Title: Quantifying trade-offs between ecological gains, economic costs, and landowners’ preferences in boreal mire protection

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Appendix S1

Survey data

Survey concerning citizen landowners’ perceptions of protecting their estates was assigned by Ministry of the Environment after the option for land expropriations was rejected. 10 of 13 provincial Centres for Economic Development, Transport and the Environment (ELY Centres) implemented the survey in spring 2015. It was sent only to the citizen landowners of those candidate mires that were finally planned to be protected ($n=562$, Table S1 and Fig. S1) (Alanen & Aapala 2015), excluding the candidate mires planned to be left outside protection. Therefore, on the territories of 10 ELY Centres about half of the mires ($n=508$) were excluded from the survey. Three northernmost ELY Centres did not implement the survey at all ($n=384$) because of the lack of time and because perceptions of landowners of the southern candidate mires were thought to be the most urgent to ask due to the alarming state of mires’ biodiversity in Southern Finland and their high proportion of private land. 42% of the landowners answered the survey: positive and negative attitudes towards conservation were 47% and 41%, respectively, and 12% were not sure about their opinion (Alanen & Aapala 2015). Protection of sites owned by forestry or peat mining companies or the state of Finland was negotiated between them and the Ministry of the Environment, and the mire-specific results of the negotiations were included to the observed landowners' resistance to protection.

ELY Centres had slightly different practices in implementing the survey and recording answers. Some sent the survey letter to only one landowner per each estate, while others send the letters to all landowners. Some ELY Centres registered answers of a single estate, if at least one of an estate’s owner responded, while others registered answers only when all landowners of an estate had the same perception towards conservation. Due to incoherence, we needed to simplify the observed survey data. We assumed that the number of sent survey letters corresponded to the number of estates per single candidate mire and that each estate had one voice for or against protection.
Hence, the assumed number of estates is probably larger than the real number of estates (Table S2).

In the processed survey data, positive and negative perceptions were 47.7 and 41.2%, respectively (Table S3).
Figure S1. Existing protected mires (blue), candidate mires (yellow), borders of provinces, and numbers indicating regional ELY Centres (see also Table S1). Some of the ELY Centres implemented the landowner survey in several provinces. The Complementary Mire Protection Program (CMPP) did not cover the northern Lapland and Åland Islands in south-west.
**Table S1.** Province-specific information of landowners’ preferences concerning protection of their land in the processed survey data.

| Province                  | Mires included (of which no answers) | Mires excluded | Companies or state owned mires | Observed avg resistance % | Extrapolated avg resistance % |
|---------------------------|--------------------------------------|----------------|-------------------------------|---------------------------|-------------------------------|
| 1. Uusimaa                | 42 (6)                               | 18             | 0                             | 25.1                      | 19.0                          |
| 2. South-West Finland     | 75 (7)                               | 58             | 0                             | 17.9                      | 16.9                          |
| 3. Tavastland             | 45 (3)                               | 36             | 5                             | 18.2                      | 20.0                          |
| 4. South-East Finland     | 52 (7)                               | 33             | 3                             | 20.1                      | 20.9                          |
| 5. Pirkanmaa              | 57 (3)                               | 24             | 4                             | 20.5                      | 23.7                          |
| 6. Central Finland        | 59 (11)                              | 92             | 9                             | 14.3                      | 11.7                          |
| 7. South Savo             | 54 (6)                               | 19             | 3                             | 12.1                      | 17.6                          |
| 8. South Ostrobothnia     | 66 (1)                               | 125            | 1                             | 29.9                      | 30.6                          |
| 9. North Savo             | 56 (2)                               | 27             | 5                             | 16.6                      | 14.3                          |
| 10. North Karelia         | 56 (11)                              | 76             | 11                            | 12.4                      | 12.2                          |
| 11. North Ostrobothnia    | 0 (0)                                | 180            | 0                             | NA                       | 18.4                          |
| 12. Kainuu                | 0 (0)                                | 138            | 34                            | 18.4                      | 18.4                          |
| 13. Lapland               | 0 (0)                                | 66             | 4                             | 18.4                      | 18.4                          |
| **Total**                | **562 (57)**                         | **892**       | **79**                        | **Average**              | **18.7**                     |

* Numbers and names of the provinces corresponds with the map in Fig. S1.

