Preferences for familiar and unfamiliar ecosystem insurance services in forests

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***Abstract* – The concept of *ecosystem services* has increased in importance and popularity in recent years. The ecosystem service approach has been shown to be especially useful for studying economic preferences concerning environmental goods. This contribution analyzes Willingness to Pay (WTP) for several functional ecosystem services concerning protection against ecological risks in local forests. We conducted a postal survey with a random sample of German citizens (n = 311). The study uses the stated preference methodology (choice experiment). Nested Logit analysis estimates an annual WTP between 11 and 25 €/year/respondent for ecosystem service improvements concerning ecological risk protection. In applied terms, our results suggest a firm conservation focus on maintaining and fostering forest resistance and resilience against environmental risks.**

Introduction

Ecosystem services are generally defined as benefits humans obtain from ecological systems. Economic studies play an important role in specifically highlighting the costs of the loss of these services provided by nature. Although there has been a considerable number of economic studies concerning various aspects of ecosystem services (e.g. Barkmann et al., 2008; Susaeta et al., 2010), this has not been the case for one type of important functional regulating services: so-called *insurance services*, which offer protection against ecological risks.

In this paper, we extend a study by Rajmis et al. (2009) on economic preferences for protection from ecological risks by ecosystem services in forests. To compare economic preferences for protection against risks with varying degrees of familiarity to the respondents, we selected risks that respondents have different levels of knowledge about. We include economic preferences for (i) protection against insect pests and storms (well-known risk), (ii) climate change mitigation (reasonably known risk) as well as (iii) protection against potential, yet unknown ecological risks (little-known risk). Besides, we check for the influences of socio-demographic variables on respondent preferences.

The protection against unknown ecological risks represents a special kind of ecosystem service, which is stated by the insurance hypothesis (Yachi and Loreau, 1999). In many cases, a greater number of species increases the chances of ecosystems to recover from exogenous disturbances and to maintain or regain their functioning even after loss of species. Therefore, biodiversity can be considered as a kind of insurance against environmental or man-made risks. This functioning, in turn, ensures the preservation of ecosystem services important for production and consumption by humans.

Methods

We conducted our survey in the two German federal states of Thuringia and Lower Saxony. The questionnaire was pre-tested (n = 24) and piloted (n = 145) from December 2008 to June 2009. The main survey was conducted from August to October 2009 as a postal survey. 1,455 questionnaires were sent to randomly selected households. Target individuals were identified by the *last-birthday* method. The minimum age of participation was 18 years. The response rate was 22.2% (n = 323). Quantitative WTP analyses are based on a set of 311 households.

We asked respondents to value various precautionary scenarios against several environmental risks in their local forests via a choice experiment. The attributes used in the choice experiment refer to forest based ecosystem services that a) mitigate risks from climate change, b) result in an improved resistance and resilience of the forests against insect pests and storms, and c) improve forest ecosystem resistance and resilience against unknown environmental risks.

We calculated single and overall WTP models with the Nested Logit procedures (using NLOGIT 3.0) for assessing the impact of socio-demographic variables on WTP. Single models examine the influence of one variable at a time. The overall models were created by putting all variables, which proved to have a significant influence on WTP in the single models, in a nested logit model. Afterwards those variables which turned out to be insignificant were excluded from the model.

Results

The basic WTP model as a whole is most significant ($P_{chi^2}<0.00001$). Respondents express a WTP for all of the three suggested attributes ($P<0.0001$ for all attributes). WTP for improved climate change mitigation measures amounts to 11.28 €/person/year for one ton of additionally sequestered CO_2. Increase of resistance and resilience against insect pests and storms has the highest WTP with 24.88 € per level. For resistance and resilience against unknown envi-

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ronmental risks, we calculated a WTP of 17.45 € per level.

Table 1 shows the influence of each socio-demographic variable on WTP, calculated in single models. Age has a strongly negative and highly significant impact on all attributes. Net income and education have a strongly positive and significant influence on WTP for climate change mitigation and forest resistance and resilience against insect pests and storms. Also, increasing household size leads to a higher WTP for climate change mitigation and forest resistance against insect pests and storms. Increasing frequency of forest visits leads to an increase in WTP for climate change mitigation. Female respondents have a higher WTP for climate change mitigation and forest resistance against unknown environmental risks than male respondents. The only variable with no impact at all on choices is the area of residence.

