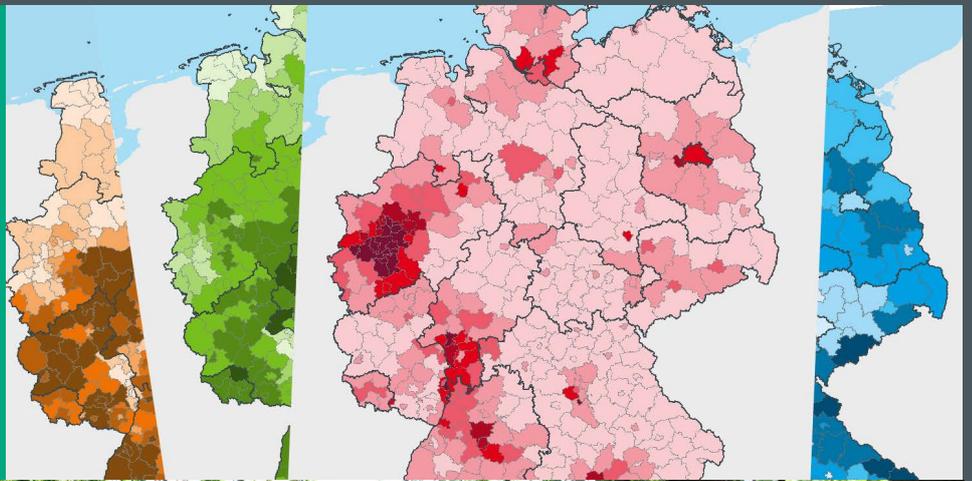


Thünen à la carte

Multitalented forests: recreation 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 forest recreation, of the forests' contribution to global climate protection, of raw wood production as well as of services for nature conservation and landscape protection.

The economic value of each of the above-mentioned forest services is determined using a separate valuation function that describes the relationship between the respective service and its value from the demand's point of view. The economic impacts of possible alternative forest management options on forest services can be calculated in the model. The model, which is implemented in a geographic information system (ESRI ArcGIS), visualises the results at the district level (i. e. NUTS 3) by maps.

FOREST RECREATION AS AN ECOSYSTEM SERVICE

Everyone is allowed to visit the forests in Germany for recreation without having to pay for it. This is guaranteed by the Federal Forest Act – for public as well as for private forests. Even though there are no entrance fees and no market for forest recreation, the benefit of the recreation service for the population can be

valued in monetary terms. For this purpose, the scientists of the Thünen Institute have determined the population's hypothetical willingness to pay (WTP) for local recreation in the forests and examined how this willingness to pay is distributed spatially.

The estimated annual WTP for forest visits is based on data from a representative population survey conducted by the Thünen Institute in 2013 (see diagram on page 5). The survey shows an average WTP of just under 30 euros per person per year for forests in the residential environment. The average WTP in the municipalities is determined by the ratio of local forest visitors to non-visitors and their respective WTP; forest visitor shares of the municipalities are estimated statistically, also using results of the aforementioned survey.

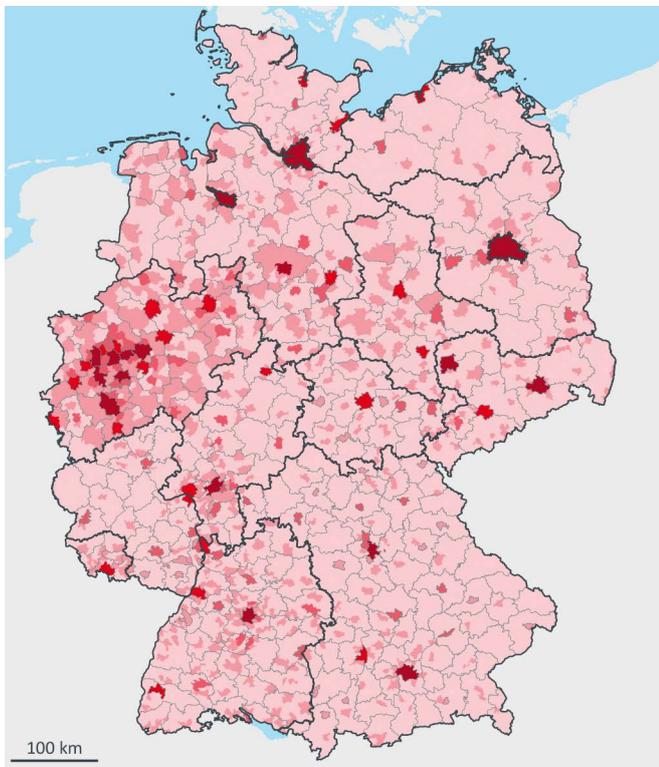
Extrapolated to all residents of Germany, the recreational value of German forests amounts to 2.4 billion euros per year, with considerable regional differences (Map 1). This is an average of more than 200,000 euros per municipality, with a range from nearly 0 to 44 million euros – depending on whether we are talking about a small municipality with only a few inhabitants or a megacity like Cologne or Munich. Subsequently, it is calculated how much the visitation rates decrease with increasing distance from a municipality. Using the distance function thus determined, the ReWaLe model distributes the WTP from the individual municipalities over the surrounding forests and adds up the results for each district. The result shows a spatial distribution pattern

