**Supplementary Information for:**

**“The importance of species diversity for human well-being in Europe”**

Joel Methorst, Katrin Rehdanz, Thomas Müller, Bernd Hansjürgens,

Aletta Bonn, Katrin Böhning-Gaese

Contents

[1. Socio-economic data description 2](#_Toc56328182)

[2. CORINE land cover categorization 3](#_Toc56328183)

[3. Summary statistics 4](#_Toc56328184)

[4. Variation within and between NUTS regions 7](#_Toc56328185)

[5. Results for OLS models with log-linear specification of species richness 8](#_Toc56328186)

[6. Results for OLS models with linear specification of species richness 20](#_Toc56328187)

[7. Comparing EBBA data with recent bird species richness data from Germany and Britain 28](#_Toc56328188)

[8. Literature 33](#_Toc56328189)

## Socio-economic data description

Here we present detailed descriptions of each variable used in our study.

**Table S1.** Socio- and macro-economic variables and their detailed descriptions.

|  |  |  |
| --- | --- | --- |
| **Main category** | **Subcategory** | **Description** |
| Socio-economic factors | Categorical net household income | Categorical income variable with 22 categories. The lowest category marks net monthly income <50 EUR. The highest category groups people with monthly income >5,500 EUR. |
| Mean of categorical net household income | Estimated mean monthly net household income based on the categorical income variable (continuous variable). We took the midpoints of each income category. |
| Age and quadratic term of age | Age (<18 years) and a quadratic term of age was included to account for the U-shaped relationship found in the literature. |
| Male/Gender | Binary variable for males. |
| Educational level | Three categories: tertiary, secondary and primary or less. |
| Health status | Five categories: very good, good, fair, bad and very bad. |
| Household structure | Five categories: single, couple, single parent, couple with child, other households. |
| Employment status | Seven categories: employed, unemployed, unable, retired, homemaker, student and other. |
| Volunteering | A variable which describes how frequently people do voluntary work in three categories: does not volunteer, volunteers occasionally and volunteers regularly. |
| Macro-economic factors | GDP per capita | GDP per capita in purchasing power standard (PPS) for each NUTS region. |
| Unemployment rate | Unemployment rate for each NUTS region. |
| Further control variables | Urban | Binary variable for urban areas. |
| Recreation access | A variable which describes how the participants assess their access to recreational areas in five categories: great difficulty, with some difficulty, easily, very easily and service not used. |
| Eastern Europe dummy | Binary variable for all former East-Bloc countries (i.e. Latvia, Lithuania, Estonia, Poland, Czech Republic, Slovakia, Hungary, Romania and Bulgaria). |
| NUTS area size | Area size (km2) of each NUTS region. |

## CORINE land cover categorization

Here we report the categorizations of land cover types from the CORINE land cover database (Table S2). Based on these land cover types we calculated the variables for landscape heterogeneity, green space and blue space cover.

**Table S2.** Land cover categories used to estimate habitat heterogeneity as well as green and blue space.

|  |  |  |  |
| --- | --- | --- | --- |
| **5 Categories** | **15 Categories** | **44 Categories** | **Green and blue space** |
| Artificial surfaces | Urban fabric | Continuous urban fabric | / |
| Discontinuous urban fabric |
| Industrial, commercial and transport units | Industrial or commercial units |
| Road and rail networks and associated land |
| Port areas |
| Airports |
| Mine, dump and construction sites | Mineral extraction sites |
| Dump sites |
| Construction sites |
| Artificial, non-agricultural vegetated areas | Green urban areas |
| Sport and leisure facilities |
| Agricultural areas | Arable land | Non-irrigated arable land | Green space |
| Permanently irrigated land |
| Rice fields |
| Permanent crops | Vineyards |
| Fruit trees and berry plantations |
| Olive groves |
| Pastures | Pastures |
| Heterogeneous agricultural areas | Annual crops associated with permanent crops |
| Complex cultivation patterns |
| Land principally occupied by agriculture, with significant areas of natural vegetation |
| Agro-forestry areas |
| Forest and semi natural areas | Forests | Broad-leaved forest | Green space |
| Coniferous forest |
| Mixed forest |
| Scrub and/or herbaceous vegetation associations | Natural grasslands | Green space |
| Moors and heathland |
| Sclerophyllous vegetation |
| Transitional woodland-shrub |
| Open spaces with little or no vegetation | Beaches, dunes, sands | / |
| Bare rocks |
| Sparsely vegetated areas |
| Burnt areas |
| Glaciers and perpetual snow |
| Wetlands | Inland wetlands | Inland marshes | Green space |
| Peat bogs |
| Maritime wetlands | Salt marshes | Green space |
| Salines |
| Intertidal flats |
| Water bodies | Inland waters | Water courses | Blue space |
| Water bodies |
| Marine waters | Coastal lagoons | Blue space |
| Estuaries |
| Sea and ocean |

## Summary statistics

Presented here are summary statistics of the data used in our study (Table S3 and S4).

**Table S3.** Summary statistics for continuous variables on NUTS region and individual level (n = 26,749).

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Variable** | **Min.** | **Median** | **Mean** | **Max.** |
| **NUTS region level** |  |  |  |  |
| Bird species richness | 67.67 | 136.08 | 133.10 | 170.60 |
| Mammals (all) species richness | 7.84 | 39.02 | 37.95 | 55.71 |
| Mammal (no bats) species richness | 2.96 | 21.60 | 20.56 | 29.85 |
| Megafauna (>44kg) species richness | 0.00 | 3.00 | 2.93 | 4.93 |
| Megafauna (>0.5kg) species richness | 0.95 | 15.75 | 14.69 | 20.77 |
| Tree species richness | 1.00 | 19.56 | 19.67 | 53.31 |
| Landscape heterogeneity | 0.97 | 1.44 | 1.44 | 2.04 |
| Topographic heterogeneity | 13.63 | 432.57 | 574.60 | 3578.66 |
| Green space cover (%) | 13.40 | 92.25 | 87.38 | 97.85 |
| Blue space cover (%) | 0.00 | 0.99 | 2.05 | 14.65 |
| Protected area cover (%) | 0.71 | 19.68 | 25.04 | 82.13 |
| Cooling degree days | 0.00 | 14.08 | 42.39 | 358.20 |
| Heating degree days | 315.72 | 2555.00 | 2561.00 | 5863.58 |
| GDP per capita (PPS) | 7400.00 | 23300.00 | 25347.00 | 68600.00 |
| Unemployment rate (%) | 2.70 | 8.93 | 9.99 | 30.10 |
| NUTS region area size (km2) | 163.17 | 15429.00 | 25693.00 | 227106.65 |
| **Individual level** |  |  |  |  |
| Life-satisfaction | 1.00 | 7.00 | 7.03 | 10.00 |
| Mean of categorical net household income (EUR) | 25.00 | 1237.00 | 1708.00 | 5500.00 |
| Age | 18.00 | 51.00 | 51.14 | 95.00 |

**Table S4.** Summary statistics for categorical and dummy variables (n = 26,749).

|  |  |  |
| --- | --- | --- |
| **Categorical variables** | **n** | **Percent (%)** |
| Recreation access: great difficulty | 749 | 2.8 |
| Recreation access: with some difficulty | 2323 | 8.7 |
| Recreation access: easily | 11008 | 41.2 |
| Recreation access: very easily | 10586 | 39.6 |
| Recreation access: service not used | 2083 | 7.8 |
| Education: primary or less | 2987 | 11.2 |
| Education: secondary | 17409 | 65.1 |
| Education: tertiary | 6353 | 23.8 |
| Health: very good | 5283 | 19.8 |
| Health: good | 10136 | 37.9 |
| Health: fair | 8085 | 30.2 |
| Health: bad | 2505 | 9.4 |
| Health: very bad | 740 | 2.8 |
| Householdstructure: single | 6808 | 25.5 |
| Householdstructure: couple | 7834 | 29.3 |
| Householdstructure: single parent | 988 | 3.7 |
| Householdstructure: couple with child | 5525 | 20.7 |
| Householdstructure: other household | 5594 | 20.9 |
| Employmentstatus: employed | 12245 | 45.8 |
| Employmentstatus: unemployed | 1985 | 7.4 |
| Employmentstatus: unable | 652 | 2.4 |
| Employmentstatus: retired | 8858 | 33.1 |
| Employmentstatus: homemaker | 1597 | 6.0 |
| Employmentstatus: student | 1057 | 4.0 |
| Employmentstatus: other | 355 | 1.3 |
| Volunteering: does not volunteer | 18179 | 68.0 |
| Volunteering: volunters occasionally | 5646 | 21.1 |
| Volunteering: volunteers regularly | 2924 | 10.9 |
|  |  |  |
| **Dummy variables** | **0 (%)** | **1 (%)** |
| Male | 57.1 | 42.9 |
| Coastline | 49.1 | 50.9 |
| Urban | 49.0 | 51.0 |
| Eastern Europe | 73.8 | 26.2 |

## Variation within and between NUTS regions

We examined how much our species richness data varied within NUTS region and determined for each species group whether the within-region variance was a major factor explaining the overall variation of species richness across Europe (between-region variance).

We took species diversity values intersecting with NUTS regions from the 50x50km grid (see Methods) and performed simple ANOVAs with species richness as the response variable and the NUTS regions as factor variable. We used only species diversity values (intersecting grid polygons) that covered at least 1% of the NUTS region area. Data from Kosovo, Serbia, Turkey, Iceland, Cyprus, Malta, Macedonia and Montenegro were also removed. Based on the ANOVA results we then calculated the percentage of overall variance explained by the within- and the between-region variation by dividing the between-regions and residual sum of squares with the total sum of squares.

The results indicate that a major part of the total variance of species richness across Europe is driven by the between-region variance and not the within-region variance (Table S5).