Table 1. Influence of socio-demographic variables on WTP for protection against environmental risks, calculated in single models.

Interaction with	N	Coefficient of Interaction Term		
		Climate Change	Insect Pests and Storms	Unknown Environmental Risks
Gender	308	**-0.0774***	0.0088	**-0.1103***
Age	305	**-0.1562****	**-0.1987*****	**-0.2178****
Net income	265	**0.2410****	**0.3009****	0.0431
Household size	302	**0.0948****	**0.1246***	-0.0456
Education	298	**0.1506****	**0.1760****	0.0740
Residence	308	0.0410	0.0187	0.0658
Frequency of forest visits	303	**0.0787***	-0.0017	-0.0519

****significant at p<0.0001; ***significant at p<0.001; **significant at p<0.01; *significant at p<0.1.

When calculating overall models, some of the variables influencing WTP are considerably reduced. WTP for climate change mitigation is significantly and strongly positively influenced by net income (0.1997, P>0.0001) and education (0.1155, P=0.0039). Gender and age exhibit negative effects on WTP, however, these effects are smaller and less significant (-0.0637, P=0.0971 (gender); -0.0898, P=0.0234 (age)). WTP for forest resistance and resilience against insect pests and storms is in the overall model strongly positively and significantly influenced by net income (0.2780, P<0.0001). Furthermore, age has a negative, but less significant impact on WTP (-0.1163, P=0.0379). WTP for forest resistance and resilience against unknown environmental risks is influenced by age (-0.2053, P=0.0001) and gender (-0.0907, P=0.0786).

Discussion

All attributes are significant determinants of choice. Absolute WTP values are similar to those found by Rajmis et al. (2009), which argues for the validity of our choice instrument application. Preferences for ecosystem insurance services range between about 11 and 25 € per respondent and year.

In the single models, almost all of the socio-demographic variables show an impact on WTP for climate change mitigation. The majority of socio-demographic variables also influence WTP for forest resistance and resilience against insect pests and storms. Yet, almost none of the socio-demographic variables have an impact on WTP for protection against unknown environmental risks. Presumably, the formation of preferences for unknown ecological risks is determined by other than socio-demographic factors, e.g. deeply rooted beliefs or risk perception.

In the overall models, the important variables still influencing preferences for climate change mitigation are net income and education. Preferences for resistance and resilience against insect pests and storms are mainly influenced by net income, whereas WTP for resistance and resilience against unknown environmental risks is mainly influenced by age. Thus, only the three variables net income, education and age remain as important predictors of WTP. However, whereas net income and education show a positive effect on WTP, age has a negative influence, i.e. the older the respondents are, the less inclined they are to pay for the protection from unknown ecological risks. Probably older respondents are less receptive to topics such as ecological risk prevention, especially not to unfamiliar risks such as until now unknown environmental risks.

In summary, we conclude that particularly net income, education and age are important variables influencing preferences for ecosystem insurance services. However, especially preferences for unknown environmental risks are mainly unaffected by socio-demographic factors. It is especially interesting that net income – the variable with the highest influence on the other two attributes – has no impact at all on WTP for forest resistance and resilience against unknown ecological risks. It seems that the otherwise highly important monetary restrictions do not play a crucial role for respondents when valuing protection from unknown environmental risks.

References

Barkmann, J., Glenk, K., Keil, A., Leemhuis, C., Dietrich, N., Gerold, G. and Marggraf, R. (2008). Confronting unfamiliarity with ecosystem functions: The case for an ecosystem service approach to environmental valuation with stated preference methods. *Ecological Economics* 65(1):48-62.

Rajmis, S., Barkmann, J. and Marggraf, R. (2009). User community preferences for climate change mitigation and adaptation measures around Hainich National Park, Germany. *Climate Research* 40(1):61-73.

Susaeta, A., Alavalapati, J., Lal, P., Matta, J.R. and Mercer, E. (2010). Assessing public preferences for forest biomass based energy in the southern United States. *Environmental Management* 45(4):697-710.

Yachi, S. and Loreau, M. (1999). Biodiversity and ecosystem productivity in a fluctuating environment: The insurance hypothesis. *Proceedings of the National Academy of Sciences of the United States of America* 96(4):1463-1468.