Map 1:

Annual amount of willingness to pay in the municipalities for forest visits near the place of residence, in m€/year

- ≤ 0,5
- > 0,5 to 2
- > 3 to 5
- > 5 to 10
- > 10

Source: Thünen Institute

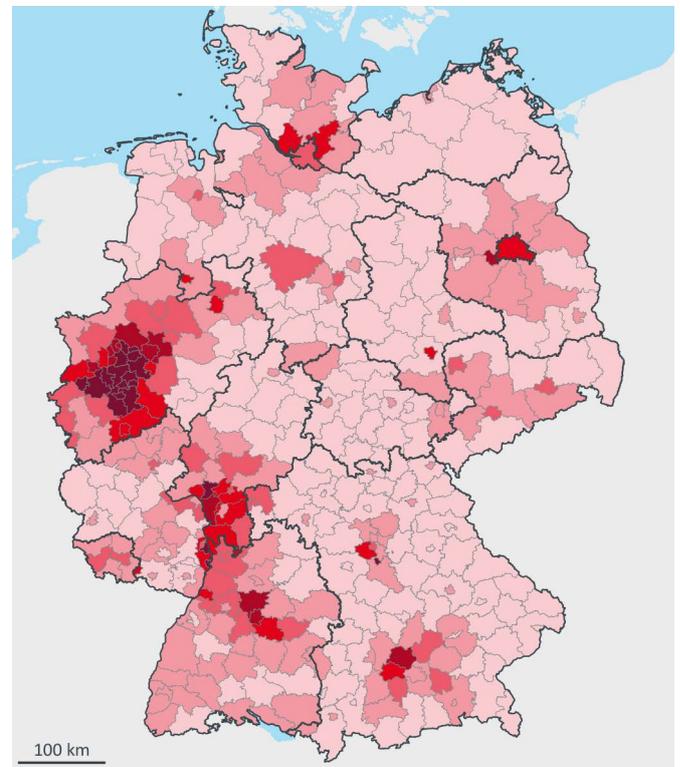


Map 2:

Annual WTP for forest visits near the place of residence, spatially distributed according to the distance function for forest visits, in k€/year/km² district area

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

Source: Thünen Institute



(Map 2) that is clearly different from the distribution pattern of other ecosystem services, such as raw wood production (Map 3).

The benefit of the recreation service is mainly influenced by the distance between forests and places of residence, less by the type of forests or forest density. The densely populated regions around the Ruhr area, the Upper Rhine Plain and the large cities (e.g. Munich, Hanover, Hamburg, Berlin, Dresden, Leipzig) therefore stand out with particularly high recreational values; at these locations, they reach almost 70,000 euros per square kilometre of district area per year. The WTP of the local population is not limited to the forests within the respective district boundaries, but also strongly influences the recreational values in the surrounding area. This is clearly visible in the surroundings of Berlin, for example.

However, even in areas with lower population density and low forest cover, forests can have high recreational values – because with low forest cover, forests are scarce as recreational sites. This becomes clearly visible when the willingness to pay is not reported for the total area of the districts, but converted to their forest area (Map 4). Then the forest-poor north in particular stands out with average recreational values of over 500 euros per year and hectare of forest area (or 50,000 euros/year/km² forest area).