**Table S2.** Distribution of area and estates between different forms of landowning in the processed survey data.

| Landowners                | Citizen landowners | Private companies | State of Finland | Total |
|---------------------------|--------------------|-------------------|------------------|-------|
|                           | Number             | Number            | Number           | Number |
|                           | %                  | %                 | %                | %     |
| Hectares                  | 36 511             | 12 088            | 98 083           | 146 682 |
|                          | 24.9               | 8.2               | 66.9             | 100.0 |
| Estates                   | 5 436              | 193               | 516              | 6 145 |
|                          | 88.5               | 3.1               | 8.4              | 100.0 |

**Table S3.** Number of landowners, number of total answers received from all of the landowners, and number and percent of positive, negative, and unsure perceptions towards conservation in each group of different landowning form.

| Landowners       | Total answers | Positive answers | Negative answers | Unsure answers |
|------------------|---------------|------------------|------------------|----------------|
| Citizen landowners| 5 436         | 2 260            | 1 078            | 932            |
| Private companies| 3 193         | 1 078            | 932              | 932            |
| The state        | 1 516         | 516              | 516              | 516            |

*Numbers and names of the provinces corresponds with the map in Fig. S1.*
Extrapolation of the survey data

Altogether 892 candidate mires were excluded from the survey and the data was deficient for 57 included candidate mires due to lacking survey answers (Table S1). Due to the shortages, we extrapolated citizen respondents’ resistance to protection to cover mires lacking the observed data.

Whether citizen landowners would voluntarily protect their land or resist protection may depend on their relationship to regional advisors and authors (Salomaa et al. 2016). Presumably, landowners living in the same region have more parallel attitudes towards conservation than randomly picked landowners do. Provinces included to the survey had different levels of resistance (Table S1). Therefore, for the mires of such provinces where at least part of the mires were included to the survey (provinces 1–10 in Fig. S1 and Table S1), we extrapolated citizen landowners’ resistance to protection based on the observed survey data. We calculated average resistance for each mire of which we had observed resistance data. For the mires lacking the observed data, we extrapolated the resistance randomly from the resistance distribution of the mires within the province in question. For the provinces that were totally excluded from the survey (provinces 11–13 in Fig. S1 and Table S1), we repeated the same procedure, but used the observed average resistance distribution of all the provinces included to the survey. We did randomization by Shuffle tool of Microsoft Excel 2016.

References

Alanen, A., and Aapala, K. (Eds.). 2015. Proposal of the Mire Conservation Group for supplemental mire conservation. Reports of the Ministry of the Environment 26 | 2015. http://hdl.handle.net/10138/158285 (in Finnish, English summary).

Salomaa, A., Paloniemi, R., Hujala, T., Rantala, S., Arponen, A., and Niemelä, J. 2016. The use of knowledge in evidence-informed voluntary conservation of Finnish forests. Forest Policy and Economics 73: 90–98. https://doi.org/10.1016/j.forpol.2016.09.004
Appendix S2

Correlations in the data

For background knowledge, we tested correlations of the candidate mires' area, price, resistance, and conservation priority using two-way Pearson correlation (Table S1). While preparing the analysis in phases, with respect to the used data and other considerations (see e.g. Kareksela et al. 2013), we also constructed an analysis version with all the presented biodiversity features included, but without connectivity, costs, and resistance considered. We used the rank order of the candidate mires of this analysis version as a variable for conservation priority.

Area and cost of the candidate mires correlated negatively likely because large mires are commonly treeless and therefore their acquire costs are lower than those of small mires (Table S1). Conservation priority and costs of the candidate mires correlated positively. This is intuitive as more fertile mires have higher tree growth, higher species richness, and they consist of more threatened habitat types. Area and conservation priority of the candidate mires correlated negatively, likely because large mires always include both highly and less valuable biodiversity features, so the average conservation value in relation to area is lower on large than on small mires. Landowners' resistance to protection did not correlate with any variable.