**Table S5.** ANOVA results and percentage of variance explained by within- and between-region variance of species richness. Degrees of freedom (Df) are different for the taxonomic groups because the respective bird, mammal and tree species richness values (grid data) have varying numbers of missing values.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **Df** | **Sum of Sq.** | **Mean Sq.** | **F-value** | **p-value** | **Percent explained** |
| **Bird species richness** |  | | | | | |
| NUTS region (between) | 228 | 1171878.30 | 5139.82 | 18.36 | <0.001 | **61.42** |
| Residuals (within) | 2630 | 736175.8 | 279.91 | - | - | 38.58 |
| **Mammal species richness** |  | | | | | |
| NUTS region (between) | 229 | 274540.30 | 1198.87 | 85.58 | <0.001 | **88.08** |
| Residuals (within) | 2651 | 37139.20 | 14.01 | - | - | 11.92 |
| **Mammal species richness (no bats)** |  | | | | | |
| NUTS region (between) | 229 | 58597.08 | 255.88 | 49.30 | <0.001 | **80.98** |
| Residuals (within) | 2651 | 13759.84 | 5.19 | - | - | 19.02 |
| **Megafauna species richness (>44kg)** |  | | | | | |
| NUTS region (between) | 229 | 2573.08 | 11.24 | 34.67 | <0.001 | **74.97** |
| Residuals (within) | 2651 | 859.04 | 0.32 | - | - | 25.03 |
| **Megafauna species richness (>0.5kg)** |  | | | | | |
| NUTS region (between) | 229 | 32773.40 | 143.12 | 46.33 | <0.001 | **80.01** |
| Residuals (within) | 2651 | 8189.71 | 3.09 | - | - | 19.99 |
| **Tree species richness** |  | | | | | |
| NUTS region (between) | 228 | 242328.40 | 1062.84 | 20.55 | <0.001 | **65.45** |
| Residuals (within) | 2473 | 127935.10 | 51.73 | - | - | 34.55 |

## Results for OLS models with log-linear specification of species richness

**Multi-taxon models**

Here we present the results for the multi-taxon models calculated with ordinary least squares (OLS) and the ordered logistic regression models (oLogit). All species richness variables have a log-linear specification.

**Table S6:** Model results for the multi-taxon OLS models with clustered standard errors and different sets of log-transformed species richness predictor variables (OLS 1: all mammals, OLS 2: mammals (no bats), OLS 3; megafauna >44kg, OLS 4: megafauna >0.5kg). The OLS models contain the mean of the categorical net household income variable (Table S1), socio-economic and macro-economic control variables (see Methods for more details). Shown are coefficients, standard errors in parenthesis, t-values and p-values as asterisk symbols. Response variable = life-satisfaction. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Predictor variables** | **OLS 1** | **OLS 2** | **OLS 3** | **OLS 4** |
| **Species richness** |  | | | |
| Log bird species richness | 0.55  (0.26)  2.12\* | 0.55  (0.25) 2.17\* | 0.57  (0.28) 2.05\* | 0.53  (0.26) 2.06\* |
| Log mammal species richness (all) | -0.11 (0.11)  -0.97 | - | - | - |
| Log mammal species richness (no bats) | - | -0.10  (0.08)  -1.25 | - | - |
| Log megafauna species richness (>44kg) | - | - | -0.07  (0.10)  -0.68 | - |
| Log megafauna species richness (>0.5kg) | - | - | - | -0.03 (0.05)  -0.57 |
| Log tree species richness | -0.01  (0.10)  -0.03 | -0.01  (0.10)  -0.05 | -0.02  (0.10)  -0.12 | -0.02  (0.10)  -0.13 |
| **Other nature characteristics** |  | | | |
| Landscape heterogeneity | -0.19 (0.23)  -0.82 | -0.19 (0.23)  -0.84 | -0.19 (0.23)  -0.81 | -0.19 (0.23)  -0.80 |
| Topographic heterogeneity | 0.01  (0.01)  0.18 | 0.01  (0.01)  0.17 | 0.01  (0.01)  0.14 | 0.01  (0.01)  0.11 |
| Green space cover | -0.01 (0.01)  -0.24 | -0.01 (0.01)  -0.23 | -0.01 (0.01)  -0.20 | -0.01 (0.01)  -0.21 |
| Blue space cover | -0.02 (0.02)  -0.78 | -0.02 (0.02)  -0.76 | -0.02 (0.02)  -0.72 | -0.02 (0.02)  -0.73 |
| Coastline | -0.01 (0.06)  -0.14 | -0.01 (0.06)  -0.12 | -0.02 (0.07)  -0.19 | -0.01 (0.06)  -0.09 |
| Protected area cover | 0.01  (0.01)  0.68 | 0.01  (0.01)  0.7 | 0.01  (0.01)  0.69 | -0.01 (0.06)  -0.09 |
| **Climate** |  | | | |
| Cooling degree days | 0.01  (0.01)  1.73 | 0.01  (0.01)  1.68 | 0.01  (0.01)  1.66 | 0.01  (0.01)  1.66 |
| **Socio-economic variables** |  | | | |
| Recreation access: great difficulty | Reference group | | | |
| Recreation access: with some difficulty | 0.03  (0.17)  0.13 | 0.03  (0.17)  0.13 | 0.03  (0.17)  0.14 | 0.03  (0.17)  0.13 |
| Recreation access: easily | 0.33  (0.16) 2.13\* | 0.33  (0.16) 2.13\* | 0.33  (0.16) 2.14\* | 0.33  (0.16) 2.13\* |
| Recreation access: very easily | 0.54  (0.16) 3.58\*\*\* | 0.54  (0.16) 3.58\*\*\* | 0.54  (0.16) 3.58\*\*\* | 0.54  (0.16) 3.58\*\*\* |
| Recreation access: service not used | 0.09  (0.16)  0.53 | 0.09  (0.16)  0.53 | 0.09  (0.16)  0.54 | 0.09  (0.16)  0.53 |
|  | | | | |
| Log net household income | 0.36  (0.03) 12.09\*\*\* | 0.36  (0.03) 12.09\*\*\* | 0.36  (0.03) 12.09\*\*\* | 0.36  (0.03) 12.09\*\*\* |
| Age | -0.05 (0.01)  -9.08\*\*\* | -0.05 (0.01)  -9.08\*\*\* | -0.05 (0.01)  -9.08\*\*\* | -0.05 (0.01)  -9.08\*\*\* |
| Age-squared | 0.01  (0.01) 10.12\*\*\* | 0.01  (0.01) 10.12\*\*\* | 0.01  (0.01) 10.11\*\*\* | 0.01  (0.01) 10.12\*\*\* |
| Male | -0.1  (0.03)  -3.98\*\*\* | -0.10  (0.03)  -3.98\*\*\* | -0.1  (0.03)  -3.99\*\*\* | -0.10  (0.03)  -3.99\*\*\* |
| Urban | -0.17 (0.04)  -4.31\*\*\* | -0.17 (0.04)  -4.30\*\*\* | -0.17 (0.04)  -4.30\*\*\* | -0.17 (0.04)  -4.30\*\*\* |
| Education: primary or less | Reference group | | | |
| Education: secondary | 0.05  (0.05)  0.87 | 0.05  (0.05)  0.87 | 0.05  (0.05)  0.86 | 0.05  (0.05)  0.87 |
| Education: tertiary | 0.19  (0.06) 3.52\*\*\* | 0.19  (0.06) 3.51\*\*\* | 0.19  (0.06) 3.53\*\*\* | 0.19  (0.06) 3.53\*\*\* |
| Health: very bad | Reference group | | | |
| Health: bad | 0.80  (0.11) 7.81\*\*\* | 0.79  (0.11) 7.81\*\*\* | 0.80  (0.11) 7.81\*\*\* | 0.79  (0.11) 7.81\*\*\* |
| Health: fair | 1.64  (0.11) 15.91\*\*\* | 1.64  (0.11) 15.9\*\*\* | 1.64  (0.11) 15.9\*\*\* | 1.64  (0.11) 15.9\*\*\* |
| Health: good | 2.11  (0.11) 19.43\*\*\* | 2.11  (0.11) 19.42\*\*\* | 2.11  (0.11) 19.43\*\*\* | 2.11  (0.11) 19.42\*\*\* |
| Health: very good | 2.53  (0.12) 21.79\*\*\* | 2.53  (0.12) 21.78\*\*\* | 2.53  (0.12) 21.79\*\*\* | 2.53  (0.12) 21.79\*\*\* |
| Householdstructure: single | Reference group | | | |
| Householdstructure: couple | 0.24  (0.05) 5.63\*\*\* | 0.24  (0.05) 5.63\*\*\* | 0.24  (0.05) 5.63\*\*\* | 0.24  (0.05) 5.64\*\*\* |
| Householdstructure: single parent | -0.38 (0.08)  -5.03\*\*\* | -0.38 (0.08)  -5.03\*\*\* | -0.38 (0.08)  -5.03\*\*\* | -0.38 (0.08)  -5.03\*\*\* |
| Householdstructure: couple with child | 0.21  (0.05) 4.15\*\*\* | 0.21  (0.05) 4.15\*\*\* | 0.21  (0.05) 4.16\*\*\* | 0.21  (0.05) 4.17\*\*\* |
| Householdstructure: other household | -0.06 (0.05)  -1.05 | -0.06 (0.05)  -1.05 | -0.06 (0.05)  -1.05 | -0.06 (0.05)  -1.05 |
| Employmentstatus: employed | Reference group | | | |
| Employmentstatus: unemployed | -0.83 (0.07)  -13.14\*\*\* | -0.83 (0.07)  -13.13\*\*\* | -0.83 (0.07)  -13.14\*\*\* | -0.83 (0.07)  -13.14\*\*\* |
| Employmentstatus: unable | -0.24 (0.11)  -2.16\* | -0.24 (0.11)  -2.16\* | -0.24 (0.11)  -2.16\* | -0.24 (0.11)  -2.16\* |
| Employmentstatus: retired | 0.16  (0.06) 2.85\*\* | 0.16  (0.06) 2.86\*\* | 0.16  (0.06) 2.86\*\* | 0.16  (0.06) 2.85\*\* |
| Employmentstatus: homemaker | -0.08 (0.07)  -1.13 | -0.08 (0.07)  -1.14 | -0.08 (0.07)  -1.14 | -0.08 (0.07)  -1.13 |
| Employmentstatus: student | 0.22  (0.07) 3.16\*\* | 0.22  (0.07) 3.16\*\* | 0.22  (0.07) 3.16\*\* | 0.22  (0.07) 3.17\*\* |
| Employmentstatus: other | -0.15 (0.11)  -1.33 | -0.15 (0.11)  -1.33 | -0.15 (0.11)  -1.34 | -0.15 (0.11)  -1.33 |
| Volunteering: does not volunteer | Reference group | | | |
| Volunteering: volunters occasionally | 0.08  (0.04) 2.08\* | 0.08  (0.04) 2.08\* | 0.08  (0.04) 2.08\* | 0.08  (0.04) 2.08\* |
| Volunteering: volunteers regularly | 0.19  (0.04) 5.2\*\*\* | 0.19  (0.04) 5.2\*\*\* | 0.19  (0.04) 5.19\*\*\* | 0.19  (0.04) 5.19\*\*\* |
| **Macro-economic variables** |  | | | |
| Unemploymentrate | -0.03 (0.02)  -2.03\* | -0.03 (0.02)  -2.03\* | -0.03 (0.02)  -1.99\* | -0.03 (0.02)  -1.98\* |
| GDP per capita (PPS) | -0.01 (0.01)  -1.24 | -0.01 (0.01)  -1.22 | -0.01 (0.01)  -1.15 | -0.01 (0.01)  -1.15 |
| Eastern Europe | -0.72 (0.19)  -3.91\*\*\* | -0.72  (0.18)  -4.09\*\*\* | -0.76 (0.18)  -4.42\*\*\* | -0.76 (0.18)  -4.33\*\*\* |
|  | | | | |
| NUTS region area size | 0.01  (0.01)  0.14 | 0.01  (0.01)  0.30 | 0.01  (0.01)  0.32 | 0.01  (0.01)  0.28 |
|  | | | | |
| Constant | 1.57  (1.41)  1.12 | 1.48  (1.42)  1.05 | 1.22  (1.49)  0.83 | 1.4  (1.43)  0.99 |
| Country dummies | yes | yes | yes | yes |
| Observations | 26,749 | 26,749 | 26,749 | 26,749 |
| AIC | 109860.20 | 109859.60 | 109860.40 | 109860.90 |
| BIC | 110409.20 | 110408.60 | 110409.40 | 110409.90 |
| LogLik | -54863.12 | -54862.81 | -54863.21 | -54863.46 |
| Adjusted R-squared | 0.24 | 0.24 | 0.24 | 0.24 |
| AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion | | | | |

**Table S7.** Model results for the ordered logit regressions models with clustered standard errors and different sets of log-transformed species richness predictor variables (oLogit 1: all mammals, oLogit 2: mammals (no bats), oLogit 3; megafauna >44kg, oLogit 4: megafauna >0.5kg). The ordered logit models contain the mean of the categorical net household income variable (Table S1), socio-economic and macro-economic control variables (see Methods for more details). Shown are coefficients, standard errors in parenthesis, Wald z-scores and p-values as asterisk symbols. Response variable = life-satisfaction. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Predictor variables** | **oLogit 1** | **oLogit 2** | **oLogit 3** | **oLogit 4** |
| **Species richness** |  | | | |
| Log bird species richness | 0.49  (0.23) 2.16\* | 0.45  (0.23) 1.99\* | 0.48  (0.24) 1.95\* | 0.46  (0.22) 2.07\* |
| Log mammal species richness (all) | -0.18  (0.11)  -1.61 | - | - | - |
| Log mammal species richness (no bats) | - | -0.19  (0.08)  -2.26\* | - | - |
| Log megafauna species richness (>44kg) | - | - | -0.06  (0.09)  -0.67 | - |
| Log megafauna species richness (>0.5kg) | - | - | - | -0.06  (0.05)  -1.22 |
| Log tree species richness | -0.01  (0.08)  -0.05 | 0.05  (0.07)  0.75 | -0.01  (0.08)  -0.16 | -0.01  (0.08)  -0.15 |
| **Other nature characteristics** |  | | | |
| Landscape heterogeneity | -0.11  (0.19)  -0.58 | -0.13  (0.20)  -0.67 | -0.11  (0.20)  -0.54 | -0.11  (0.19)  -0.56 |
| Topographic heterogeneity | 0.01  (0.01)  0.38 | 0.01  (0.01)  0.30 | 0.01  (0.01)  0.24 | 0.01  (0.001) 0.24 |
| Green space cover | -0.01  (0.01)  -0.06 | -0.01  (0.01)  -0.06 | 0.01  (0.01)  0.02 | 0.01  (0.01)  0.01 |
| Blue space cover | -0.01  (0.01)  -0.90 | -0.01  (0.01)  -0.76 | -0.01  (0.01)  -0.79 | -0.01  (0.01)  -0.81 |
| Coastline | 0.03  (0.05)  0.47 | 0.03  (0.05)  0.56 | 0.02  (0.06)  0.44 | 0.03  (0.05)  0.53 |
| Protected area cover | 0.01  (0.01)  0.45 | 0.01  (0.01)  0.22 | 0.01  (0.01)  0.48 | 0.01  (0.01)  0.48 |
| **Climate** |  |  |  |  |
| Cooling degree days | 0.01  (0.01)  1.81 | 0.01  (0.01)  1.60 | 0.01  (0.01)  1.68 | 0.01  (0.01)  1.69 |
| **Socio-economic variables** |  | | | |
| Recreation access: great difficulty | Reference group | | | |
| Recreation access: with some difficulty | -0.04  (0.14)  -0.26 | -0.04  (0.14)  -0.26 | -0.04  (0.14)  -0.25 | -0.04  (0.14)  -0.25 |
| Recreation access: easily | 0.24  (0.13)  1.90 | 0.24  (0.13)  1.91 | 0.24  (0.13)  1.90 | 0.24  (0.13)  1.90 |
| Recreation access: very easily | 0.45  (0.13) 3.57\*\*\* | 0.44  (0.12) 3.57\*\*\* | 0.45  (0.13) 3.58\*\*\* | 0.44  (0.13) 3.57\*\*\* |
| Recreation access: service not used | 0.03  (0.13)  0.21 | 0.03  (0.13)  0.19 | 0.03  (0.13)  0.21 | 0.03  (0.13)  0.20 |
|  | | | | |
| Log net household income | 0.33  (0.03) 11.90\*\*\* | 0.33  (0.03) 12.10\*\*\* | 0.33  (0.03) 11.90\*\*\* | 0.33  (0.03) 11.91\*\*\* |
| Age | -0.04  (0.01)  -9.02\*\*\* | -0.05  (0.01)  -9.05\*\*\* | -0.04  (0.01)  -9.02\*\*\* | -0.04  (0.01)  -9.02\*\*\* |
| Age-squared | 0.01  (0.01) 10.65\*\*\* | 0.01  (0.01) 10.67\*\*\* | 0.01  (0.01) 10.64\*\*\* | 0.01  (0.01) 10.65\*\*\* |
| Male | -0.10  (0.02)  -4.45\*\*\* | -0.10  (0.02)  -4.43\*\*\* | -0.10  (0.02)  -4.47\*\*\* | -0.10  (0.02)  -4.46\*\*\* |
| Urban | -0.15  (0.04)  -3.97\*\*\* | -0.15  (0.04)  -4.00\*\*\* | -0.15  (0.04)  -3.97\*\*\* | -0.15  (0.04)  -3.96\*\*\* |
| Education: primary or less | Reference group | | | |
| Education: secondary | 0.03  (0.05)  0.76 | 0.04  (0.05)  0.80 | 0.03  (0.05)  0.76 | 0.03  (0.05)  0.76 |
| Education: tertiary | 0.13  (0.05) 2.64\*\* | 0.132 (0.05) 2.66\*\* | 0.132 (0.05) 2.67\*\* | 0.13  (0.05) 2.65\*\* |
| Health: very bad | Reference group | | | |
| Health: bad | 0.70  (0.09) 7.94\*\*\* | 0.70  (0.09) 7.93\*\*\* | 0.70  (0.09) 7.94\*\*\* | 0.70  (0.09) 7.94\*\*\* |
| Health: fair | 1.50  (0.09) 16.00\*\*\* | 1.50  (0.09) 15.98\*\*\* | 1.50  (0.09) 15.99\*\*\* | 1.50  (0.09) 16.00\*\*\* |
| Health: good | 1.97  (0.10) 19.68\*\*\* | 1.98  (0.10) 19.66\*\*\* | 1.97  (0.10) 19.68\*\*\* | 1.97  (0.10) 19.68\*\*\* |
| Health: very good | 2.49  (0.11) 22.98\*\*\* | 2.49  (0.11) 22.94\*\*\* | 2.49  (0.11) 22.97\*\*\* | 2.49  (0.11) 22.97\*\*\* |
| Householdstructure: single | Reference group | | | |
| Householdstructure: couple | 0.26  (0.04) 6.51\*\*\* | 0.26  (0.04) 6.48\*\*\* | 0.26  (0.04) 6.52\*\*\* | 0.26  (0.04) 6.52\*\*\* |
| Householdstructure: single parent | -0.33  (0.07)  -4.97\*\*\* | -0.33  (0.07)  -4.97\*\*\* | -0.33  (0.07)  -4.97\*\*\* | -0.33  (0.07)  -4.97\*\*\* |
| Householdstructure: couple with child | 0.23  (0.05) 5.05\*\*\* | 0.23  (0.05) 5.00\*\*\* | 0.23  (0.05) 5.09\*\*\* | 0.23  (0.05) 5.08\*\*\* |
| Householdstructure: other household | -0.01  (0.04)  -0.09 | -0.01  (0.04)  -0.21 | -0.01  (0.04)  -0.08 | -0.01  (0.04)  -0.09 |
| Employmentstatus: employed | Reference group | | | |
| Employmentstatus: unemployed | -0.71  (0.06)  -11.83\*\*\* | -0.70  (0.06)  -11.75\*\*\* | -0.71  (0.06)  -11.83\*\*\* | -0.70  (0.06)  -11.83\*\*\* |
| Employmentstatus: unable | -0.12  (0.10)  -1.22 | -0.12 (0.102)  -1.16 | -0.12  (0.10)  -1.21 | -0.12  (0.10)  -1.21 |
| Employmentstatus: retired | 0.17  (0.05) 3.22\*\* | 0.17  (0.05) 3.22\*\* | 0.166 (0.052) 3.21\*\* | 0.17  (0.05) 3.22\*\* |
| Employmentstatus: homemaker | 0.01  (0.06)  0.18 | 0.01  (0.06)  0.22 | 0.011 (0.059) 0.17 | 0.01  (0.06)  0.18 |
| Employmentstatus: student | 0.20  (0.06) 3.26\*\* | 0.20  (0.06) 3.27\*\* | 0.20  (0.062) 3.26\*\* | 0.20  (0.06) 3.26\*\* |
| Employmentstatus: other | -0.09  (0.10)  -0.97 | -0.09  (0.10)  -0.94 | -0.093 (0.095)  -0.98 | -0.09  (0.10)  -0.97 |
| Volunteering: does not volunteer | Reference group | | | |
| Volunteering: volunters occasionally | 0.06  (0.03)  1.76 | 0.06  (0.03)  1.76 | 0.06  (0.03)  1.77 | 0.06  (0.03)  1.77 |
| Volunteering: volunteers regularly | 0.20  (0.03) 5.96\*\*\* | 0.20  (0.03) 5.99\*\*\* | 0.20  (0.03) 5.94\*\*\* | 0.20  (0.03) 5.94\*\*\* |
| **Macro-economic variables** |  | | | |
| Unemploymentrate | -0.02  (0.01)  -2.03\* | -0.02  (0.01)  -2.01\* | -0.02  (0.01)  -1.92 | -0.02  (0.01)  -1.93 |
| GDP per capita (PPS) | 0.01  (0.01)  -1.25 | 0.01  (0.01)  -1.27 | 0.01  (0.01)  -1.05 | 0.01  (0.01)  -1.09 |
| Eastern Europe | -0.67  (0.16)  -4.12\*\*\* | -0.61  (0.14)  -4.46\*\*\* | -0.75  (0.15)  -4.99\*\*\* | -0.74  (0.15)  -4.81\*\*\* |
|  | | | | |
| NUTS region area size | 0.01  (0.01)  -0.11 | 0.01  (0.01)  0.25 | 0.01  (0.01)  0.24 | 0.01  (0.01)  0.20 |
|  | | | | |
| y >= 2 | -0.66  (1.23)  -0.54 | -0.75  (1.27)  -0.59 | -1.10  (1.30)  -0.84 | -0.96  (1.24)  -0.77 |
| y >= 3 | -1.35  (1.22)  -1.11 | -1.44  (1.26)  -1.14 | -1.79  (1.29)  -1.38 | -1.65  (1.23)  -1.34 |
| y >= 4 | -2.07  (1.22)  -1.70 | -2.153 (1.25)  -1.72 | -2.50  (1.29)  -1.94 | -2.37  (1.23)  -1.92 |
| y >= 5 | -2.60  (1.22)  -2.13\* | -2.68  (1.26)  -2.14\* | -3.03  (1.29)  -2.35\* | -2.89  (1.23)  -2.35\* |
| y >= 6 | -3.53  (1.22)  -2.90\*\* | -3.62  (1.26)  -2.88\*\* | -3.97  (1.29)  -3.07\*\* | -3.83  (1.23)  -3.11\*\* |
| y >= 7 | -4.13  (1.22)  -3.38\*\*\* | -4.22  (1.26)  -3.35\*\*\* | -4.57  (1.29)  -3.53\*\*\* | -4.43  (1.24)  -3.59\*\*\* |
| y >= 8 | -5.02  (1.23)  -4.10\*\*\* | -5.108 (1.26)  -4.05\*\*\* | -5.46  (1.30)  -4.21\*\*\* | -5.32  (1.24)  -4.30\*\*\* |
| y >= 9 | -6.33  (1.23)  -5.16\*\*\* | -6.42  (1.26)  -5.08\*\*\* | -6.77  (1.30)  -5.22\*\*\* | -6.63  (1.24)  -5.35\*\*\* |
| y >= 10 | -7.31  (1.23)  -5.95\*\*\* | -7.40  (1.27)  -5.84\*\*\* | -7.75  (1.30)  -5.96\*\*\* | -7.61  (1.24)  -6.13\*\*\* |
|  | | | | |
| Country dummies | yes | yes | yes | yes |
| Observations | 26,749 | 26,749 | 26,749 | 26,749 |
| AIC | 102700.60 | 102700.60 | 102702.80 | 102702.30 |
| BIC | 103307.00 | 103298.80 | 103309.20 | 103308.70 |
| LogLik | -51276.29 | -51277.32 | -51277.40 | -51277.15 |
| Nagelkerke R-squared | 0.25 | 0.25 | 0.25 | 0.25 |
| AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion | | | | |

**Single-taxon models**

Here we present the results for the single-taxon models calculated with ordinary least squares (OLS) and ordered logistic regression models (oLogit). All species richness variables are log-transformed. We only show detailed results for selected predictor variables: species richness, other nature characteristics, climate and access to local recreational areas. Socio-economic variables and other explanatory variables are the same as in the multi-taxon models.

**Table S8.** Model results for the single-taxon OLS regressions with clustered standard errors and a single log-transformed species richness predictor (OLS 1: birds, OLS 2: all mammals, OLS 3: mammals (no bats), OLS 4; megafauna >44kg, OLS 5: megafauna >0.5kg, OLS 6: trees). The OLS models contain the mean of the categorical net household income variable (Table S1), socio-economic and macro-economic control variables (see Methods for more details). Shown are coefficients, standard errors in parenthesis, t-values and p-values as asterisk symbols. Response variable = life-satisfaction. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Predictor variables** | **OLS 1** | **OLS 2** | **OLS 3** | **OLS 4** | **OLS 5** | **OLS 6** |
| **Species richness** |  | | | | | |
| Log bird species richness | 0.50  (0.24) 2.07\* | - | - | - | - | - |
| Log mammal species richness (all) | - | 0.03 (0.11) 0.27 | - | - | - | - |
| Log mammal species richness  (no bats) | - | - | -0.03 (0.07)  -0.35 | - | - | - |
| Log megafauna species richness (>44kg) | - | - | - | 0.06 (0.08) 0.66 | - | - |
| Log megafauna species richness (>0.5kg) | - | - | - | - | 0.03 (0.04) 0.70 | - |
| Log tree species richness | - | - | - | - | - | 0.07  (0.1)  0.69 |
| **Other nature characteristics** |  | | | | | |
| Landscape heterogeneity | -0.19 (0.23)  -0.80 | -0.23 (0.22)  -1.01 | -0.23 (0.22)  -1.03 | -0.22 (0.23)  -0.98 | -0.22 (0.22)  -0.99 | -0.23 (0.22)  -1.05 |
| Topographic heterogeneity | 0.01 (0.01) 0.09 | 0.01 (0.01) 0.12 | 0.01 (0.01) 0.17 | 0.01 (0.01) 0.11 | 0.01 (0.01) 0.13 | 0.01 (0.01) 0.12 |
| Green space cover | -0.01 (0.01)  -0.21 | -0.01 (0.01)  -0.35 | -0.01 (0.01)  -0.36 | -0.01 (0.01)  -0.36 | -0.01 (0.01)  -0.35 | -0.01 (0.01)  -0.34 |
| Blue space cover | -0.01 (0.02)  -0.68 | -0.01 (0.02)  -0.43 | -0.01 (0.02)  -0.45 | -0.01 (0.02)  -0.46 | -0.01 (0.02)  -0.43 | -0.01 (0.02)  -0.30 |
| Coastline | -0.01 (0.06)  -0.06 | -0.01 (0.06)  -0.04 | -0.01 (0.06)  -0.07 | 0.01 (0.06) 0.06 | -0.01 (0.06)  -0.03 | -0.01 (0.06)  -0.04 |
| Protected area cover | 0.01 (0.01) 0.74 | 0.01 (0.01) 1.22 | 0.01 (0.01) 1.23 | 0.01 (0.01) 1.19 | 0.01 (0.01) 1.21 | 0.01 (0.01) 1.22 |
| **Climate** |  | | | | | |
| Cooling degree days | 0.01 (0.01) 1.70 | 0.01 (0.01) 1.10 | 0.01 (0.01) 1.09 | 0.01 (0.01) 1.15 | 0.01 (0.01) 1.12 | 0.01 (0.01) 1.25 |
| **Socio-economic variables** |  | | | | | |
| Recreation access:  great difficulty | Reference group | | | | | |
| Recreation access:  with some difficulty | 0.03 (0.17) 0.13 | 0.03 (0.17) 0.17 | 0.03 (0.17) 0.18 | 0.03 (0.17) 0.17 | 0.03 (0.17) 0.17 | 0.03 (0.17) 0.17 |
| Recreation access:  easily | 0.33 (0.16) 2.13\* | 0.34 (0.16) 2.17\* | 0.34 (0.16) 2.17\* | 0.33 (0.16) 2.16\* | 0.34 (0.16) 2.17\* | 0.33 (0.16) 2.17\* |
| Recreation access:  very easily | 0.54 (0.16) 3.58\*\*\* | 0.55 (0.16) 3.61\*\*\* | 0.55 (0.16) 3.61\*\*\* | 0.55 (0.16) 3.6\*\*\* | 0.55 (0.16) 3.61\*\*\* | 0.55 (0.16) 3.61\*\*\* |
| Recreation access:  service not used | 0.09 (0.16) 0.53 | 0.09 (0.16) 0.55 | 0.09 (0.16) 0.55 | 0.09 (0.16) 0.55 | 0.09 (0.16) 0.55 | 0.09 (0.16) 0.55 |
|  | | | | | | |
| Constant | 1.45 (1.41) 1.04 | 3.80  (0.75) 5.11\*\*\* | 3.97 (0.71) 5.61\*\*\* | 3.83 (0.71) 5.44\*\*\* | 3.83 (0.69) 5.58\*\*\* | 3.71  (0.7) 5.37\*\*\* |
| Socio-economic factors | yes | yes | yes | yes | yes | yes |
| Macro-economic factors | yes | yes | yes | yes | yes | yes |
| Country dummies | yes | yes | yes | yes | yes | yes |
| Observations | 26,749 | 26,749 | 26,749 | 26,749 | 26,749 | 26,749 |
| AIC | 109857.20 | 109867.60 | 109868.00 | 109867.60 | 109867.80 | 109866.70 |
| BIC | 110389.80 | 110400.20 | 110400.60 | 110400.20 | 110400.50 | 110399.40 |
| LogLik | -54863.58 | -54868.78 | -54868.99 | -54868.78 | -54868.92 | -54868.37 |
| Adjusted R-squared | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 | 0.24 |
| AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion | | | | | | |

**Table S9.** Model results for the ordered logit regressions (with clustered standard errors) with only a single log-transformed species richness predictor (oLogit 1: birds, oLogit 2: all mammals, oLogit 3: mammals (no bats), oLogit 4; megafauna >44kg, oLogit 5: megafauna >0.5kg, oLogit 6: trees). The ordered logit models contain the mean of the categorical net household income variable (Table S1), socio-economic and macro-economic control variables (see Methods for more details). Shown are coefficients, standard errors in parenthesis, Wald z-scores and p-values as asterisk symbols. Response variable = life-satisfaction. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Predictor variables** | **oLogit 1** | **oLogit 2** | **oLogit 3** | **oLogit 4** | **oLogit 5** | **oLogit 6** |
| **Species richness** |  | | | | | |
| Log bird species richness | 0.41 (0.20) 2.01\* | - | - | - | - | - |
| Log mammal species richness (all) | - | -0.06 (0.10)  -0.56 | - | - | - | - |
| Log mammal species richness  (no bats) | - | - | -0.08 (0.06)  -1.19 | - | - | - |
| Log megafauna species richness (>44kg) | - | - | - | 0.04 (0.08) 0.50 | - | - |
| Log megafauna species richness (>0.5kg) | - | - | - | - | -0.01 (0.04)  -0.32 | - |
| Log tree species richness | - | - | - | - | - | 0.05 (0.07) 0.65 |
| **Other nature characteristics** |  | | | | | |
| Landscape heterogeneity | -0.10 (0.19)  -0.54 | -0.14 (0.19)  -0.77 | -0.15 (0.19)  -0.80 | -0.13 (0.19)  -0.70 | -0.14 (0.19)  -0.75 | -0.14 (0.19)  -0.77 |
| Topographic heterogeneity | 0.01  (0.01) 0.18 | 0.01 (0.01) 0.32 | 0.01 (0.01) 0.34 | 0.01 (0.01) 0.21 | 0.01  (0.01) 0.27 | 0.01  (0.01) 0.22 |
| Green space cover | 0.01 (0.01) 0.01 | -0.01 (0.01)  -0.17 | -0.01 (0.01)  -0.18 | -0.01 (0.01)  -0.15 | -0.01 (0.01)  -0.15 | -0.01 (0.01)  -0.13 |
| Blue space cover | -0.01 (0.01)  -0.74 | -0.01 (0.01)  -0.52 | -0.01 (0.01)  -0.52 | -0.01 (0.01)  -0.50 | -0.01 (0.01)  -0.49 | -0.01 (0.01)  -0.35 |
| Coastline | 0.03 (0.05) 0.59 | 0.03 (0.05) 0.56 | 0.03 (0.05) 0.54 | 0.04 (0.05) 0.66 | 0.03 (0.05) 0.58 | 0.03 (0.05) 0.60 |
| Protected area cover | 0.01 (0.01) 0.53 | 0.01 (0.01) 1.02 | 0.01 (0.01) 1.04 | 0.01 (0.01) 0.98 | 0.01 (0.01) 1.01 | 0.01 (0.01) 1.00 |
| **Climate** |  | | | | | |
| Cooling degree days | 0.01 (0.01) 1.71 | 0.01 (0.01) 1.16 | 0.01 (0.01) 1.13 | 0.01 (0.01) 1.21 | 0.01 (0.01) 1.16 | 0.01 (0.01) 1.31 |
| **Socio-economic variables** |  | | | | | |
| Recreation access:  great difficulty | Reference group | | | | | |
| Recreation access:  with some difficulty | -0.04 (0.14)  -0.26 | -0.03 (0.14)  -0.22 | -0.03 (0.14)  -0.22 | -0.03 (0.14)  -0.23 | -0.03 (0.14)  -0.22 | -0.03 (0.14)  -0.23 |
| Recreation access:  easily | 0.24 (0.13) 1.89 | 0.24 (0.13) 1.93 | 0.24 (0.13) 1.93 | 0.24 (0.13) 1.92 | 0.24 (0.13) 1.93 | 0.24 (0.13) 1.93 |
| Recreation access:  very easily | 0.44 (0.13) 3.57\*\*\* | 0.45 (0.13) 3.6\*\*\* | 0.45 (0.13) 3.59\*\*\* | 0.45  (0.13) 3.59\*\*\* | 0.45 (0.13) 3.59\*\*\* | 0.45 (0.13) 3.6\*\*\* |
| Recreation access:  service not used | 0.03 (0.12)  0.2 | 0.03  (0.13) 0.21 | 0.03 (0.13) 0.21 | 0.03 (0.13) 0.21 | 0.03 (0.13) 0.21 | 0.03 (0.13) 0.21 |
|  | | | | | | |
| y >= 2 | -0.88 (1.22)  -0.72 | 1.35 (0.68) 1.97 | 1.37 (0.62)  2.20 | 1.08 (0.61) 1.77 | 1.17 (0.60) 1.95 | 0.99  (0.60) 1.65 |
| y >= 3 | -1.57 (1.21)  -1.3 | 0.66 (0.68) 0.98 | 0.69 (0.61) 1.12 | 0.39 (0.60) 0.66 | 0.49 (0.59) 0.82 | 0.30 (0.59) 0.51 |
| y >= 4 | -2.29 (1.21)  -1.9 | -0.06 (0.67)  -0.09 | -0.03 (0.61)  -0.05 | -0.33 (0.60)  -0.54 | -0.23 (0.588)  -0.39 | -0.42 (0.58)  -0.72 |
| y >= 5 | -2.81 (1.21)  -2.33\* | -0.59 (0.67)  -0.87 | -0.56 (0.61)  -0.92 | -0.85 (0.60)  -1.42 | -0.76 (0.59)  -1.29 | -0.95 (0.59)  -1.62 |
| y >= 6 | -3.75 (1.21)  -3.11\*\* | -1.52 (0.68)  -2.26\* | -1.50 (0.61)  -2.44\* | -1.79 (0.60)  -2.96\* | -1.70 (0.60)  -2.85\* | -1.88 (0.59)  -3.20\* |
| y >= 7 | -4.35 (1.21)  -3.6\*\*\* | -2.12 (0.68)  -3.13\*\*\* | -2.10 (0.62)  -3.4\*\*\* | -2.39 (0.69)  -3.93\*\*\* | -2.30 (0.60)  -3.84\*\*\* | -2.48 (0.59)  -4.2\*\*\* |
| y >= 8 | -5.24 (1.21)  -4.32\*\*\* | -3.01 (0.68)  -4.43\*\*\* | -2.99 (0.62)  -4.81\*\*\* | -3.28 (0.61)  -5.37\*\*\* | -3.19 (0.60)  -5.3\*\*\* | -3.37 (0.60)  -5.67\*\*\* |
| y >= 9 | -6.55 (1.22)  -5.4\*\*\* | -4.32 (0.68)  -6.33\*\*\* | -4.30 (0.63)  -6.88\*\*\* | -4.59 (0.62)  -7.47\*\*\* | -4.50 (0.61)  -7.44\*\*\* | -4.68 (0.60)  -7.84\*\*\* |
| y >= 10 | -7.53 (1.22)  -6.19\*\*\* | -5.30 (0.69)  -7.72\*\*\* | -5.28 (0.63)  -8.38\*\*\* | -5.57 (0.62)  -8.98\*\*\* | -5.48 (0.61)  -8.98\*\*\* | -5.66 (0.60)  -9.39\*\*\* |
|  | | | | | | |
| Socio-economic factors | yes | yes | yes | yes | yes | yes |
| Macro-economic factors | yes | yes | yes | yes | yes | yes |
| Country dummies | yes | yes | yes | yes | yes | yes |
| Observations | 26,749 | 26,749 | 26,749 | 26,749 | 26,749 | 26,749 |
| AIC | 102699.50 | 102707.70 | 102706.80 | 102707.70 | 102708.00 | 102707.20 |
| BIC | 103289.50 | 103297.70 | 103296.80 | 103297.70 | 103298.00 | 103297.20 |
| LogLik | -51277.77 | -51281.85 | -51281.42 | -51281.87 | -51281.99 | -51281.60 |
| Nagelkerke R-squared | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 | 0.25 |
| AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion | | | | | | |

## Results for OLS models with linear specification of species richness

**Multi-taxon models**

Here we present the results for the multi-taxon models calculated with ordinary least squares (OLS) and the ordered logistic regression models (oLogit). All species richness variables have a linear specification.

**Table S10:** Model results for the multi-taxon OLS models with clustered standard errors and different species richness predictor sets (OLS 1: all mammals, OLS 2: mammals (no bats), OLS 3; megafauna >44kg, OLS 4: megafauna >0.5kg). The OLS models contain the mean of the categorical net household income variable (Table S1), socio-economic and macro-economic control variables (see Methods for more details). Shown are coefficients, standard errors in parenthesis, t-values and p-values as asterisk symbols. Response variable = life-satisfaction. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Predictor variables** | **OLS 1** | **OLS 2** | **OLS 3** | **OLS 4** |
| **Species richness** |  | | | |
| Bird species richness | 0.005  (0.002)  2.21\* | 0.005  (0.002)  2.39\* | 0.004  (0.002)  1.82 | 0.004  (0.002) 2.08\* |
| Mammal species richness (all) | -0.01  (0.01)  -1.20 | - | - | - |
| Mammal species richness (no bats) | - | -0.02  (0.01)  -1.89 | - | - |
| Megafauna species richness (>44kg) | - | - | -0.01  (0.04)  -0.21 | - |
| Megafauna species richness (>0.5kg) | - | - | - | -0.01  (0.01)  -0.77 |
| Tree species richness | 0.003  (0.01)  0.48 | 0.003  (0.01)  0.49 | 0.001  (0.01)  0.24 | 0.002  (0.01)  0.32 |
| **Other nature characteristics** |  | | | |
| Landscape heterogeneity | -0.22  (0.22)  -0.97 | -0.22  (0.23)  -0.99 | -0.20  (0.23)  -0.88 | -0.21  (0.23)  -0.91 |
| Topographic heterogeneity | 0.01  (0.01)  0.37 | 0.01  (0.01)  0.41 | 0.01  (0.01)  0.14 | 0.01  (0.01)  0.20 |
| Green space cover | -0.01  (0.01)  -0.24 | -0.01  (0.01)  -0.23 | -0.01  (0.01)  -0.16 | -0.01  (0.01)  -0.16 |
| Blue space cover | -0.01  (0.01)  -0.70 | -0.01  (0.01)  -0.65 | -0.01  (0.01)  -0.60 | -0.01  (0.01)  -0.60 |
| Coastline | -0.02  (0.06)  -0.28 | -0.01  (0.06)  -0.25 | -0.01  (0.06)  -0.12 | -0.01  (0.06)  -0.18 |
| Protected area cover | 0.01  (0.01)  0.74 | 0.01  (0.01)  0.78 | 0.01  (0.01)  0.74 | -0.01  (0.06)  -0.74 |
| **Climate** |  | | | |
| Cooling degree days | 0.01  (0.01)  1.71 | 0.01  (0.01)  1.58 | 0.01  (0.01)  1.60 | 0.01  (0.01)  1.60 |
| **Recreation access** |  | | | |
| Recreation access: great difficulty | Reference group | | | |
| Recreation access: with some difficulty | 0.02  (0.17)  0.13 | 0.02  (0.17)  0.13 | 0.02  (0.17)  0.13 | 0.02  (0.17)  0.13 |
| Recreation access: easily | 0.32  (0.15) 2.13\* | 0.32  (0.15) 2.13\* | 0.32  (0.15) 2.13\* | 0.32  (0.15) 2.13\* |
| Recreation access: very easily | 0.54  (0.15) 3.58\*\*\* | 0.54  (0.15) 3.58\*\*\* | 0.54  (0.15) 3.58\*\*\* | 0.54  (0.15) 3.58\*\*\* |
| Recreation access: service not used | 0.08  (0.15)  0.53 | 0.08  (0.15)  0.53 | 0.08  (0.15)  0.53 | 0.08  (0.15)  0.53 |
|  |  | | | |
| Constant | 3.42  (0.74)  4.64\*\*\* | 3.46  (0.75)  4.63\*\*\* | 3.29  (0.74)  4.43\*\*\* | 3.33  (0.74)  4.48\*\*\* |
|  |  | | | |
| Socio-economic factors | yes | yes | yes | yes |
| Macro-economic factors | yes | yes | yes | yes |
| Country dummies | yes | yes | yes | yes |
| Observations | 26,749 | 26,749 | 26,749 | 26,749 |
| AIC | ﻿109859.20 | ﻿109855.80 | ﻿109861.40 | ﻿109860.70 |
| BIC | 110408.20 | 110408.80 | 110409.40 | 110409.70 |
| LogLik | -54862.58 | -54860.91 | -54863.68 | -54863.35 |
| Adjusted R-squared | 0.2369 | ﻿0.2371 | ﻿0.2369 | 0.2369 |
| AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion | | | | |

**Table S11.** Model results for the ordered logit regressions models with clustered standard errors and different species richness predictor sets (oLogit 1: all mammals, oLogit 2: mammals (no bats), oLogit 3; megafauna >44kg, oLogit 4: megafauna >0.5kg). The ordered logit models contain the mean of the categorical net household income variable (Table S1), socio-economic and macro-economic control variables (see Methods for more details). Shown are coefficients, standard errors in parenthesis, Wald z-scores and p-values as asterisk symbols. Response variable = life-satisfaction. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Predictor variables** | **oLogit 1** | **oLogit 2** | **oLogit 3** | **oLogit 4** |
| **Species richness** |  | | | |
| Bird species richness | 0.004  (0.002) 2.29\* | 0.004  (0.002) 2.54\* | 0.003  (0.002) 1.67 | 0.004  (0.002) 2.09\* |
| Mammal species richness (all) | -0.01  (0.01)  -1.68 | - | - | - |
| Mammal species richness (no bats) | - | -0.02  (0.01)  -3.47\*\* | - | - |
| Megafauna species richness (>44kg) | - | - | -0.002  (0.04)  -0.05 | - |
| Megafauna species richness (>0.5kg) | - | - | - | -0.06  (0.05)  -1.12 |
| Tree species richness | -0.002  (0.005)  -0.47 | 0.003  (0.004)  0.68 | -0.004  (0.01)  -0.08 | -0.001  (0.01)  -0.22 |
| **Other nature characteristics** |  | | | |
| Landscape heterogeneity | -0.14  (0.19)  -0.74 | -0.15  (0.19)  -0.79 | -0.11  (0.19)  -0.60 | -0.13  (0.19)  -0.65 |
| Topographic heterogeneity | 0.01  (0.01)  0.67 | 0.01  (0.01)  0.69 | 0.01  (0.01)  0.21 | 0.01  (0.01)  0.37 |
| Green space cover | -0.01  (0.01)  -0.08 | -0.01  (0.01)  -0.07 | 0.01  (0.01)  0.03 | 0.01  (0.01)  0.04 |
| Blue space cover | -0.01  (0.01)  -0.83 | -0.01  (0.01)  -0.76 | -0.01  (0.01)  -0.69 | -0.01  (0.01)  -0.69 |
| Coastline | 0.03  (0.05)  0.30 | 0.02  (0.05)  0.39 | 0.03  (0.06)  0.52 | 0.02  (0.05)  0.42 |
| Protected area cover | 0.01  (0.01)  0.53 | 0.01  (0.01)  0.49 | 0.01  (0.01)  0.54 | 0.01  (0.01)  0.54 |
| **Climate** |  |  |  |  |
| Cooling degree days | 0.01  (0.01)  1.77 | 0.01  (0.01)  1.51 | 0.01  (0.01)  1.60 | 0.01  (0.01)  1.60 |
| **Recreation access** |  | | | |
| Recreation access: great difficulty | Reference group | | | |
| Recreation access: with some difficulty | -0.04  (0.14)  -0.26 | -0.04  (0.14)  -0.26 | -0.03  (0.14)  -0.25 | -0.03  (0.14)  -0.25 |
| Recreation access: easily | 0.24  (0.13)  1.90 | 0.24  (0.12)  1.91 | 0.24  (0.13)  1.90 | 0.24  (0.13)  1.90 |
| Recreation access: very easily | 0.45  (0.12) 3.58\*\*\* | 0.44  (0.12) 3.58\*\*\* | 0.45  (0.12) 3.57\*\*\* | 0.45  (0.12) 3.58\*\*\* |
| Recreation access: service not used | 0.03  (0.13)  0.21 | 0.03  (0.13)  0.21 | 0.03  (0.13)  0.21 | 0.03  (0.13)  0.21 |
|  |  | | | |
| y >= 2 | -0.84  (0.65)  -1.29 | -0.86  (0.66)  -1.30 | -0.66  (0.65)  -1.01 | -0.71  (0.65)  -1.09 |
| y >= 3 | -0.14  (0.64)  -0.23 | -0.17  (0.65)  -0.26 | -0.03  (0.64)  -0.05 | -0.03  (0.64)  -0.04 |
| y >= 4 | -0.57  (0.64)  -0.90 | -0.55  (0.64)  -0.85 | -0.75  (0.64)  -1.18 | -0.69  (0.64)  -1.09 |
| y >= 5 | -1.10  (0.64)  -1.72 | -1.07  (0.64)  -1.67 | -1.27  (0.64)  -2.00 | -1.21  (0.64)  -1.91 |
| y >= 6 | -2.03  (0.64)  -3.18\*\* | -2.01  (0.64)  -3.10\*\* | -2.21  (0.64)  -3.45\*\* | -2.16  (0.64)  -3.36\*\* |
| y >= 7 | -2.63  (0.64)  -4.10\*\* | -2.61  (0.65)  -4.01\*\* | -2.81  (0.64)  -4.36\*\* | -2.75  (0.64)  -4.27\*\* |
| y >= 8 | -3.52  (0.64)  -5.45\*\*\* | -3.50  (0.65)  -5.35\*\*\* | -3.70  (0.64)  -7.69\*\*\* | -3.64  (0.64)  -5.63\*\*\* |
| y >= 9 | -4.83  (0.64)  -7.44\*\*\* | -4.81  (0.66)  -7.31\*\*\* | -5.99  (0.65)  -7.69\*\*\* | -4.96  (0.64)  -7.61\*\*\* |
| y >= 10 | -5.81  (0.66)  -8.88\*\*\* | -5.79  (0.66)  -8.72\*\*\* | -5.99  (0.65)  -9.12\*\*\* | -5.93  (0.66)  -9.03\*\*\* |
|  |  | | | |
| Socio-economic factors | yes | yes | yes | yes |
| Macro-economic factors | yes | yes | yes | yes |
| Country dummies | yes | yes | yes | yes |
| Observations | 26,749 | 26,749 | 26,749 | 26,749 |
| AIC | 102699.80 | 102694.20 | 102704.30 | 102702.80 |
| BIC | 103306.10 | 103292.40 | 103310.70 | 103309.10 |
| LogLik | -51275.89 | -51274.09 | -51278.17 | -51277.38 |
| Nagelkerke R-squared | 0.24 | 0.24 | 0.24 | 0.24 |
| AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion | | | | |

**Single-taxon models**

Here we present the results for the single-taxon models calculated with ordinary least squares (OLS) and ordered logistic regression models (oLogit). All species richness variables are linear. We only show detailed results for selected predictor variables: species richness, other nature characteristics, climate and access to local recreational areas. Socio-economic variables and other explanatory variables are the same as in the multi-taxon models.

