Non-market valuation of the impacts of global change on ecosystems and biodiversity

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Introduction

My doctoral thesis is concerned with evaluating whether **public policies aimed at reducing impacts of global change on ecosystems and biodiversity contribute to societal welfare**. The thesis is motivated by predictions that global change, particularly the occurrence of more extreme climate and weather conditions, will affect the future state of ecosystems and biodiversity, while our understanding of the resulting societal damages is currently incomplete.

Key takeaways

- Wildfires in heathland areas may lead to a decrease in recreational value from **EUR 413** (95 percent confidence interval (CI): 208-617) per person per year to **EUR 273** (95 percent CI: 136-409) per person per year (see Chapter 2)
- State-of-the-art **climate change damage functions in integrated assessment models may underestimate actual damage costs** because they do not incorporate the premium that the public is willing to pay to avoid human-caused biodiversity losses (see Chapter 3)
- **Protected area designations may be more socially efficient** than implied by previous research based on low-resolution biodiversity data and based on aspatial regression models.

Jury members and collaborators

Internal jury members:
Prof. Dr Robert Malina
Prof. Dr Francois Rineau
Prof. Dr Sebastien Lizin
Dr Nele Witters

External jury members:
Dr Mark Staples
Dr Carmen Vanmechelen

Collaborators:
Prof. Dr Roy Brouwer (University of Waterloo, Canada)
Prof. Dr David I. Stern (Australian National University)

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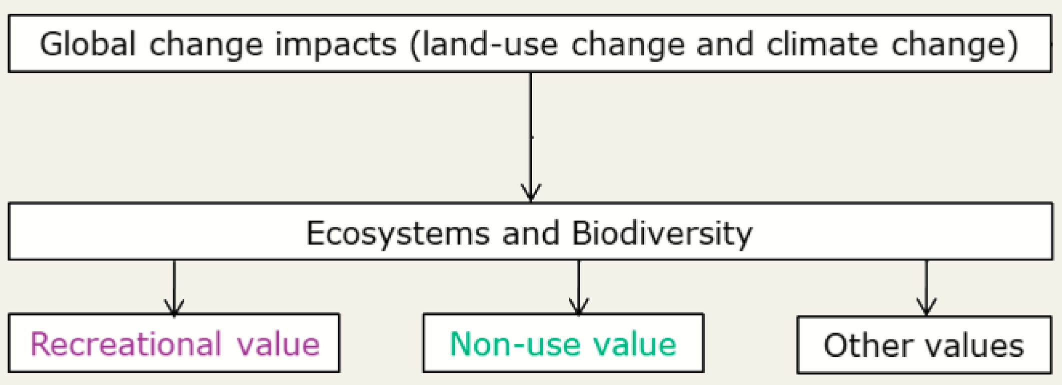
Dissertation overview



Chapter 2 of my dissertation focuses on recreational value**. Chapter 3** focuses on non-use value. **Chapter 4** focuses on ecosystem and biodiversity values in general.

Chapter 2: The impact of wildfires on the recreational value of heathland

Based on the publication: Nobel, A., Lizin, S., Witters, N., Rineau, F., and Malina, R. (2020). The impact of wildfires on the recreational value of heathland: A discrete factor approach with adjustment for on-site sampling. **Journal of Environmental Economics and Management**, 101, 102317.

