



Preferences for forest structural attributes in Germany – Evidence from a choice experiment

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ABSTRACT

Using a discrete choice experiment we elicit coefficients and willingness to pay (WTP) values for eight structural characteristics of forests for 2932 respondents from a Germany-wide population sample. Results of the monetary valuation show that positive WTP values exist for increasing the share of forests, increasing biodiversity, increasing the harvest age of forests and maintaining some unused forest areas. Large negative WTP values are found for decreasing the share of forests, changing the amount of coniferous trees to 70%, and increasing the amount of trees from other countries. For some of the attributes investigated changes in any direction are valued negatively, i.e., field size and foreign species. Results are relatively robust to different model specifications, mainly regarding the signs of the preference parameters.

1. Introduction

Forests and forested landscapes provide a multitude of goods and services to society. Many of these have characteristics of public goods, for which pure market allocation would fail due to the absence of undistorted market prices. In order to cope with such allocation problems, policies and political strategies have been developed and adopted by governments in Europe (and elsewhere), some of which directly impact on forestry. In Germany, the 'Forest Strategy 2020' (BMELV, 2011) aims at accommodating the demands of society towards forests with regard to competing goods and services, such as demands for timber provision, for the mitigation of climate change, for recreation opportunities, and for nature protection. Other sectoral strategies specify particular demands. For example, the German biodiversity and sustainability strategies stipulate that 5% of the forest area be set aside for natural development, that deciduous trees be more favoured than in the past, that the cultivation of non-indigenous tree species be avoided, and that species diversity be better supported (BMU, 2007; RNE, 2002). Several policy instruments for supporting such goals are applied at EU and national level. Among these are legal regulations (e.g., the EU-Habitats Directive, 1992), the Common Agricultural Policy (CAP) and national subsidisation schemes which pay landowners for including some of society's demands on forests in the enterprises' management decisions, as well as advisory services of public forest administrations offered to forest landowners. While there are several analyses of the associated costs (Job and Mayer, 2012; Rosenkranz et al., 2014; Wüstemann and Rühs, 2015; Rosenkranz and Seintsch, 2016), studies which account for

the economic benefits of changes in forestal goods and services supply are rare for Germany as a whole, specifically with regard to monetary valuation of public goods associated to biodiversity protection and structural characteristics of forests.

Germany is covered by 11.4 million hectares of forest, summing up to one third of the German area. According to the most recent Federal Forest Inventory (Bundeswaldinventur 3; BMEL, 2015) 48% of forests are privately owned, 19% are corporate forests and 33% are state forests. 54% of trees in German forests are coniferous trees, 46% are deciduous trees. The average age of forests is 77 years, with 24% of forests being > 100 years old (BMEL, 2015). To ensure recreation the general public has the right to enter forests for recreation at any time, including privately owned forests (BWaldG, 2017; §14). German forestry has a long tradition of multifunctionality, meaning that forests are generally used for the production of timber, for the provision of protection services, as well as for recreation purposes at the same time.

Given the widespread multiple demands and trade-offs between different goods and services supplied by forests and society's demand for these goods and services (see for example BMELV, 2011), economic valuation can support policy making, by identifying options for a more efficient forest resource use that includes society's preferences towards the various non-marketed public goods. In the policy context shortly described above, this study applies a choice experiment (CE) for valuing public goods provided by forests in Germany at national level. Specifically, we identify the population's preferences and willingness to pay (WTP) for possible structural changes in eight attributes of forests, which are particularly relevant in current discussions about nature

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protection in forestry and forest management.

This article is structured as follows: in [Section 2](#) we provide a short literature review, in [Section 3](#) we explain our data base and modelling approach and in [Section 4](#) we present our results. In [Section 5](#) we discuss our results and conclude.

2. Literature review

Available valuation studies in Europe deal with valuation of different forest services such as recreation or structure and management of forests, using different elicitation methods (stated preferences like CVM and CE, expert surveys) and in differing (regional) contexts (for a systematic overview of studies from Germany, Austria and Switzerland see [Elsasser et al., 2016a](#); for a general overview over environmental valuation see [Hoyos, 2010](#)). Other studies with a broader regional perspective include [Edwards et al. \(2012\)](#), where European experts assessed preferences for structural attributes of forests for four regions in Europe, or the German TEEB study ([Elsasser et al., 2016b](#); [Bösch et al., 2018](#)), which gives an overview of the economic significance of the goods and services provided by forests, at the same time pointing out uncovered gaps in the valuation of many of these goods and services.

