FIDELIO

European Research Council
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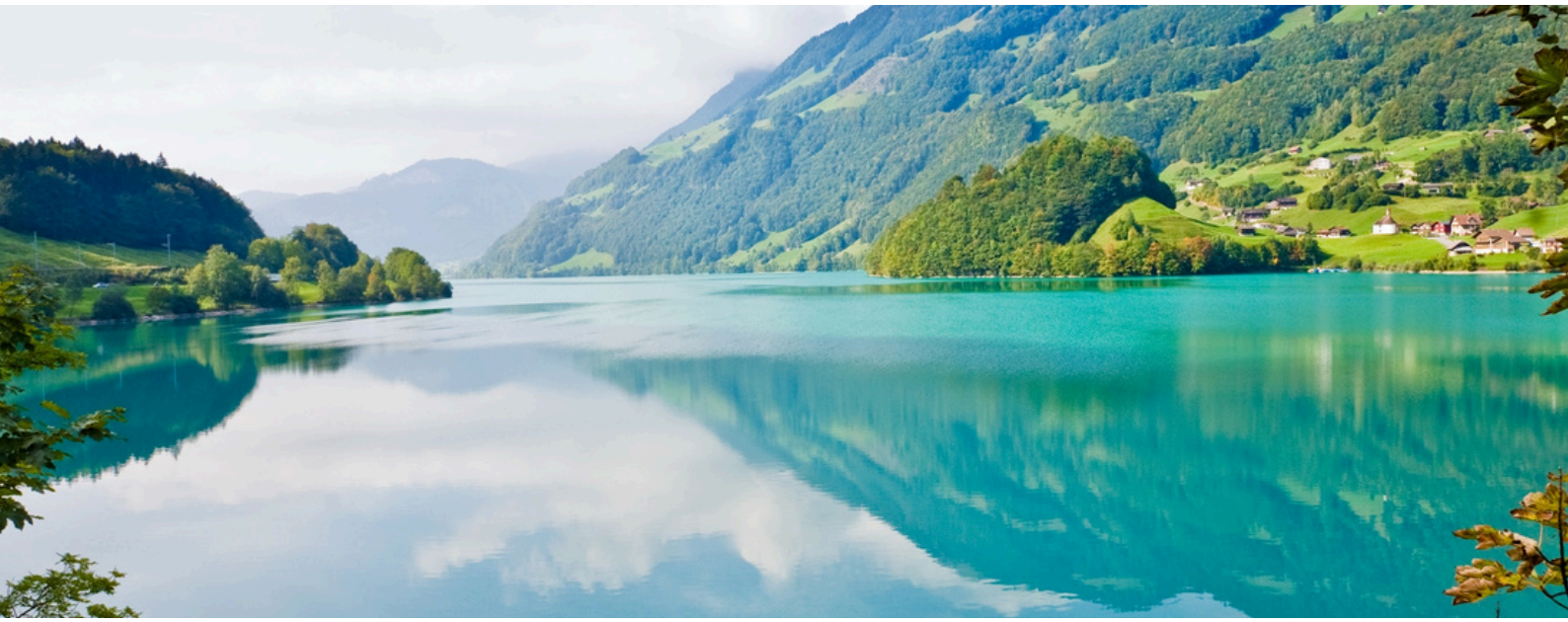
EXPLORING AND PREDICTING CHANGE OF PERCEIVED SOCIAL BENEFITS OF PROTECTED AREAS THROUGH TIME

2024



UNIVERSITY OF CAMBRIDGE
Department of Land Economy

WARWICK
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FULL REPORT

Authors:
Chrisovaladis Malesios
Nikoleta Jones

University of Warwick

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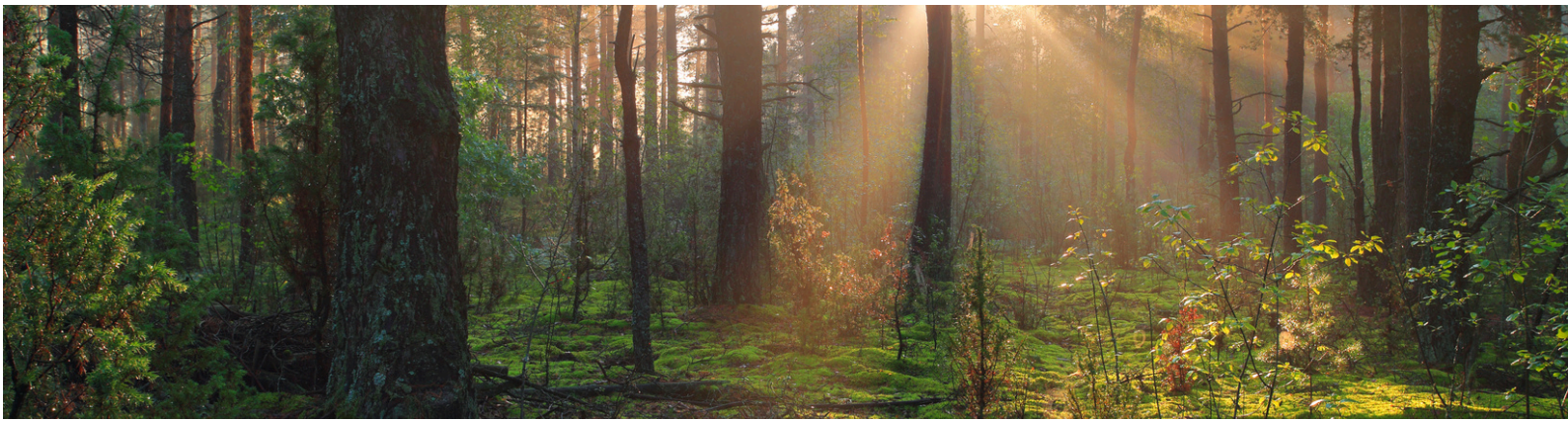
INTRODUCTION



FIDELIO is a 5 year project (2019-2024) aiming to develop a theoretical framework explaining perceptions on social impacts and the implementation of a mixed-methods approach. The empirical study included two large rounds of social surveys, with an approximate 2-3 year gap between them, in four Protected Areas in Europe. Furthermore, the framework and model of the project was tested in additional 15 PAs across Europe. You can read the results of all case studies here: www.warwick.ac.uk/fidelio/publications.

This approach allowed the exploration of changes in perceived social impacts over time while taking into consideration the influence of explanatory factors both at micro and macro level. A second round of semi-structured interviews with some of the key stakeholders was also conducted after 2-3 years aiming to capture perceptions of social impacts and how these have changed since the first year of the project along with the factors influencing this change. A structured questionnaire was distributed in a random sample living near or inside the protected area selected. The second survey used the same questionnaire for comparison purposes.The tools used in the first and second survey are available in a dedicated webpage of the project: www.warwick.ac.uk/fidelio/tools.