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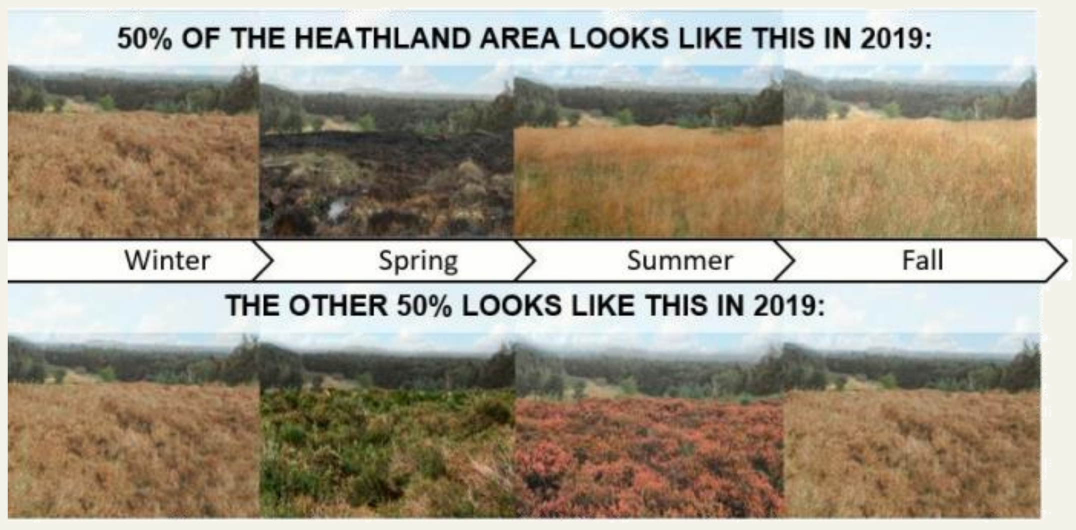
I estimated recreational value changes due to wildfires in a heathland area. Global climate change is predicted to increase the frequency and duration of wildfires in Europe. Wildfires may, in turn, affect the recreational value of ecosystems. In this study, **a finite mixture model is combined with on-site survey data after extending the model to control for on-site sampling bias.** The model is informed with *empirical preference data from 293 heathland visitors* in the Hoge Kempen National Park (Belgium). Visitors were presented with wildfire scenarios (see example below).



The empirical model was used to provide **the first estimates of the recreational value of heathland and of how wildfires affect this value**. The results suggest that extreme *wildfires negatively affect the recreational value of heathlands but that this impact is only temporary* (see table)

	Corrected for on-site sampling bias	
	Mean	95% CI
Predicted trips per person per year		
$E(y_1$|current situation)	28.90	(18.02–39.77)
$E(y_2$|50 % grass cover in year+2)	29.22	(18.06–40.37)
$E(y_3$|100 % grass cover in year+2)	24.02	(12.80–35.23)
$E(y_4$|50 % burned cover in year+1)	23.28	(14.77–31.78)
$E(y_5$|100 % burned cover in year+1)	19.09	(11.32–26.85)
$E(y_6$|current situation, but with access fee in year+1)	26.30	(16.18–36.41)
Consumer surplus per trip	14.28	(12.24–16.31)
Consumer surplus per person per year		
CS (current situation)	412.59	(208.37–616.80)
CS (50 % grass cover in year+2)	417.15	(224.07–610.22)
CS (100 % grass cover in year+2)	342.95	(142.26–543.63)
CS (50 % burned cover in year+1)	332.44	(175.60–489.27)
CS (100 % burned cover in year+1)	272.62	(136.06–409.17)
CS (current situation, but with access fee in year+1)	375.55	(184.97–566.12)

Chapter 3: Are biodiversity losses valued differently when they are caused by human activities?

Based on the publication: Nobel, A., Lizin, S., Brouwer, R., Bruns, S. B., Stern, D. I., and Malina, R. (2020). Are biodiversity losses valued differently when they are caused by human activities? A meta-analysis of the non-use valuation literature. **Environmental Research Letters**, 15, 073003.

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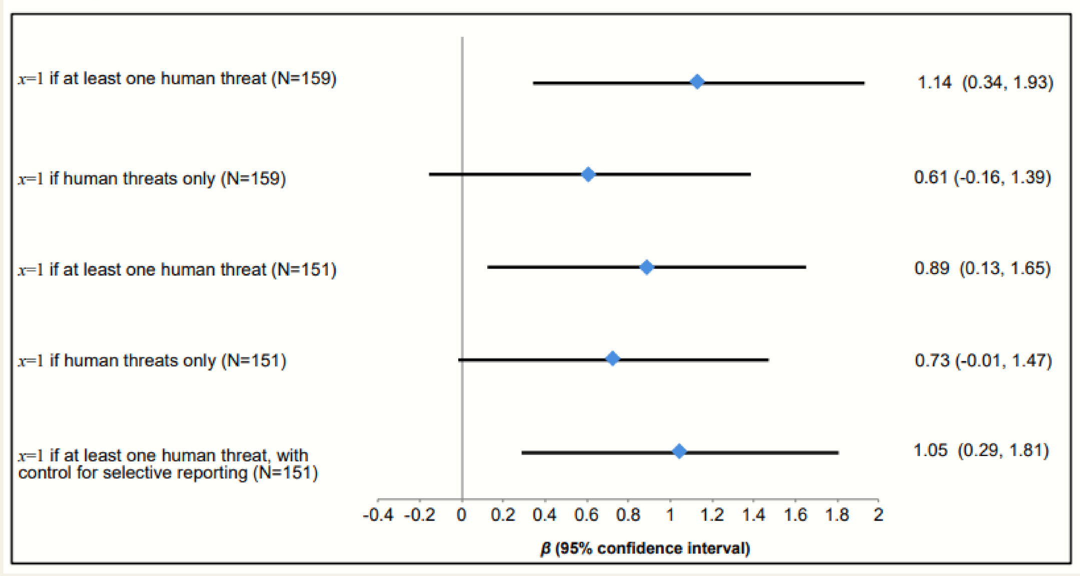
Chapter 3 (continued):