**Table S12.** Model results for the single-taxon OLS regressions with clustered standard errors and a single species richness predictor (OLS 1: birds, OLS 2: all mammals, OLS 3: mammals (no bats), OLS 4; megafauna >44kg, OLS 5: megafauna >0.5kg, OLS 6: trees). The OLS models contain the mean of the categorical net household income variable (Table S1), socio-economic and macro-economic control variables (see Methods for more details). Shown are coefficients, standard errors in parenthesis, t-values and p-values as asterisk symbols. Response variable = life-satisfaction. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Predictor variables** | **OLS 1** | **OLS 2** | **OLS 3** | **OLS 4** | **OLS 5** | **OLS 6** |
| **Species richness** |  | | | | | |
| Bird species richness | 0.004  (0.002)  1.99\* | - | - | - | - | - |
| Mammal species richness (all) | - | 0.001  (0.01)  0.19 | - | - | - | - |
| Mammal species richness  (no bats) | - | - | -0.006  (0.01)  -0.84 | - | - | - |
| Megafauna species richness (>44kg) | - | - | - | 0.03  (0.04)  0.77 | - | - |
| Megafauna species richness (>0.5kg) | - | - | - | - | 0.005  (0.01)  0.49 | - |
| Tree species richness | - | - | - | - | - | 0.004  (0.01)  0.60 |
| **Other nature characteristics** |  | | | | | |
| Landscape heterogeneity | -0.19  (0.22)  -0.85 | -0.22 (0.22)  -1.11 | -0.24  (0.22)  -1.07 | -0.21  (0.22)  -0.98 | -0.22  (0.22)  -0.99 | -0.23  (0.22)  -1.06 |
| Topographic heterogeneity | 0.01 (0.01)  0.11 | 0.01  (0.01) 0.09 | 0.01 (0.01) 0.26 | 0.01 (0.01) 0.06 | 0.01 (0.01)  0.09 | 0.01 (0.01) 0.12 |
| Green space cover | -0.01 (0.01)  -0.17 | -0.01 (0.01)  -0.33 | -0.01 (0.01)  -0.39 | -0.01 (0.01)  -0.35 | -0.01 (0.01)  -0.34 | -0.01 (0.01)  -0.33 |
| Blue space cover | -0.01 (0.01)  -0.64 | -0.01 (0.01)  -0.43 | -0.01 (0.01)  -0.46 | -0.01 (0.01)  -0.48 | -0.01 (0.01)  -0.43 | -0.01 (0.01)  -0.32 |
| Coastline | -0.01 (0.06)  -0.09 | -0.01 (0.06)  -0.02 | -0.01 (0.06)  -0.12 | 0.01 (0.06) 0.11 | -0.01 (0.06)  -0.01 | -0.01 (0.06)  -0.03 |
| Protected area cover | 0.01 (0.01) 0.75 | 0.01 (0.01) 1.22 | 0.01 (0.01) 1.28 | 0.01 (0.01) 1.16 | 0.01 (0.01) 1.20 | 0.01 (0.01) 1.22 |
| **Climate** |  | | | | | |
| Cooling degree days | 0.01 (0.01)  1.63 | 0.01 (0.01) 1.11 | 0.01 (0.01) 1.02 | 0.01 (0.01) 1.17 | 0.01 (0.01) 1.14 | 0.01 (0.01) 1.21 |
| **Recreation access** |  | | | | | |
| Recreation access:  great difficulty | Reference group | | | | | |
| Recreation access:  with some difficulty | 0.02 (0.17) 0.13 | 0.03 (0.17) 0.17 | 0.03 (0.17) 0.17 | 0.03 (0.16) 0.16 | 0.03 (0.17) 0.17 | 0.03 (0.17) 0.17 |
| Recreation access:  easily | 0.32 (0.15) 2.13\* | 0.33 (0.15) 2.16\* | 0.33 (0.15) 2.17\* | 0.33 (0.15) 2.15\* | 0.33  (0.15) 2.16\* | 0.33 (0.15) 2.16\* |
| Recreation access:  very easily | 0.54 (0.15) 3.58\*\*\* | 0.55 (0.15) 3.61\*\*\* | 0.55 (0.15) 3.60\*\*\* | 0.55 (0.15) 3.59\*\*\* | 0.55 (0.15) 3.60\*\*\* | 0.55 (0.15) 3.60\*\*\* |
| Recreation access:  service not used | 0.08 (0.15) 0.53 | 0.08 (0.15) 0.55 | 0.08 (0.15) 0.55 | 0.08 (0.15) 0.54 | 0.08 (0.15) 0.54 | 0.08 (0.15) 0.54 |
|  |  | | | | | |
| Constant | 3.30 (0.75) 4.4\*\*\* | 3.85  (0.68) 5.65\*\*\* | 4.04 (0.69) 5.86\*\*\* | 3.82 (0.69) 5.50\*\*\* | 3.83 (0.68) 5.62\*\*\* | 3.81  (0.65) 5.85\*\*\* |
|  |  | | | | | |
| Socio-economic factors | yes | yes | yes | yes | yes | yes |
| Macro-economic factors | yes | yes | yes | yes | yes | yes |
| Country dummies | yes | yes | yes | yes | yes | yes |
| Observations | 26,749 | 26,749 | 26,749 | 26,749 | 26,749 | 26,749 |
| AIC | ﻿109857.60 | ﻿109868.00 | ﻿109867.10 | ﻿109867.20 | ﻿109867.80 | ﻿109866.60 |
| BIC | 110390.30 | 110400.60 | 110399.70 | 110399.80 | 110400.40 | 110399.30 |
| LogLik | -54863.82 | -54868.99 | -54868.53 | -54868.58 | -54868.88 | -54868.31 |
| Adjusted R-squared | ﻿0.2370 | ﻿0.2367 | 0.23﻿67 | ﻿0.2367 | ﻿0.2367 | ﻿0.2367 |
| AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion | | | | | | |

**Table S13.** Model results for the ordered logit regressions (with clustered standard errors) with only a single species richness predictor (oLogit 1: birds, oLogit 2: all mammals, oLogit 3: mammals (no bats), oLogit 4; megafauna >44kg, oLogit 5: megafauna >0.5kg, oLogit 6: trees). The ordered logit models contain the mean of the categorical net household income variable (Table S1), socio-economic and macro-economic control variables (see Methods for more details). Shown are coefficients, standard errors in parenthesis, Wald z-scores and p-values as asterisk symbols. Response variable = life-satisfaction. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| **Predictor variables** | **oLogit 1** | **oLogit 2** | **oLogit 3** | **oLogit 4** | **oLogit 5** | **oLogit 6** |
| **Species richness** |  | | | | | |
| Bird species richness | 0.003  (0.002) 1.88 | - | - | - | - | - |
| Mammal species richness (all) | - | -0.002  (0.01)  -0.42 | - | - | - | - |
| Mammal species richness  (no bats) | - | - | -0.01  (0.01)  -1.52 | - | - | - |
| Megafauna species richness (>44kg) | - | - | - | 0.03  (0.03) 0.79 | - | - |
| Megafauna species richness (>0.5kg) | - | - | - | - | -0.001 (0.001)  -0.06 | - |
| Tree species richness | - | - | - | - | - | 0.002 (0.01) 0.44 |
| **Other nature characteristics** |  | | | | | |
| Landscape heterogeneity | -0.11  (0.19)  -0.59 | -0.14 (0.19)  -0.78 | -0.16  (0.19)  -0.84 | -0.13 (0.19)  -0.69 | -0.14 (0.19)  -0.74 | -0.15 (0.19)  -0.78 |
| Topographic heterogeneity | 0.01  (0.01) 0.21 | 0.01 (0.01) 0.34 | 0.01 (0.01) 0.51 | 0.01 (0.01) 0.14 | 0.01  (0.01) 0.25 | 0.01  (0.01) 0.23 |
| Green space cover | 0.01 (0.01) 0.03 | -0.01 (0.01)  -0.19 | -0.01 (0.01)  -0.23 | -0.01 (0.01)  -0.14 | -0.01 (0.01)  -0.15 | -0.01 (0.01)  -0.13 |
| Blue space cover | -0.01 (0.01)  -0.70 | -0.01 (0.01)  -0.52 | -0.01 (0.01)  -0.53 | -0.01 (0.01)  -0.53 | -0.01 (0.01)  -0.48 | -0.01 (0.01)  -0.40 |
| Coastline | 0.03 (0.05) 0.56 | 0.03 (0.05) 0.54 | 0.03 (0.05) 0.49 | 0.04 (0.05) 0.73 | 0.03 (0.05) 0.58 | 0.03 (0.05) 0.60 |
| Protected area cover | 0.01 (0.01) 0.55 | 0.01 (0.01) 1.06 | 0.01 (0.01) 1.12 | 0.01 (0.01) 0.95 | 0.01 (0.01) 1.02 | 0.01 (0.01) 1.01 |
| **Climate** |  | | | | | |
| Cooling degree days | 0.01 (0.01) 1.64 | 0.01 (0.01) 1.15 | 0.01 (0.01) 1.03 | 0.01 (0.01) 1.25 | 0.01 (0.01) 1.17 | 0.01 (0.01) 1.24 |
| **Recreation access** |  | | | | | |
| Recreation access:  great difficulty | Reference group | | | | | |
| Recreation access:  with some difficulty | -0.03 (0.14)  -0.25 | -0.03 (0.14)  -0.22 | -0.03 (0.14)  -0.22 | -0.03 (0.14)  -0.23 | -0.03 (0.14)  -0.22 | -0.03 (0.14)  -0.23 |
| Recreation access:  easily | 0.24 (0.13) 1.90 | 0.24 (0.13) 1.93 | 0.24 (0.13) 1.94 | 0.24 (0.13) 1.91 | 0.24 (0.13) 1.93 | 0.24 (0.13) 1.92 |
| Recreation access:  very easily | 0.44 (0.12) 3.57\*\*\* | 0.45 (0.13) 3.60\*\*\* | 0.45 (0.13) 3.60\*\*\* | 0.45  (0.13) 3.58\*\*\* | 0.45 (0.13) 3.59\*\*\* | 0.45 (0.13) 3.59\*\*\* |
| Recreation access:  service not used | 0.03 (0.13)  0.21 | 0.03  (0.13) 0.21 | 0.03 (0.13) 0.22 | 0.03 (0.13) 0.20 | 0.03 (0.13) 0.21 | 0.03 (0.13) 0.21 |
|  |  | | | | | |
| y >= 2 | 0.66  (0.66)  1.00 | 1.23  (0.60)  2.04 | 1.36 (0.59)  2.28 | 1.06 (0.60) 1.77 | 1.14 (0.60) 1.92 | 1.09  (0.57) 1.92 |
| y >= 3 | -0.03  (0.64)  -0.04 | 0.54  (0.59)  0.91 | 0.67 (0.58) 1.12 | 0.37 (0.59) 0.63 | 0.45 (0.58) 0.78 | 0.40 (0.55) 0.72 |
| y >= 4 | -0.75  (0.64)  -1.17 | -0.18  (0.59)  -0.31 | -0.05 (0.58)  -0.08 | -0.34 (0.59)  -0.59 | -0.26 (0.58)  -0.45 | -0.31 (0.55)  -0.57 |
| y >= 5 | -1.27  (0.64)  -1.98 | -0.71  (0.59)  1.20 | -0.57 (0.58)  -0.98 | -0.87 (0.59)  -1.48 | -0.79 (0.58)  -1.35 | -0.84 (0.55)  -1.52 |
| y >= 6 | -2.21  (0.64)  -3.42\*\*\* | -1.64  (0.59)  -2.77\*\* | -1.51 (0.59)  -2.57\*\* | -1.81 (0.59)  -3.05\*\* | -1.72 (0.58)  -2.94\*\* | -1.78 (0.55)  -3.19\*\* |
| y >= 7 | -2.81  (0.65)  -4.33\*\*\* | -2.24  (0.60)  -3.76\*\*\* | -2.11 (0.59)  -3.57\*\*\* | -2.40 (0.60)  -4.04\*\*\* | -2.32 (0.59)  -3.94\*\*\* | -2.37 (0.56)  -4.24\*\*\* |
| y >= 8 | -3.70  (0.65)  -5.67\*\*\* | -3.13  (0.60)  -5.23\*\*\* | -3.00 (0.60)  -5.05\*\*\* | -3.30 (0.60)  -5.50\*\*\* | -3.21 (0.59)  -5.42\*\*\* | -3.27 (0.56)  -5.79\*\*\* |
| y >= 9 | -5.01  (0.65)  -7.64\*\*\* | -4.44  (0.61)  -7.37\*\*\* | -4.31 (0.60)  -7.21\*\*\* | -4.61 (0.60)  -7.63\*\*\* | -4.52 (0.59)  -7.58\*\*\* | -4.58 (0.56)  -8.06\*\*\* |
| y >= 10 | -5.99  (0.66)  -9.06\*\*\* | -5.42  (0.61)  -8.92\*\*\* | -5.29 (0.60)  -8.77\*\*\* | -5.59 (0.61)  -9.17\*\*\* | -5.50 (0.60)  -9.14\*\*\* | -5.56 (0.57)  -9.68\*\*\* |
|  |  | | | | | |
| Socio-economic factors | yes | yes | yes | yes | yes | yes |
| Macro-economic factors | yes | yes | yes | yes | yes | yes |
| Country dummies | yes | yes | yes | yes | yes | yes |
| Observations | 26,749 | 26,749 | 26,749 | 26,749 | 26,749 | 26,749 |
| AIC | 102700.40 | 102707.70 | 102704.90 | 102707.10 | 102708.00 | 102707.50 |
| BIC | 103289.40 | 103297.70 | 103294.90 | 103297.10 | 103298.00 | 103297.50 |
| LogLik | -51278.18 | -51281.86 | -51280.46 | -51281.54 | -51282.02 | -51281.50 |
| Nagelkerke R-squared | 0.249 | 0.248 | 0.249 | 0.248 | 0.248 | 0.248 |
| AIC = Akaike Information Criterion, BIC = Bayesian Information Criterion | | | | | | |