This report has two aims:

- To present the results of a statistical analysis exploring differences between the two rounds in the four case studies and the main factors driving this change.

- To present the results of a prediction model developed by the project team providing estimates for the change of perceived social impacts in a 3 year period.

METHODS

Four case studies were selected to collect data capturing the actual change of perceptions through time. The first case study is **the Black Forest National Park** in Germany which was established in 2014 and it covers an area of 100.62 km2 . This is an important case study as significant conflicts emerged between the local community and management authorities when it was first designated. A large part of local communities are dependent on the local natural resources, especially those involved in logging activities. The official establishment of the National Park brought significant new restrictions for logging activities but it also allowed new opportunities for sustainable tourism. Thus, there is a growing need to find the right balance in the area between costs and benefits of the National Park for local communities.

The second case study is the **National Park of Eastern Macedonia and Thrace** (established in 2008 in Greece and covering an area of 929.5 Km2). This national park is part of a wider policy change in Greece to apply PAs with co□management frameworks promoting theparticipation of local stakeholders (Vokou et al., 2014). The main pressures in the area are from fishing and recreational activities and the protection zones affect significantly the rural and urban communities which are dependent on the local natural resources (Dimitrakopoulos et al., 2010). The specific case study was selected as it is established in a region facing significant socio-economic challenges both because of the national recession and the migrant crisis resulting in a change in the local social and economic structure. Thus, it is important to explore the role of the PA for locals in this socio-economic context.

METHODS

The third case study is the **Matsalu National Park** established in 2008 in Estonia. It covers an area of 488.6 Km2 with communities living in and around the park affected by the designation and with significant impacts due to tourism activities (Reimann et al., 2011).. It was selected as a case study as it affects communities following traditional agricultural and fishing activities, but despite the significant human pressures it is one of the most important and successful PAs in the Baltic region.

The final case study is the **Sighisoara-Tarnava Mare** protected area in Romania covering approximately 900 Km2 and established in 2006. It is a unique case study as it includes high nature value farmland, which hosts a large proportion of semi-natural vegetation with a mosaic of low intensity agriculture and natural elements. Threats include agricultural intensification and abandonment, which is a particularly crucial issue considering that these areas rely on low chemical input and machinery but high-intensity human labour agriculture.

Apart from the 4 core case studies additional case studies were selected to explore social impacts considering also the FIDELIO framework. Predictions for these sites in terms of their social impacts were estimated using advanced statistical modelling. These were the following:

- Peak District National Park (England, UK)
- Snowdonia National Park (Wales, UK)
- Calanques National Park (France)
- Atlantic Islands of Galicia National Park (Galicia, Spain)
- Prespes National Park (Greece)

METHODS

- Eifel National Park, Nordrhein-Westfalen (Germany)
- Egadi islands (Italy)
- Alonnisos National Marine Park (Greece)
- Pienyni National Park (Slovakia)
- Dadia National Park (Greece)
- Kullaberg Nature Reserve (Sweden)
- Triglav National Park (Slovenia)
- Soderasens National Park (Sweden)
- Warwickshire Nature Reserves (England, UK)
- East of England and Scotland selected Protected Areas (North York Moors, Linconshire AONB, Norfolk Broads, Northumberland, Pembrokeshire, Cairngorms, Loch Lomond, Cambridgeshire)

Three more areas also decided to distribute the survey of the project:

- Evros National Park (Greece)
- Samaria National Park (Greece)
- Port Cros National Park (France)

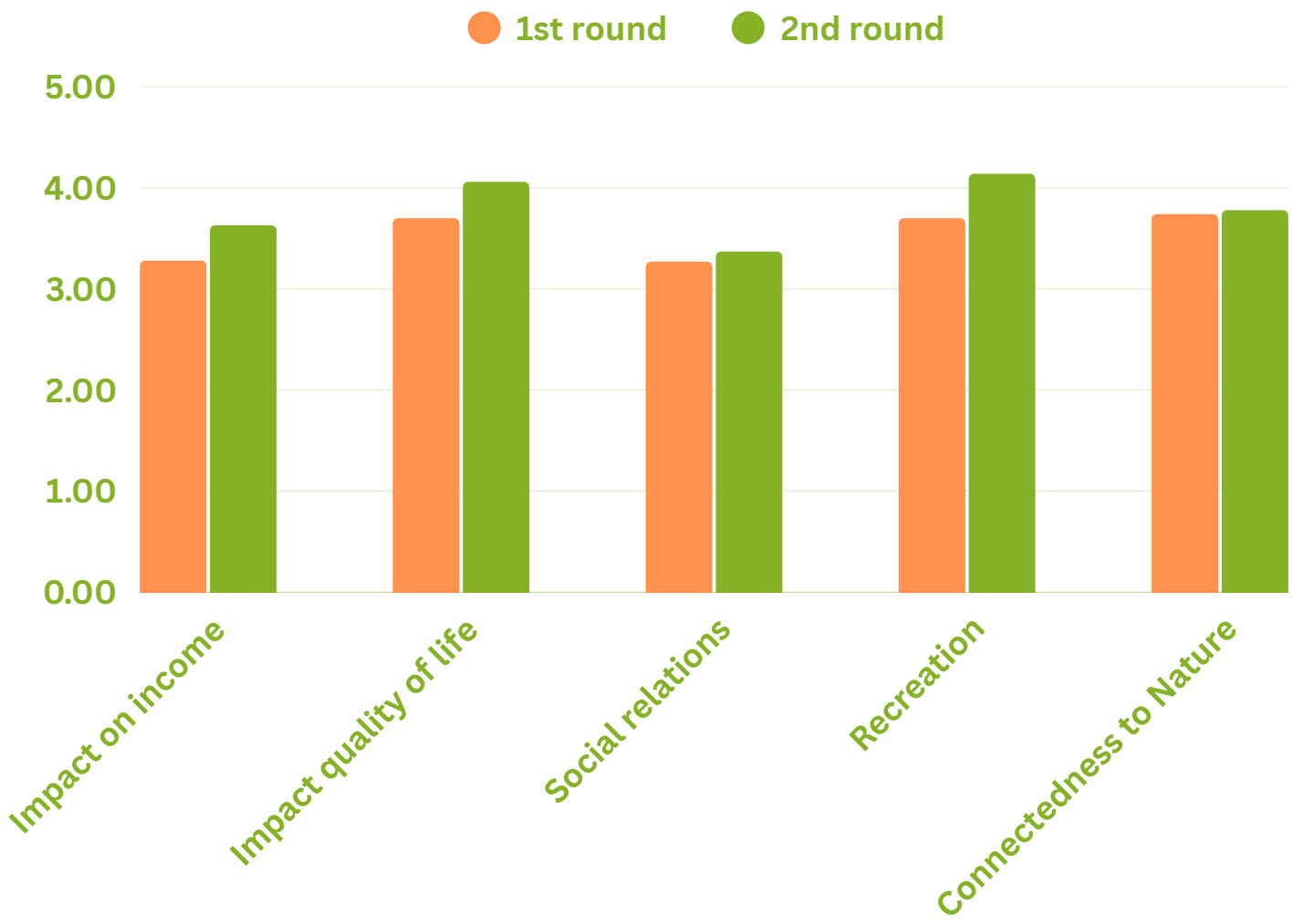
Random sampling techniques were appropriately used to ensure the sample was fully representative of the demographics in each PA. In cases where unequal sample sizes occurred between selected PAs, suitable weighting adjustments were made by assigning appropriate prior distributions for parameter estimates within the Bayesian framework followed for statistical modeling and inference. Participants from the first survey were informed that this is a 5-year project involving an additional survey. They were encouraged to participate in both surveys throughout the project cycle.