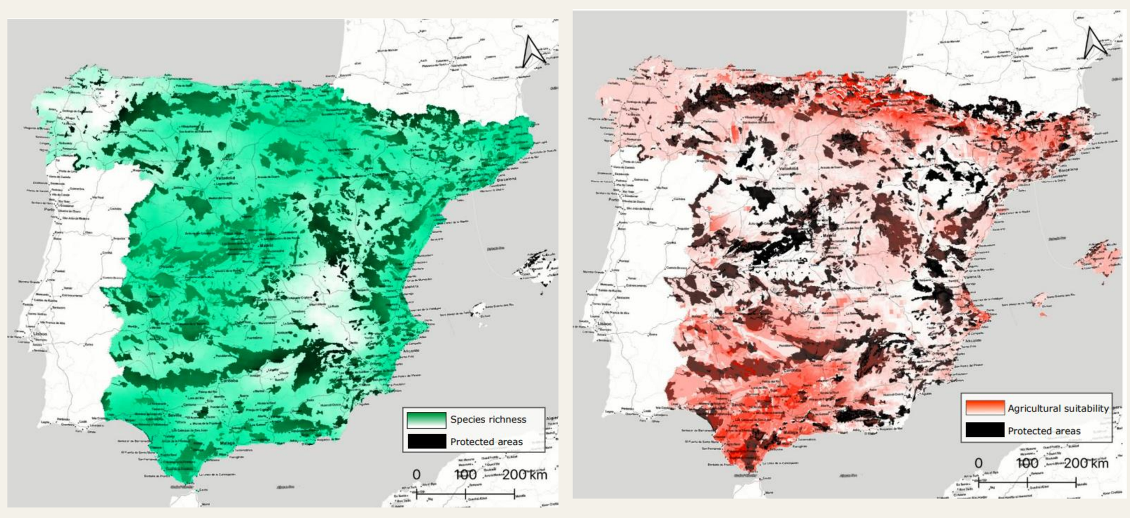
In Chapter 3, I synthesized 40 years of scientific evidence of the non-use value of biodiversity conservation. The synthesis investigates whether biodiversity values can be integrated into climate change damage estimates based on non-use valuation studies of different threats to biodiversity. The meta-regression models are estimated using 159 observations from 62 publications. The meta regression model results suggest that non-use values for biodiversity conservation addressing human impacts may be larger than those addressing other threats (see effect size of *Human threats* variable in the table below). I predict that the **mean annual WTP for avoiding human-caused biodiversity losses ranges from 0.2 to 0.4% of GDP per capita.**



Chapter 4: What drives the designation of protected areas?

This chapter is based on the working paper: Nobel, A., Lizin, S., and Malina, R. (2021). What drives the designation of protected areas? A pairwise marginal composite likelihood approach.

In Chapter 4, I estimated **conservation choice models based on protected areas in Spain and Italy**. I include *fine-resolution indicators* of biodiversity conservation benefits and opportunity costs, and account for spatial dependence using a *pairwise composite marginal likelihood approach*. I find statistically significant associations between species richness and PA locations as well as evidence of strong spatial dependence. In particular, I found for protected areas in Spain and Italy that **a 1 percent increase in species richness levels is associated with increases in the probability of protection of between 0.22 and 0.59 percent.**



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