Table S1. Correlations between the candidate mires' area, cost, resistance and conservation priority.

| Correlation pairs     | n   | Coefficient | 95% CI       | p-value |
|-----------------------|-----|-------------|--------------|---------|
| Area vs. resistance   | 437 | 0.049       | -0.04, 0.14  | 0.304   |
| Area vs. cost         | 1 533 | -0.266 | -0.31, -0.21 | 0.000   |
| Cost vs. resistance   | 437 | -0.045      | -0.14, 0.05  | 0.347   |
| Biodiversity vs. resistance | 437 | -0.020 | -0.11, 0.07 | 0.683   |
| Biodiversity vs. cost | 1 533 | 0.270 | 0.22, 0.32   | 0.000   |
| Biodiversity vs. area | 1 533 | -0.237 | -0.28, -0.19 | 0.000   |
References

Kareksela, S., Moilanen, A., Tuominen, S., and Kotiaho, J.S. 2013. Use of Inverse Spatial Conservation Prioritization to Avoid Biological Diversity Loss Outside Protected Areas. Conservation Biology 27: 1294-1303. https://doi.org/10.1111/cobi.12146
Appendix S3

Weighing of features on local and national scale (from Kareksela et al. 2020)

Weights for the features inside feature groups (e.g. mire complexes, mire habitats, threatened mosses and vascular plants, birds, streams and bonds) were following the features’ Red List status classifications (Raunio et al. 2008, Rassi et al. 2010) and the between biodiversity feature group importance was defined together with the experts in the working group (Tables S1 and S2). For the features lacking Red List status, the weight was based on their relative importance according to the experts’ opinion. The expert working group comprised 14 stakeholders and experts, including experts of mire ecology, land-use planners, conservation scientists, and representatives of the environmental and forestry administration, the land owner’s association and conservation NGOs.

Table S1. Biodiversity features included in the analysis and their national conservation status, national weights (defined by the experts for the analysis), number of cells and proportion remaining before prioritization after corrected by condition (the ditching level). Condition was applied only to habitat complexes and types. Some of the names for the mire complexes do not have English equivalents.

| Mire habitat complexes                                      | Status | Weight | Number of cells | Proportion remaining before prioritization |
|-------------------------------------------------------------|--------|--------|-----------------|--------------------------------------------|
| northern boreal aapa mires                                 | LC     | 3      | 485 523         | 0.9638317                                  |
| northern boreal sloping fens                               | LC     | 3      | 41 287          | 0.9474729                                  |
| Transition states between the mire complex forms            | -      | 3      | 150 134         | 0.8004229                                  |
| Not identified                                              | -      | 3      | 39 468          | 0.4814771                                  |
| concentric raised bogs                                      | NT     | 6      | 235 750         | 0.8361712                                  |
| plateau raised bogs                                         | NT     | 6      | 1 200           | 0.7496354                                  |
| eccentric raised bogs                                       | VU     | 9      | 150 790         | 0.8783805                                  |
| *Sphagnum fuscum* raised bogs                               | VU     | 9      | 263 120         | 0.8293616                                  |
| middle boreal flark-surfaced aapa mires                     | VU     | 9      | 764 346         | 0.9101144                                  |
| middle boreal sloping fens                                  | VU     | 9      | 15 000          | 0.8454042                                  |
| seasonal wetlands                                           | DD     | 9      | 194             | 0.8811211                                  |
| harjunliesuot                                               | -      | 9      | 1 028           | 0.8722033                                  |
| suppasuut                                                   | -      | 9      | 1 863           | 0.9556830                                  |
| kumpumoreenialuueisiin liittyvat suot                       | -      | 9      | 2 058           | 0.9664723                                  |
| jokimeanderisuot                                            | -      | 9      | 427             | 0.9705796                                  |
| virtavesien rantasuot                                       | -      | 9      | 32 799          | 0.7522600                                  |
| lampien ja jarvien rantasuot                               | -      | 9      | 22 584          | 0.8860648                                  |
| jokiterasuussuot, joki- ja purolaaksojen suot               | -      | 9      | 7 033           | 0.6612576                                  |
| rannikon ja saariston nuoret suot ja soiden kehityssarjat  | -      | 9      | 2 201           | 0.9492276                                  |
| puustoiset pienisuot, erityisesti korvet                     | -      | 9      | 222 629         | 0.8310140                                  |
## Mire habitats