RESULTS

CHANGE OF PERCEIVED SOCIAL OUTCOMES IN CORE CASE STUDIES

Respondents were asked how they perceive the impact of the protected areas on five topics: personal income, quality of life, social relations, recreation and connectedness to nature. All impacts were measured at a 5-point scale ranging from 1-very negative impact to 5-very positive impact. The figure below presents the average score for each impact. Higher scores represent a more positive impact.

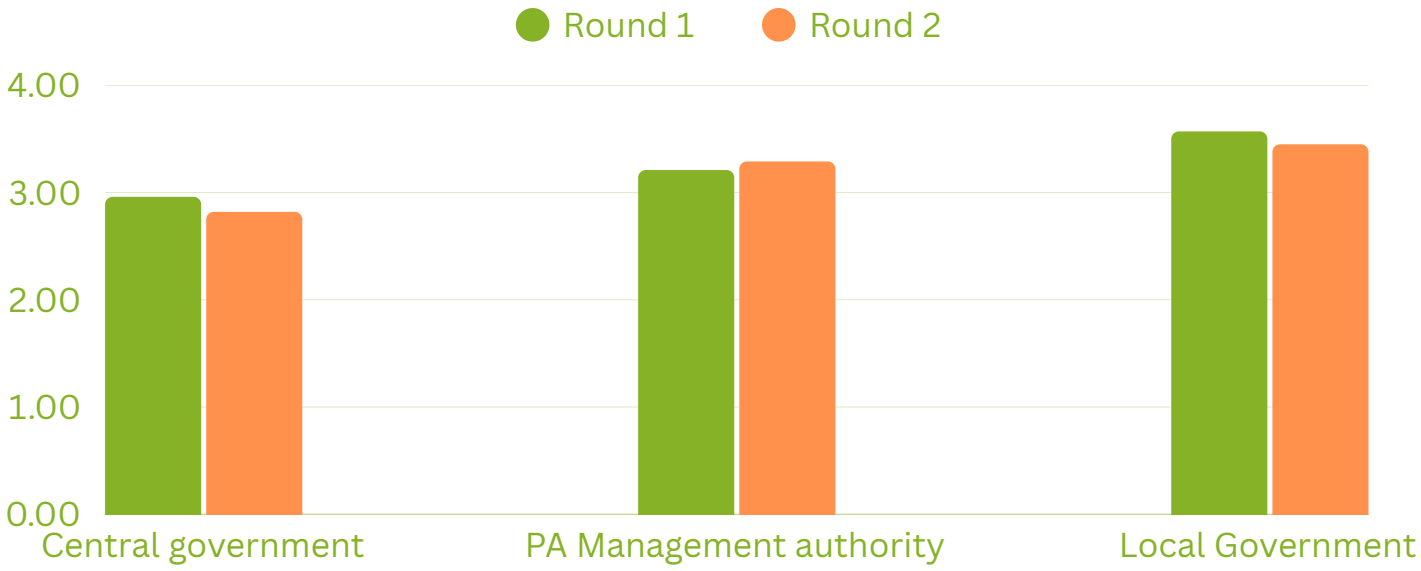
When comparing the responses of all participants between the two rounds there are small variations between the two periods and in all cases social impacts improve through time (people perceive more benefits). The differences that are observed between the two rounds are statistically significant in the case of impact on income, impact on quality of life and impact on recreation according to the independent sample t-test.



TRUST IN INSTITUTIONS

In both surveys, respondents were asked to rate their trust in various institutions involved in the management of the Protected Areas, using a 5-point Likert scale where 1 indicated the lowest and 5 the highest level of trust. Differences between the two rounds were not statistically significant in most cases. However an increase was noted in the level of trust in the protected area management authorities which was statistically significant ($p < 0.05$).

The level of trust for protected area management authorities has increased since the first survey. More neutral perceptions were recorded for governmental institutions-local and central.



ENVIRONMENTAL BEHAVIOUR

Respondents were asked if they feel they it is easy for them to behave responsibly when in the protected area on a 5 point Likert scale-with 1 representing the lowest level of agreement and 5 highest level of agreement. The mean score in round 1 was 3.99 and increased to 4.25 in the second round (a statistically significant difference).

Another question asked whether people had enough money, time and opportunities to get involved in nature conservation activities in the protected area (same scale as above). The mean score in round 1 was 3.09 and in round 2 3.05 (no statistical significant difference).

Participants were also asked questions on social norms. In particular, they were asked how much they agree that people who are important to them expect them to behave in an environmentally responsible manner. Percentages in both rounds were similar, 4.20 in both surveys. In the same category a question asked whether it is important for the participant that park visitors behaviour in a responsible way. Responses were similar in the two rounds with the mean score being 4.74 in round 1 and 4.77 in round 2.