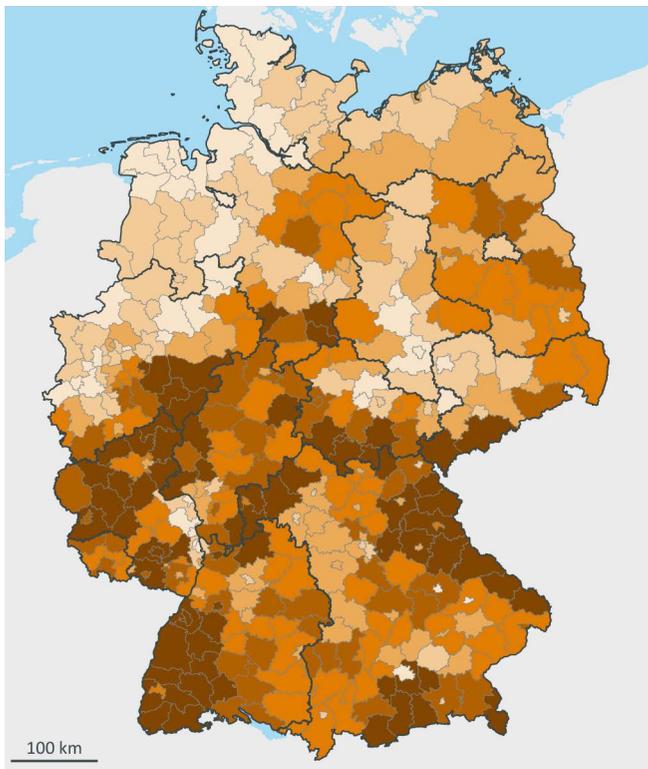
OUTLOOK

The results of the ReWaLe model make it possible to systematically compare regional values of different forest services from a

Map 3:
Annual gross revenue potential of raw wood production in k€/year/km² district area

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

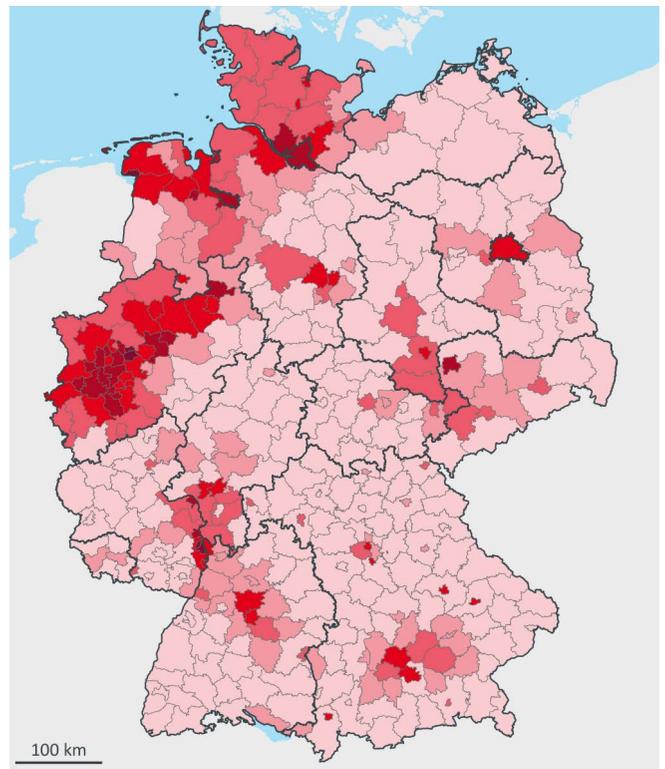
Source: Thünen Institute



Map 4:
Annual WTP for forest visits near the place of residence, spatially distributed according to the distance function for forest visits, in €/ha forest area

- ≤ 250
- > 250 to 500
- > 500 to 1.000
- > 1.000 to 2.000
- > 2.000 to 5.000
- > 5.000 to 21.000