| Mire Type | Code | Number | Percentage |
|-----------|------|--------|------------|
| Hollow bogs | LC | 3 | 1,114,925 | 0.8532036 |
| Flark fens | LC | 3 | 1,781,350 | 0.8228307 |
| Swamp fens | LC | 3 | 1,331,718 | 0.8860366 |
| Ombrotrophic low-sedge bogs | LC | 3 | 1,523,134 | 0.8426581 |
| Minerotrophic low-sedge fens | LC | 3 | 2,449,233 | 0.8588128 |
| Tall-sedge fens | LC | 3 | 2,711,144 | 0.8597798 |
| Sphagnum fuscum | LC | 3 | 2,561,744 | 0.8520335 |
| Dwarf shrub pine bogs | LC | 3 | 2,764,810 | 0.8466886 |
| Eriophorum vaginatum pine bogs | LC | 3 | 2,536,176 | 0.8489997 |
| Ridge-hollow pine bogs | LC | 3 | 1,636,626 | 0.8420008 |
| Tall-sedge pine fens | LC | 3 | 2,687,747 | 0.8536454 |
| Flark pine fens | LC | 3 | 1,939,429 | 0.8552710 |
| Open swamps | LC | 3 | 940,430 | 0.8911394 |
| Sphagnum papillosum fens | NT | 6 | 1,916,682 | 0.8430770 |
| Carex globularis pine mires | NT | 6 | 1,852,450 | 0.8984205 |
| Thin-peated pine mires | NT | 6 | 2,440,882 | 0.9019918 |
| Tall-sedge spruce-birch fens | NT | 6 | 2,212,015 | 0.8675883 |
| Low-sedge pine fens | NT | 6 | 2,603,590 | 0.8574391 |
| Rich flark fens | NT | 6 | 830,654 | 0.9373695 |
| Birch swamps | NT | 6 | 926,213 | 0.8857414 |
| Willow swamps | NT | 6 | 734,389 | 0.8978095 |
| Herb rich sedge fens | VU | 9 | 682,449 | 0.9275569 |
| Spruce-pine fens | VU | 9 | 2,049,689 | 0.8742053 |
| Thin-peated spruce mires | VU | 9 | 2,085,476 | 0.9068562 |
| Thin-peated rich spruce mires | VU | 9 | 900,302 | 0.9244929 |
| Herb-rich spruce mires | VU | 9 | 2,007,528 | 0.8897415 |
| Carex nigra birch fens | VU | 9 | 2,104,097 | 0.8577348 |
| Rich spruce-birch fens | VU | 9 | 558,369 | 0.9205659 |
| Sphagnum papillosum pine fens | VU | 9 | 1,108,069 | 0.8450825 |
| Rich pine fens | VU | 9 | 1,312,442 | 0.9141347 |
| Rich spring fens | VU | 9 | 877,313 | 0.9522184 |
| Rich birch fens | VU | 9 | 284,666 | 0.9539643 |
| Other dwarf shrub spruce mires | VU | 9 | 134,056 | 0.8786442 |
| Equisetum sylvaticum spruce mires | EN | 12 | 1,333,126 | 0.9190212 |
| Eriophorum vaginatum birch fens and Carex nigra birch fens | EN | 12 | 1,073,341 | 0.8759565 |
| Rich swamp fens | EN | 12 | 178,859 | 0.9455089 |
| Rich lawn fens | EN | 12 | 427,740 | 0.9381893 |
| Myrica gale swamps | EN | 12 | 28,659 | 0.9210170 |
| Alnus incana swamps | CR | 15 | 39,746 | 0.9165840 |

## Vascular plant and moss species

| Vascular Plant | Code | Number | Percentage |
|----------------|------|--------|------------|
| LC, otherwise interesting species | - | 1 | 1,002,638 | 1.0000000 |
| NT, RT and DD species | - | 2 | 2,257,702 | 1.0000000 |
| CR, EN and VU species | - | 3 | 2,148,028 | 1.0000000 |