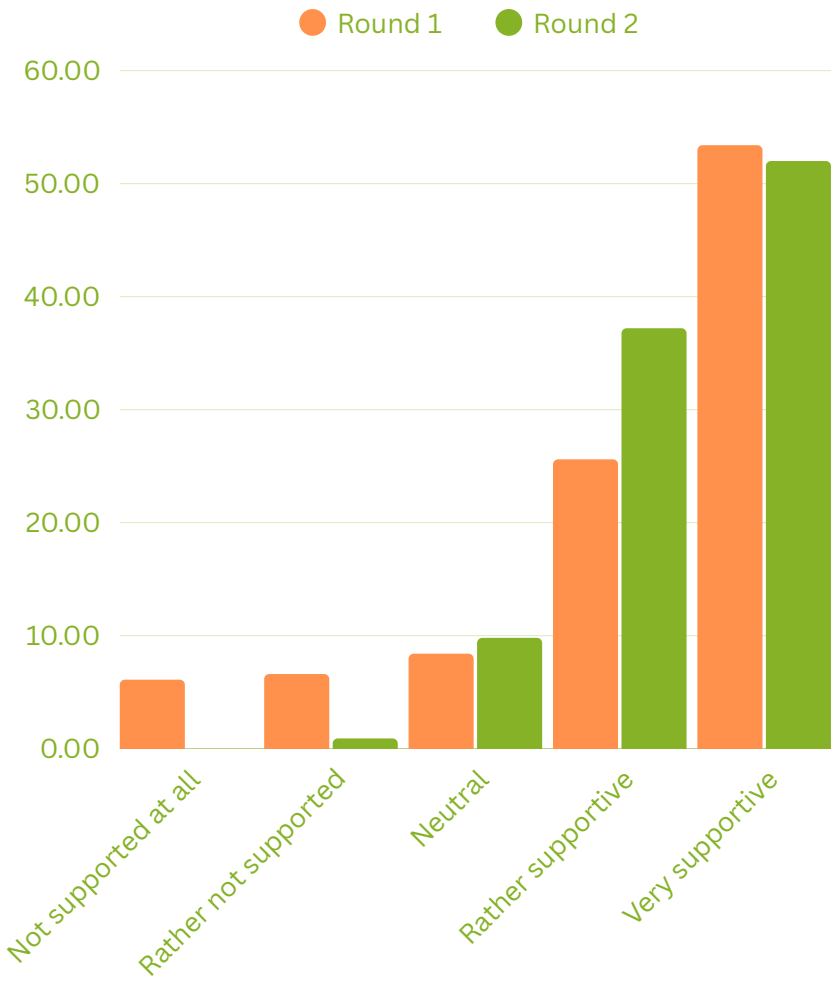
In terms of environmental values, a high level of values was noted in terms of living in harmony with nature with a mean score of 4.36 noted for both rounds.

Finally respondents were asked to state how much they agree or disagree with a statement that captures the level of place attachment (in a 7 point Likert scale): The area of [name] means a lot to me. Overall a very high level of place attachment was noted in both rounds with the average score being 5.47 in round 1 and 5.52 in round 2 (difference is not statistically significant).

PUBLIC SUPPORT FOR THE PROTECTED AREAS

Respondents were asked how much they support the existence of the protected areas on a 5-point Likert scale (1 representing strongly disagree and 5 strongly agree). The overall difference between the two rounds is small but statistically significant with an average score notes in the first round of 4.13 and in round 2 4.40 ($p < 0.01$). Looking at the graph below an increase is noted in respondents who are neutral and rather positive towards the protected areas.

Overall an increase in the level of support for the protected areas is observed



PREDICTING SOCIAL IMPACTS FOR OTHER PROTECTED AREASS

Following the observations from the two surveys regarding the change of social impacts through time, a statistical analysis was conducted aiming to predict the change of social impacts in the remaining sites of the project. Developing the prediction models involved a complex analysis of panel data using ordinal logistic regression to estimate and predict social impacts across different sites and over time. The process is described below.

Dependent Variables: The five social impact variables, each measured on a 5-point Likert scale, which are ordinal in nature. The variables were:

- Impact on Income
- Impact on Social Relations
- Connectedness to Nature
- Impact on Quality of Life
- Impact on Social Relations

Regions and Rounds: panel data were collected across four Protected Areas in Europe (Black Forest, Matsalu, Sighisoara, National Park of Eastern Macedonia and Thrace) over two time periods (referred to as rounds). This created a panel dataset, where the same units (regions) are measured repeatedly over time.

Additional Regions: After analyzing the data from the four regions, predictions were made for all additional sites using the model estimates.

The Ordinal Regression Model for prediction: Given that the dependent variables (the social impact variables) are measured on a Likert scale, we chose an ordinal regression model within a Bayesian framework to fit the data. This type of model is appropriate when the outcome variable is ordinal, meaning the values have a natural order but the distances between them are not necessarily equal.

Predictors: A set of predictors (e.g., socio-economic factors, environmental conditions, policies, etc.) that are expected to influence the social impacts have been chosen as explanatory variables. These predictors that have been identified from previous research as important are used as independent variables in the ordinal regression model.

The model was structured as follows:

$$\text{logit}(P(Y \leq j)) = \log = \alpha j - \beta 1 * X1 - \beta 2 * X2 - \ldots . - \beta k * Xk$$

In the above equation, Y represents the ordinal social impact variable, j represents the threshold for each ordinal category, αj are the cut-off points or thresholds, and $\beta 1$, $\beta 1, \ldots, \beta k$ are the coefficients for the predictors.
Given the panel structure, we have included random effects for the regions to control for unobserved heterogeneity.

PREDICTING SOCIAL IMPACTS FOR OTHER PROTECTED AREASS

The model was initially estimated using data from the four regions over the two rounds. This step involved fitting the ordinal regression model to understand how the predictors influence the social impact variables across these regions and over time.
To ensure the robustness of the model, we have performed cross-validation using the data from the three out of four regions and check robustness of the obtained estimates. This helps in assessing the model's predictive accuracy before applying it to new regions.

Prediction for Other Regions
Once the model was estimated and validated, the coefficients obtained (i.e., the estimated β values) are used to predict the social impacts for the second round in the 15 remaining regions. This involves inputting the relevant predictor values for these new regions into the model to generate predictions for each of the five social impact variables. The predictions provide an estimate of the expected social impacts (on the 5-point Likert scale) in these 15 regions, based on the patterns observed in the initial four regions.