## Comparing EBBA data with recent bird species richness data from Germany and Britain

In our study we use bird distribution data obtained from the European Breeding Bird Atlas (EBBA) (Hagemeijer and Blair, 1997). Since the EBBA data was collected between 1980 and 1990 there exist a larger time gap between the bird species richness estimates and the data obtained from the European Quality of Life Survey (data collected in 2011, see Methods). We argue that this temporal mismatch of the sampling periods should not be a major issue for this study because there have not been any major changes in species richness over time at the spatial scale of this study across Europe and within European countries (e.g. Koleček et al., 2010; Van Turnhout et al., 2007).

To make sure that there were no significant changes in bird species richness over time, which could influence our study results, we conducted additional analyses to test the robustness of our results. For this purpose, we collected data from two more recently published national bird surveys: the British and German breeding bird atlases conducted in the years 2008-2011 and 2005-2009, respectively (Gedeon et al., 2014; Gillings et al., 2019). We took the data from both atlases, which is provided on a 10x10km grid, and calculated bird species richness for all German and British NUTS regions. We did this in two steps - corresponding to the steps we took in our manuscript (see Methods, section 3.3.). In the first step, we overlayed the 10x10km grid with the European 50x50km grid and calculated species richness per 50x50 grid cell. In the second step, we used the newly calculated species richness values from the 50x50 grid to estimated area weighted mean species richness (for details see Methods, section 3.2.1).

We took the new bird species richness values and compared them with the old values (from the EBBA) by performing correlation analyses. The results show that old and new bird species richness values are highly correlated (Fig. S1 A, B). For Germany, we find a correlation of r = 0.81 (t = 8.19, df = 36, p = <0.001), for Britain the coefficient is r = 0.84 (t = 4.90, df = 10, p = <0.001).

To test the robustness of our econometric results, we replaced the old bird species richness values for Germany and Britain in our data set with the newer values (using unique NUTS regions IDs) and repeated our OLS analyses with this new ‘hybrid’ data set. The results show that bird species richness remains significantly positively related to life-satisfaction across Europe (Table S14 & S15) and that our main study results are robust in regard to the time window, in which the bird data have been collected. These results also support our assumption that bird species richness at the large spatial scale of our analysis has not changed to the degree that it impacts our results.

|  |
| --- |
| **A** |
| **B** |
| **Fig. S1:** Correlation plots for bird species richness on NUTS regional level. A: Bird species richness in Germany based on the EBBA (collected in years 1980-1990) is compared to values based on the German Breeding Bird Atlas (collected in years 2005-2009). B: Bird species richness in Great Britain based on the EBBA is compared to values based on the British Breeding Bird Atlas (collected in years 2008-2011).  **Table S14:** This table shows OLS model results based on the original data-set (old) and the hybrid data-set (new). In the hybrid data-set bird species richness values were replaced by new values for Germany and Britain. Here we show results from models including all species richness variables (multi-taxon models). OLS models with based on the old data-set correspond to the results in Supplementary Tables S6. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001. n = 26,749   |  |  |  |  |  |  |  |  |  | | --- | --- | --- | --- | --- | --- | --- | --- | --- | | OLS Models | | Log Bird species richness | Log Mammal species richness (all) | Log Mammal species richness (no bats) | Log Megafauna species richness (>44kg) | Log Megafauna species richness (>0.5kg) | Log Tree species richness | adj. R-squared / AIC | | OLS 1 | old | 0.55  (0.26)  2.12\* | -0.11  (0.11)  -0.97 | - | - | - | -0.01  (0.10)  -0.03 | 0.2369 / 109860.20 | | new | 0.55  (0.26)  2.11\* | -0.10  (0.11)  -0.93 | - | - | - | -0.01  (0.10)  -0.10 | 0.2369 / 109860.70 | | OLS 2 | old | 0.55  (0.25) 2.17\* | - | -0.10  (0.08)  -1.25 | - | - | -0.01  (0.10)  -0.05 | 0.2369 / 109859.60 | | new | 0.55  (0.25) 2.17\* | - | -0.09  (0.07)  -1.23 | - | - | -0.01  (0.10)  -0.12 | ﻿0.2369 / 109860.00 | | OLS 3 | old | 0.57  (0.28) 2.05\* | - | - | -0.07  (0.10)  -0.68 | - | -0.02  (0.10)  -0.12 | 0.2369 /  109860.40 | | new | 0.57  (0.28) 2.06\* | - | - | -0.07  (0.10)  -0.69 | - | -0.02  (0.10)  -0.19 | 0.2369 /  109860.80 | | OLS 4 | old | 0.53  (0.26) 2.06\* | - | - | - | -0.03  (0.05)  -0.57 | -0.02  (0.10)  -0.13 | 0.2369 /  109860.90 | | new | 0.52  (0.26) 2.05\* | - | - | - | -0.02  (0.04)  -0.56 | -0.02  (0.10)  -0.20 | 0.2369 /  109861.30 | |

**Table S15:** This table shows OLS model results based on the original data-set (old) and the hybrid data-set (new). In the hybrid data-set bird species richness values were replaced by new values for Germany and Britain. Here we compare selected results from models including only one species richness variable (single-taxon models) and only one species richness variable (single-taxon models). OLS models with based on the old data-set correspond to the results in Supplementary Tables S8. Asterisks: \* = p<0.05; \*\* = p<0.01; \*\*\* = p<0.001. n = 26,749

|  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- |
| OLS Models | | Log Bird species richness | Log Mammal species richness (all) | Log Mammal species richness (no bats) | Log Megafauna species richness (>44kg) | Log Megafauna species richness (>0.5kg) | Log Tree species richness | adj. R-squared / AIC |
| OLS 1 | old | 0.50  (0.24)  2.07\* | - | - | - | - | - | 0.237 /  109857.20 |
| new | 0.48  (0.23)  2.09\* | - | - | - | - | - | 0.237 /  109857.60 |
| OLS 2 | old | - | 0.03  (0.11)  0.27 | - | - | - | - | 0.2367 /  109867.60 |
| new | - | 0.03  (0.10)  0.27 | - | - | - | - | ﻿0.2367 /  109868.00 |
| OLS 3 | old | - | - | -0.03 (0.07)  -0.35 | - | - | - | 0.2367 /  109868.00 |
| new | - | - | -0.02 (0.06)  -0.34 | - | - | - | 0.2367 /  109868.00 |
| OLS 4 | old | - | - | - | 0.06  (0.08)  0.66 | - | - | 0.2367 /  109867.60 |
| new | - | - | - | 0.05  (0.08)  0.66 | - | - | 0.2367 /  109867.60 |
| OLS 5 | old | - | - | - | - | 0.03  (0.04)  0.70 | - | 0.2367 /  109867.80 |
| new | - | - | - | - | 0.02  (0.06)  0.68 | - | 0.2367 /  109867.80 |
| OLS 6 | old | - | - | - | - | - | 0.07  (0.1)  0.69 | 0.2367 /  109866.70 |
| new | - | - | - | - | - | 0.06  (0.09)  0.68 | 0.2367  109867.70 |

## Literature

Gedeon, K., Grüneberg, C., Mitschke, A., Sudfeldt, C., Eickhorst, W., Fischer, S., Flade, M., Frick, S., Geiersberger, I., Koop, B., Kramer, M., Krüger, T., Roth, N., Ryslav, T., Stübin, S., Sudmann, S.R., Steffens, R., Vökler, F., Witt, K., 2014. Atlas Deutscher Brutvogelarten - Atlas of German Breeding Birds, 1st ed. Stiftung Vogelmonitoring Deutschland & Dachverband Deutscher Avifaunisten (DDA), Münster.

Gillings, S., Balmer, D.E., Caffrey, B.J., Downie, I.S., Gibbons, D.W., Lack, P.C., Reid, J.B., Sharrock, J.T.R., Swann, R.L., Fuller, R.J., 2019. Breeding and wintering bird distributions in Britain and Ireland from citizen science bird atlases. Glob. Ecol. Biogeogr. 28, 866–874. https://doi.org/10.1111/geb.12906

Hagemeijer, W.J.M., Blair, M.J., 1997. The EBCC Atlas of European Breeding Birds - their Distribution and Abundance. T. & A.D. Poyser, London.

Koleček, J., Reif, J., Šťastný, K., Bejček, V., 2010. Changes in bird distribution in a Central European country between 1985-1989 and 2001-2003. J. Ornithol. 151, 923–932. https://doi.org/10.1007/s10336-010-0532-x

Van Turnhout, C.A.M., Foppen, R.P.B., Leuven, R.S.E.W., Siepel, H., Esselink, H., 2007. Scale-dependent homogenization: changes in breeding bird diversity in the Netherlands over a 25-year period. Biol. Conserv. 134, 505–516. https://doi.org/10.1016/j.biocon.2006.09.011