Source: Thünen Institute

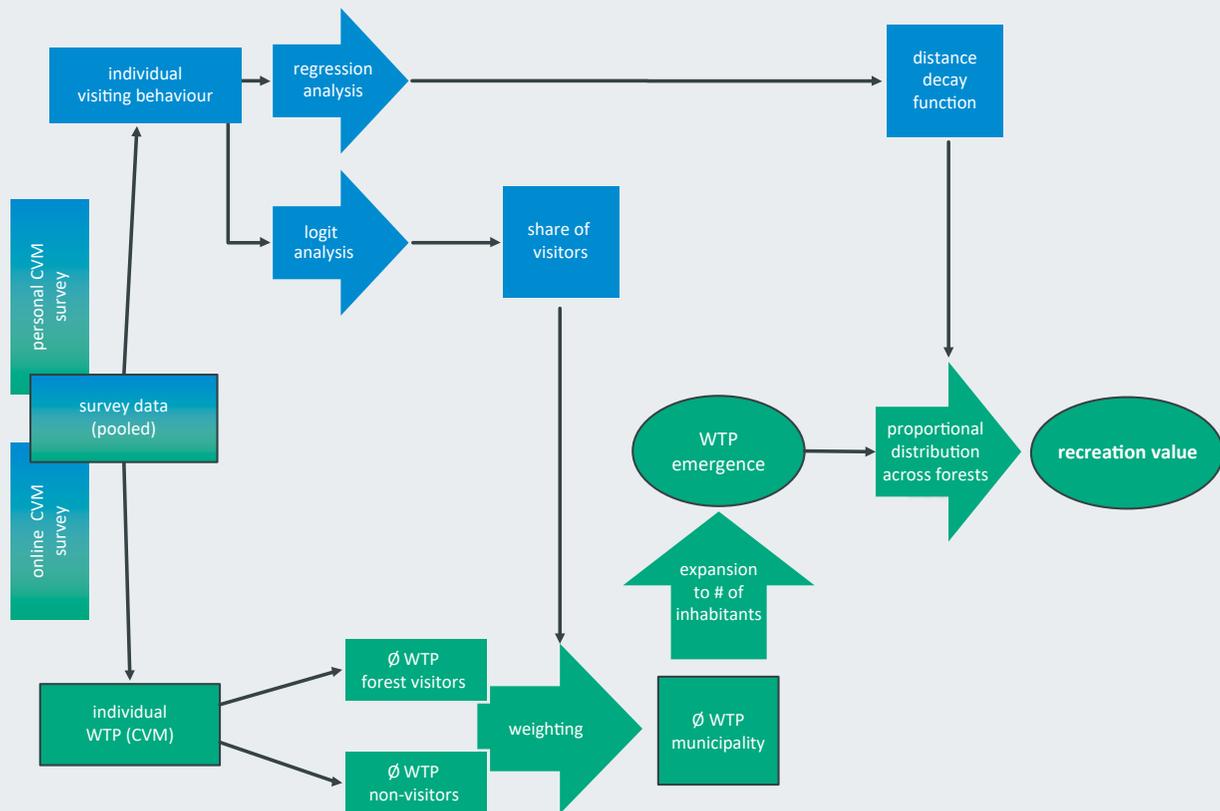


pan-economic perspective. With such comparisons, spatial hot spots of services and optimisation potentials can be identified, in order to support forest policy decision-making processes. Forest ecosystem services for raw wood production, climate protection and nature conservation are presented in further editions of the *Thünen à la carte* series.

Recreation services are clearly predominant in population agglomerations, while raw wood production and climate protection services are more strongly concentrated in rural areas. Consequently, no blanket forest policy approaches are suitable for shaping the interplay of these services; here it is more helpful to differentiate spatially. Especially in densely populated areas, strong demand for recreation

services can tie up resources, for example for forest fire protection, waste disposal and traffic safety along the forest trail network. This can affect timber production and the income opportunities of the forest owners based on it. On the other hand, the high demand potential in these areas also offers the opportunity to open up new markets for services that are not covered by the general right of access under the Federal Forest Act – the range here extends from organised sports activities to the establishment of forest kindergartens and even graveyard forests. The ReWaLe project therefore also offers suggestions on how the different forest ecosystem services could be jointly rewarded through a system of markets, private demand and government payments.

Procedure for determining and valuing the recreation service in its spatial distribution



Representative population surveys throughout Germany reveal the individual willingness to pay (WTP) for forest recreation in the residential environment as well as the individual visit behaviour (visit frequency and distances). This is used to first estimate the forest visitor share in each municipality. The WTP in the municipality is then calculated as a weighted average of the WTP of forest visitors and non-visitors and multiplied by the number of inhabitants. A distance function is estimated from the data on visitation behaviour; it describes what proportion of forest visits (and correspondingly WTP) are allocated to forests at different distances. Using this distance function, the aggregated WTP of each municipality is finally distributed over the surrounding forests, proportional to their respective distance.

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