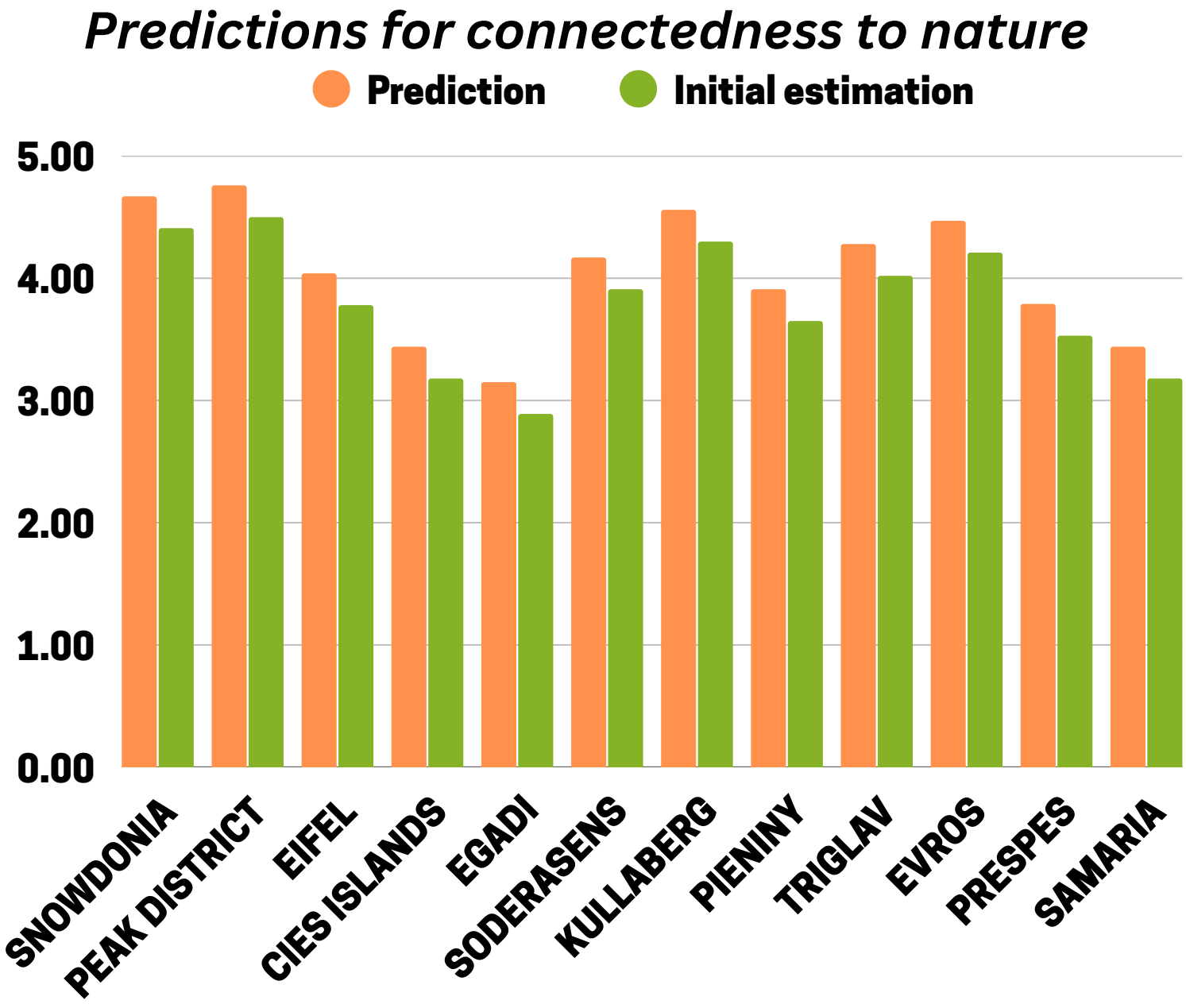
Modeling Considerations
We selected to apply a random effects model with regard to the protected areas factor, since if we have used a fixed effects model, the predictions would be conditional on the regions analyzed. With the utilization of the random effects, the predictions are theoretically applying to a broader set of regions, assuming the random effects assumption holds.

The process involved leveraging the strengths of ordinal regression to analyze panel data, with an emphasis on prediction across different regions. The use of this model allows to account for the ordinal nature of the dependent variables while making predictions that extend beyond the regions initially studied.

The predictions for the additional regions are then grounded in the relationships identified in the original model, providing a methodologically sound approach to estimating social impacts in new contexts.

PREDICTING SOCIAL IMPACTS OF PROTECTED AREAS BASED ON FIDELIO MODELLING FRAMEWORK

The next graphs provide the initial social impact estimations in each site and the predicted value based on the modelling framework. These are estimated for the five social impacts. Where missing values exist this is either because the specific social impact did not exist or because the model did not produce meaningful estimations.



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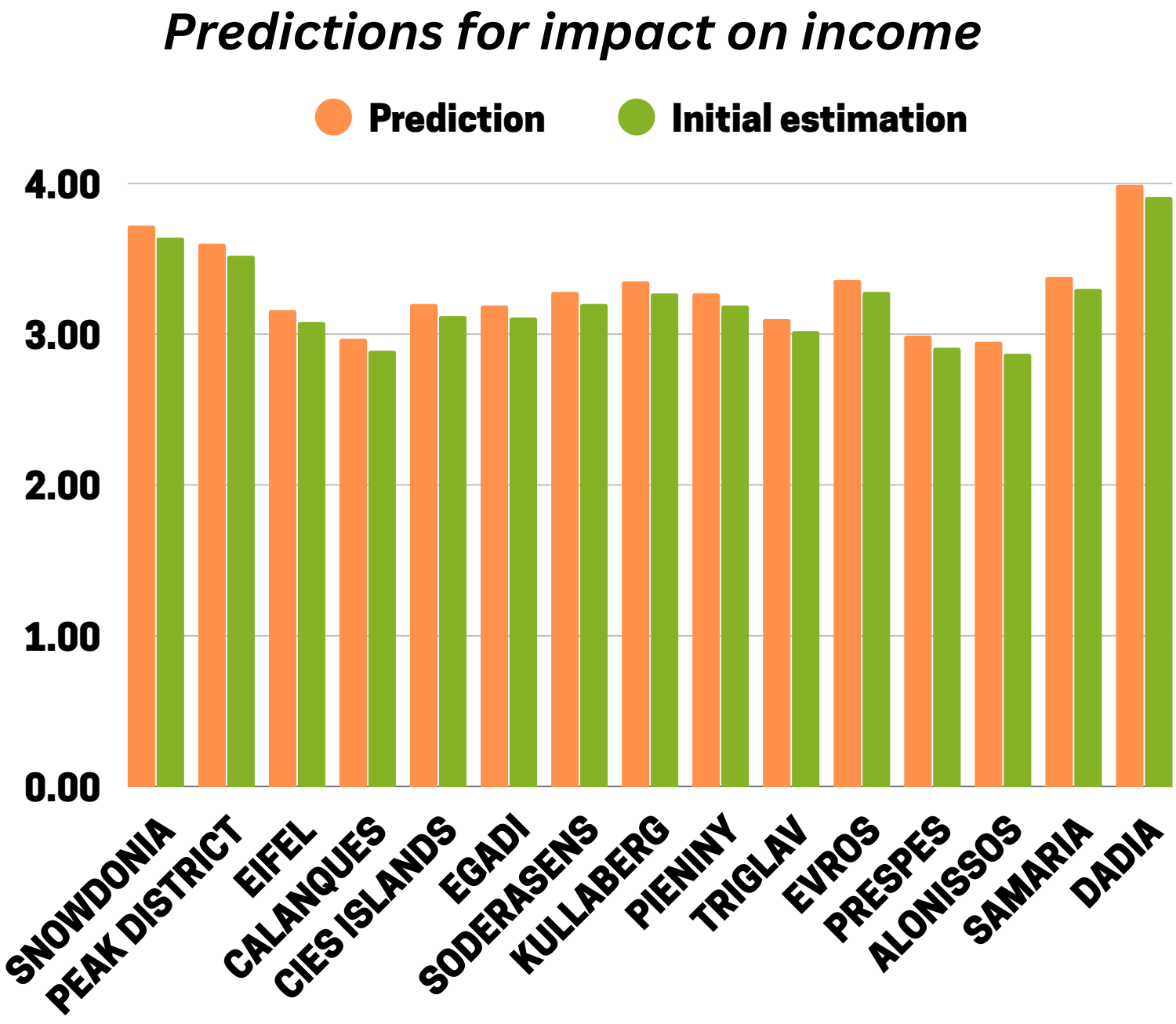