Changing structural characteristics of forests have been the subject of various studies focussing on the value of goods and services like recreation or biodiversity in general. However, an excerpt of what has been elicited in other studies in various contexts about single structural characteristics is explained in the following. As we focus on structural characteristics in forests, we learn from a previous study very similar to ours (a CE with nationwide scope, which has valued agrarian landscape changes with some forest attributes) that respondents stated negative WTP values for decreasing as well as for increasing average sizes of both field and forest patches in the landscape. Furthermore, the mentioned study found that WTP for an increase in the share of forests depends on the abundance of forests in respondents' surroundings, and shows that there are generally large utility gains from an increasing share of forests, but with negative marginal utility after a turning point of the utility function ([Sagebiel et al., 2017](#)). Other European sources also find positive WTP for afforestation, particularly if it is available for recreation, but in a CE in Ireland it was found that location relative to respondents' homes are important for WTP ([Upton et al., 2012](#)). In Italy respondents also have a positive WTP for afforestation, but (as indicated by [Sagebiel et al., 2017](#)) also a mix of landscapes types (particularly 75% woodland, 25% meadows) is valued positively, rather than too much forest ([Vecchiato and Tempesta, 2013](#)).

Some CE studies from different European countries (including Germany) value biodiversity through programmes with attributes like habitats for endangered species, number of species in forests, rare species (of fauna and flora), but also ecosystem processes, forest stand structure or landscape diversity, and find positive WTP values for increases in these attributes ([Christie et al., 2006](#), on farmland in England; [Czajkowski et al., 2009](#), in a nationalpark in Poland; [Meyerhoff et al., 2009](#), in two case study areas in Germany). In a contingent valuation survey the implementation of the national biodiversity strategy in forests is valued at 2.22 billion € ([Meyerhoff et al., 2012](#); [Wüstemann et al., 2014](#)). For ecological reasons, respondents in Poland also have a positive WTP for the protection of forests. This preference proved to be temporally stable and over several choice sets ([Czajkowski et al., 2016](#)). Furthermore, diversity of the general appearance of forests is valued positively: In the UK positive WTP for increases in mixed and broad-leaved forests exist ([Colombo and Hanley, 2008](#)) and in eastern Germany respondents to a CE prefer landscapes with a higher share of forest ([Völker and Lienhoop, 2016](#)). Also, mixed stands are preferred over monocultures and varying tree heights are preferred over uniform tree heights. Overall variation between stands adds to recreation ([Filyushkina et al., 2017](#)). In a non-monetary photo ranking study [Junge et al. \(2011\)](#) found out that the Swiss population prefers a mixed landscape with ecological areas.

Particularly the recreational aspect of forests and its structural attributes is included in several studies. Even results from a recreational context may be interpreted as an indication of preferences about structural attributes. So, forest management has been connected with recreation and investigated by means of CE, finding that more diversity in tree species and tree heights is preferred over monocultures of conifers ([Horne et al., 2005](#); [Nielsen et al., 2007](#); [Elsasser et al., 2010](#); [Dhakal et al., 2012](#); [Abildtrup et al., 2013](#)). Also [Giergiczny et al. \(2015\)](#) investigate a total of 14 management characteristics like forest type, tree species and stand age of forests for recreational purposes in Poland and find in their CE study that more naturalness and diversity in these characteristics increase recreational value, which is measured through distance respondents are willing to travel to recreation forest. Even though more naturalness is desired, forest access restrictions have a negative impact on welfare, although they may be designed to benefit wildlife ([Nielsen et al., 2016](#)). As long as recreation is possible, respondents are willing to pay for the removal of litter and to protect ecologically valuable forests ([Czajkowski et al., 2014](#)).

When we take up what has been done in the various European studies dealing with forest values, we add a large-scale valuation study particularly for entire Germany. We contribute WTP values from a CE for eight structural attributes of forests. The attributes chosen here (see [Section 3.1](#) for details on the attribute selection process) are all closely related to federal German forest policy strategies and programmes. Results from previous studies give us an indication that many of our attributes have been subject to valuation, however in different contexts. We value structural attributes of forests independently from recreation or other services. Specifically, our context is a general landscape change in the surrounding of the respondents' place of living. So our main question is what the German population wants to experience and know to exist in forests and how this is valued monetarily.

3. Data and models

3.1. Study design and samples

A Germany-wide online survey was conducted in March and April 2013. Respondents were recruited from a representative panel of a survey company,¹ with quotas for age, gender and state of residence. The average interview length was 26 minutes and the response rate² was 32.9%. The full questionnaire can be found in the Appendix. However, in the following a short description of the questionnaire is provided.

The main part of the questionnaire consisted of a CE with six different samples, into which each respondent was randomly allocated. In this article, only those two samples are considered which address forest issues. The choice cards within each sample contained six attributes, namely two 'fixed' attributes (Share of forests and Field size) and one price attribute (personal annual contribution to a landscape fund in Euro), which were identical for all samples. Additionally, each choice card included three 'flexible' attributes, which varied between samples. In this way, 'fixed' attributes were valued by 2932 respondents (number of fully completed interviews in Samples 1 and 2), whereas 'flexible' attributes were valued by 1465 (Sample 1) and 1467 (Sample 2) respondents. The attributes and their respective levels are listed in [Table 1](#).

The CE aims at the valuation of eight different forest attributes, which are being intensively discussed in German forest policy. Most attributes refer to characteristics within forests, only the two fixed attributes refer to the mix of land use types. Attributes were chosen based on policy needs and actual discussions about forest utilisation and

¹ LINK Institute, Frankfurt.

² The response rate was calculated by dividing the number of interviews completed by the number of persons invited for an interview.

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