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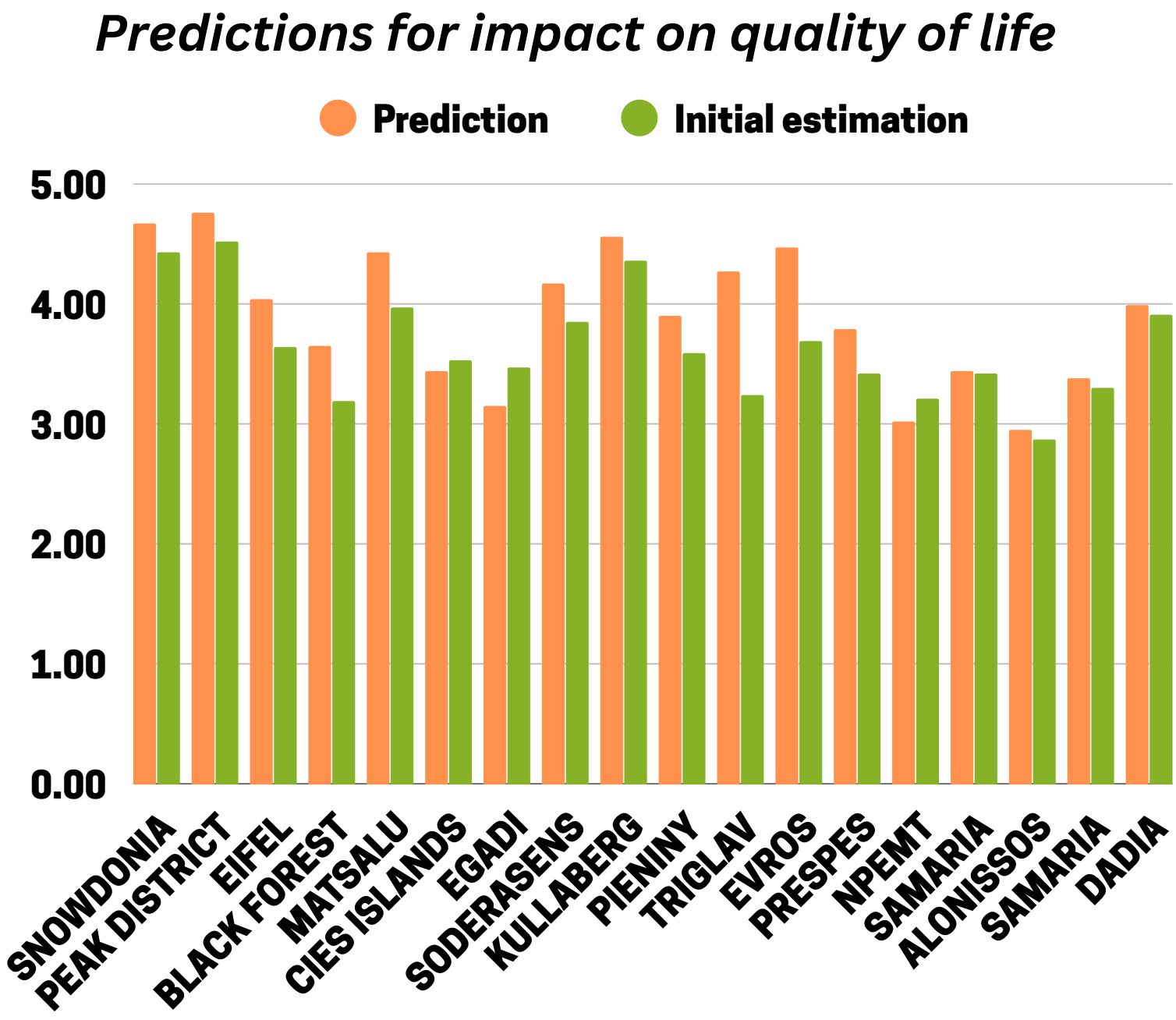

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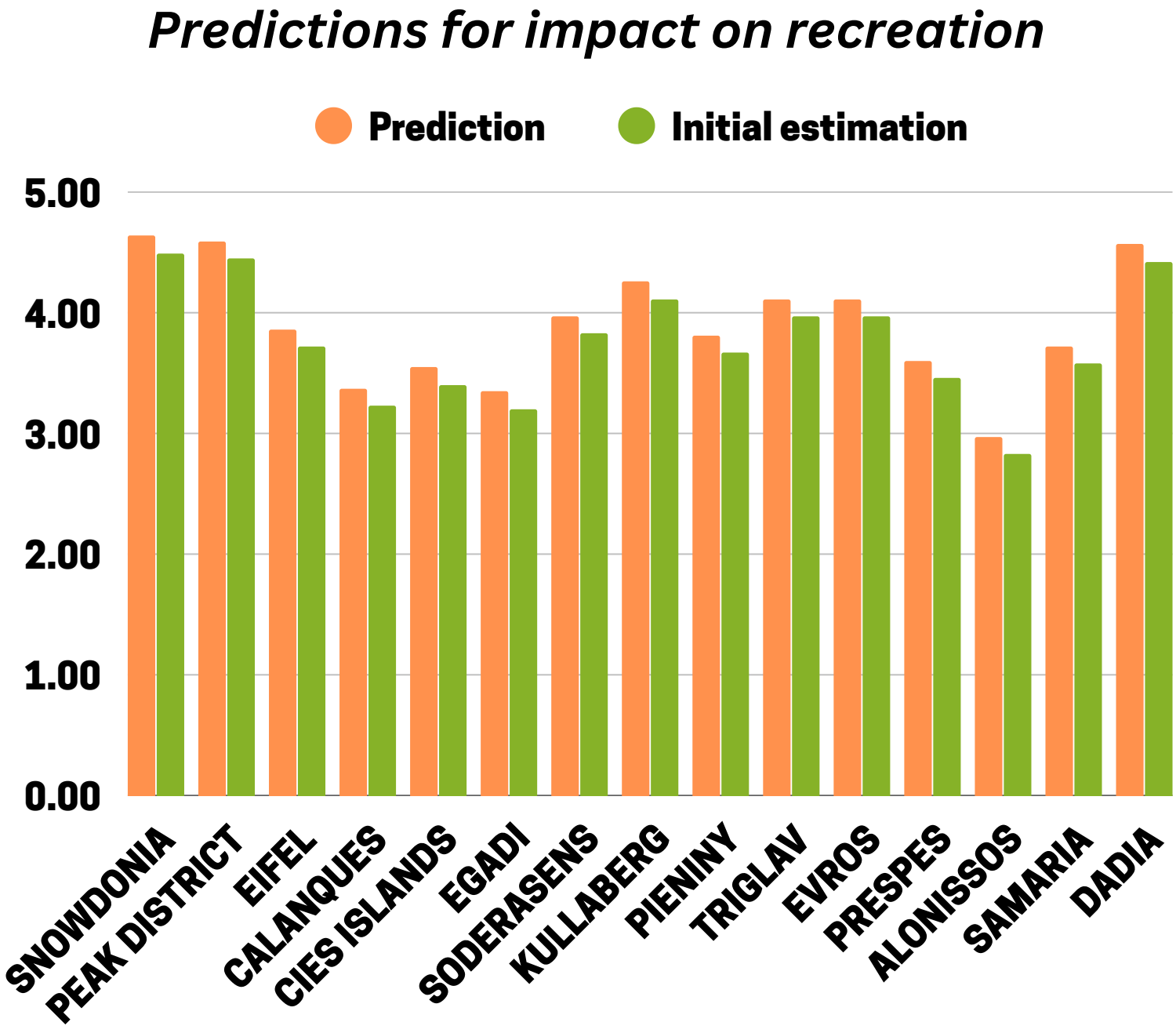

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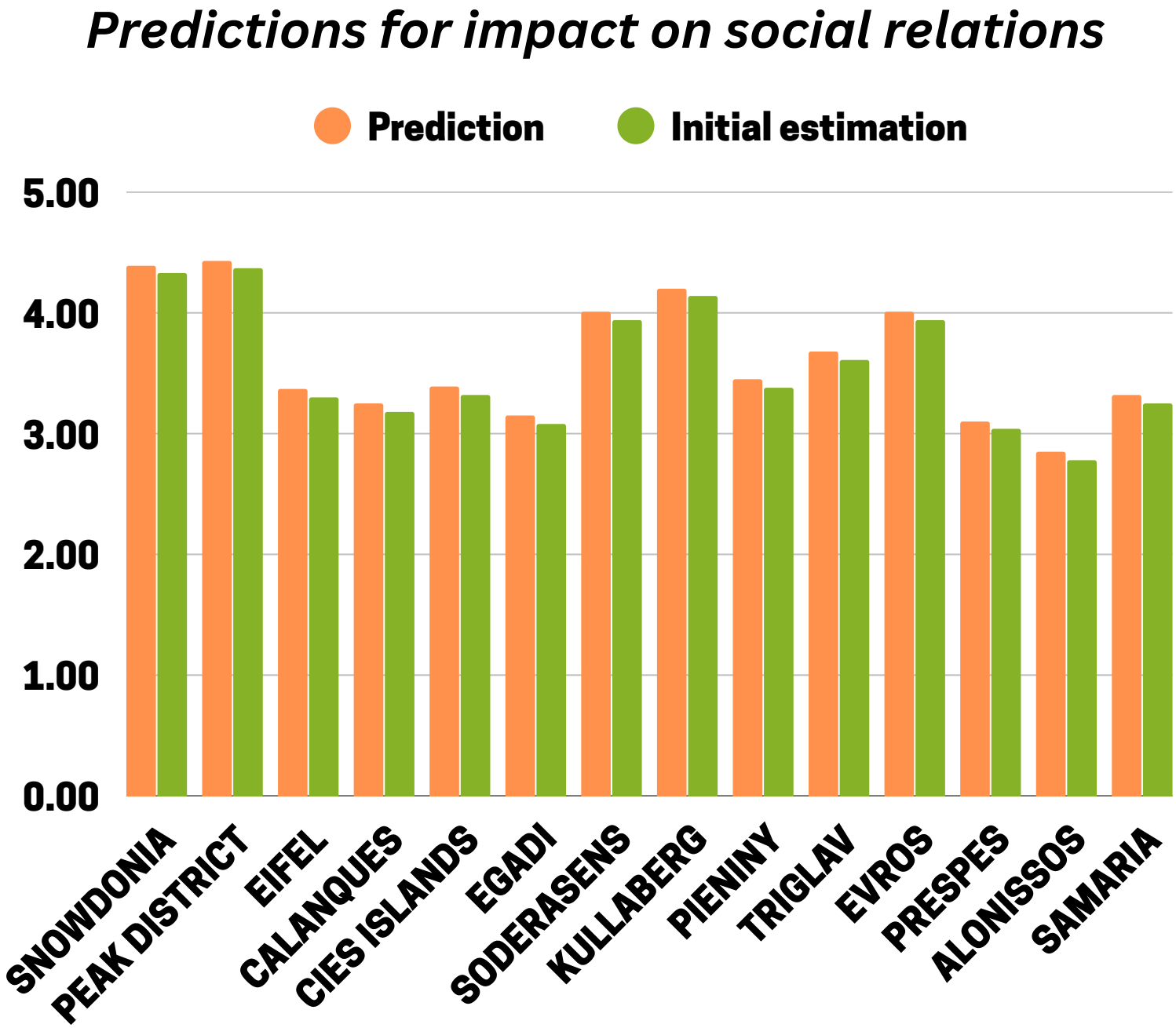

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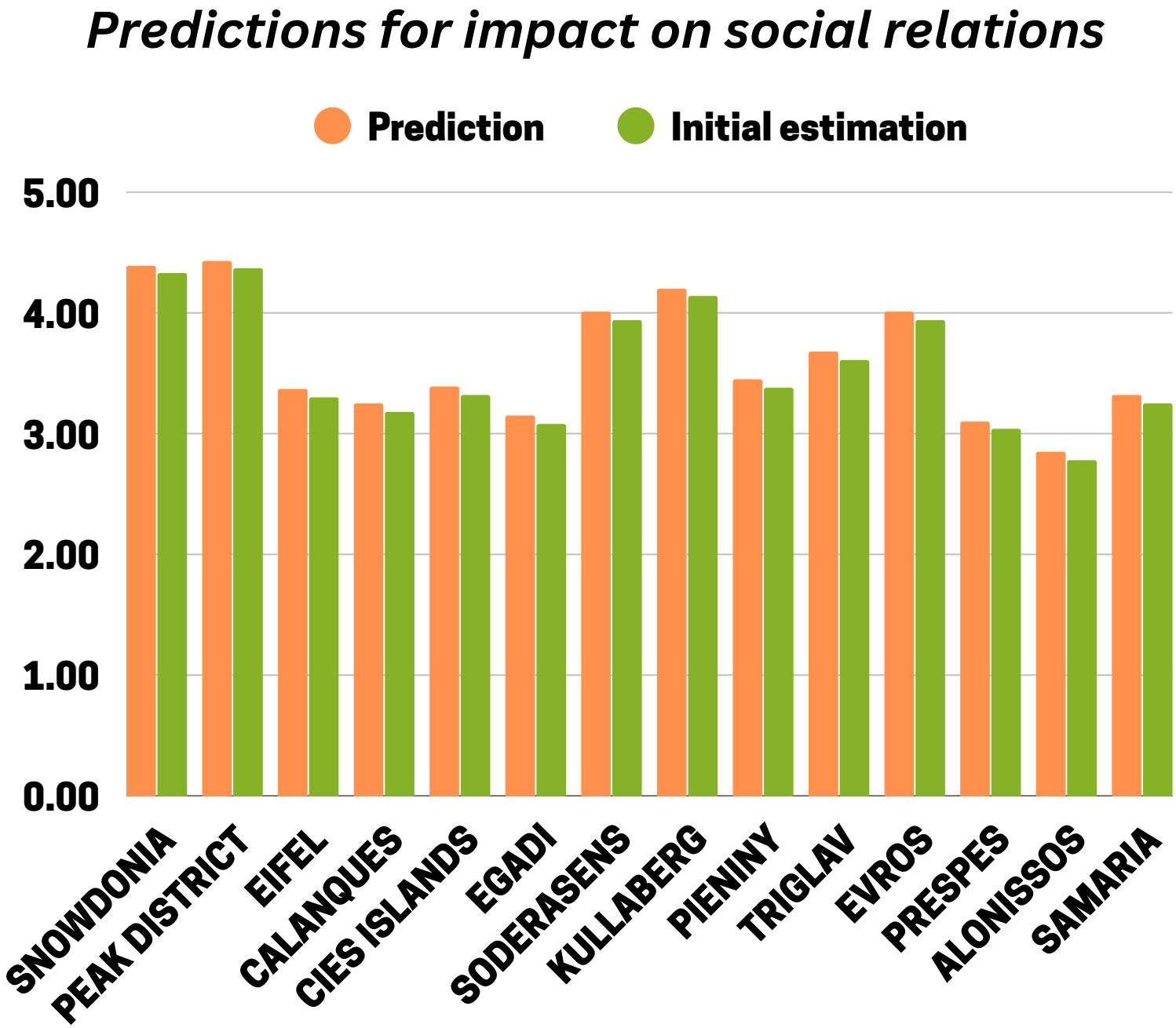

DISCUSSION AND CONCLUSIOS

The analysis presented in this report explores changes in perceptions for social impacts of Protected Areas (PAs) and other social factors using data from two rounds of social surveys in four protected sites and then using that data to predict change of perceptions in another 15 sites across Europe.

Our findings indicate that, overall, there were positive changes in the perceived social impacts of PAs between the two rounds. People consistently rated very high the impact on connectedness to nature and recreation and slightly lower the impact on income and social relations.

One of the more notable changes was the increase in trust toward PA management authorities. This increase, although modest, is important as it highlights the role of PA governance in shaping local perceptions. Trust in local and central government institutions, however, remained relatively low and stable. This implies that while PA management authorities were viewed more positively, broader governance structures might still face challenges in earning the trust of local populations.

Additionally, perceptions related to environmental responsibility saw some positive shifts. The results show a statistically significant increase in participants' perception of their ability to act responsibly within PAs, reflecting an enhanced awareness and willingness to engage in pro-environmental behavior. However, this was not matched by a similar increase in actual engagement in conservation activities, where perceptions of having enough time, money, and opportunities to support the protected area remained unchanged.

Public support for the four PAs remained high across the study, with little variation between the first and second rounds. A significant proportion of participants expressed strong support for PAs, with only minor fluctuations in neutral or less supportive responses. Place attachment, which measures the emotional connection individuals have to the PAs, was also found to be consistently high in both rounds. This suggests that these protected areas hold significant personal and cultural value for the communities involved, and these values have been resilient to changes over time.

DISCUSSION AND CONCLUSIOS

In this report we also presented a new modelling framework allowing the prediction of social impacts across other protected areas using as a baseline the data from the fours sites (including both surveys). The predictive modelling revealed small variations from the originally measured social impacts to the ones predicted by the model.

These findings are crucial because they provide a solid foundation for improving the management and governance of protected areas (PAs). The stability in public perceptions of social benefits, coupled with a slight increase in trust toward PA management authorities, suggests that while current management practices are generally accepted, there is an opportunity to increase local engagement. The data highlight areas for improvement, such as increasing the perceived economic benefits and creating more accessible opportunities for community involvement in conservation efforts. By focusing on these aspects, PA managers can tailor strategies that better address local needs, foster deeper community participation, and boost public support for conservation initiatives.

Additionally, the results of the predictive modeling are particularly important for future planning. Understanding how perceptions might evolve in different areas allows policymakers and practitioners to anticipate potential challenges and develop area-specific strategies. By identifying key factors—such as socio-economic conditions and governance structures—that influence perceptions, this model can guide resource allocation and policy adjustments, ensuring that PAs continue to provide long-term social and environmental benefits. These findings ultimately help ensure that PAs are not only conserved but are also integrated into the social and economic fabric of the communities they serve, promoting sustainability and public buy-in.

In conclusion, while protected areas are consistently perceived as offering positive social benefits, there is room for improvement in areas like economic impact and active community participation in conservation efforts. Our findings underscore the importance of strong, trusted governance and the need to promote deeper engagement with local communities to improve the long-term sustainability and social value of protected areas across Europe.

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Contact

Global Sustainable Development,
School for Cross-faculty Studies
University of Warwick, Coventry, CV4 7AL,
United Kingdom

www.warwick.ac.uk/fidelio
www.warwick.ac.uk/sociat
fidelio@warwick.ac.uk

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