## Birds

| Bird | Code | Number | Percentage |
|------|------|--------|------------|
| Emberiza pusilla | LC | 1 | 419,949 | 1.0000000 |
| Calidris falcinellus | LC | 1 | 645,588 | 1.0000000 |
| Lymnocryptes minimus | LC | 1 | 803,685 | 1.0000000 |
| Numenius arquata | LC | 1 | 3,258,354 | 1.0000000 |
| Numenius phaeopus | LC | 1 | 2,763,938 | 1.0000000 |
| Pluvialis apricaria | LC | 1 | 2,995,380 | 1.0000000 |
| Tringa erythropus | LC | 1 | 897,799 | 1.0000000 |
| Tringa glareola | LC | 1 | 3,439,271 | 1.0000000 |
| Tringa nebularia | LC | 1 | 3,232,344 | 1.0000000 |
| Anser fabalis | NT | 2 | 1,657,656 | 1.0000000 |
| Species            | Status | Code | Population | Proportion |
|--------------------|--------|------|------------|------------|
| Gavia stellata     | NT     | 2    | 1 370 234  | 1.000000   |
| Lagopus lagopus    | NT     | 2    | 2 413 535  | 1.000000   |
| Circus cyaneus     | VU     | 3    | 1 244 000  | 1.000000   |
| Emberiza rustica   | VU     | 3    | 2 728 321  | 1.000000   |
| Falco peregrinus   | VU     | 3    | 1 368 552  | 1.000000   |
| Phalaropus lobatus  | VU     | 3    | 305 567    | 1.000000   |
| Calidris pugnax    | EN     | 4    | 1 100 836  | 1.000000   |
| Streams and ponds  | -      | 1    | 109 477    | 1.000000   |
Table S2. Each biodiversity feature’s local weight in each administrative unit, and a feature’s conservation status, if classified. Conservation status in south Finland covers zones 1–3 and status in north Finland zone 4. NA means that feature in question does not occur in a given area and a dash means that feature in question has not been evaluated or has not been evaluated separately for south and north Finland. Some of the names for the mire complexes do not have English equivalents.

| Habitat complexes | 1a + 1b | 2a | 2b | 3a | 3b | 3c | Status in S Finland | 4a | 4b | Status in N Finland |
|-------------------|---------|----|----|----|----|----|---------------------|----|----|---------------------|
| Transition states | Hemibor.| S  | S  | Middle | Middle | Middle | NT | 6 | 6 | NA |
| Not identified    | 3       | 3  | 3  | 3    | 3    | 3    | NA     | 3  | 3  | LC |
| plateau raised   | 6       | 6  | 6  | 6    | 6    | 6    | NT     | 6  | 6  | NA |
| bogs              |         |    |    |      |      |      |        |    |    |      |
| kalliopainanesuot | 9       | 9  | 9  | 9    | 9    | 9    | -      | 9  | 9  | -      |
| rantavalli- ja dyynikenttien suot | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| vesitönnaskuusot | 9       | 9  | 9  | 9    | 9    | 9    | -      | 9  | 9  | -      |
| pienet avosuot   | 9       | 9  | 9  | 9    | 9    | 9    | -      | 9  | 9  | -      |
| northern boreal  | 3       | 3  | 3  | 3    | 3    | 3    | NA     | 3  | 3  | LC     |
| aapa mires       |         |    |    |      |      |      |        |    |    |      |
| northern boreal  | 3       | 3  | 3  | 3    | 3    | 3    | NA     | 3  | 3  | LC     |
| sloping fens     |         |    |    |      |      |      |        |    |    |      |
| loikkutukisen ulkopuoliset vaihettumat, streched | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | - |
| ei miärretty, streched | 0 | 0 | 0 | 0 | 0 | 0 | - | 0 | 0 | - |
| concentric raised bogs | 6 | 6 | 6 | 6 | 6 | 6 | NT | 6 | 6 | NA |
| plateau raised bogs, streched | 0 | 0 | 0 | 0 | 0 | 0 | NT | 0 | 0 | NA |
| concentric raised bogs | 9 | 9 | 9 | 9 | 9 | 9 | VU | 3 | 3 | LC |
| Sphagnum fuscum | 9       | 9  | 9  | 9    | 9    | 9    | VU     | 3  | 3  | LC     |
| raised bogs      |         |    |    |      |      |      |        |    |    |      |
| middle boreal    | 9       | 9  | 9  | 9    | 9    | 9    | VU     | 6  | 6  | NT     |
| flark-surfaced   |         |    |    |      |      |      |        |    |    |      |
| aapa mires       |         |    |    |      |      |      |        |    |    |      |
| seasonal wetlands| 9       | 9  | 9  | 9    | 9    | 9    | DD     | 9  | 9  | DD    |
| harjunlievesuot  | 9       | 9  | 9  | 9    | 9    | 9    | -      | 9  | 9  | -      |
| suppasuot        | 9       | 9  | 9  | 9    | 9    | 9    | -      | 9  | 9  | -      |
| kumpumoreenialueisiin liittyvat suot | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| jokineanderisuot | 9       | 9  | 9  | 9    | 9    | 9    | -      | 9  | 9  | -      |
| virtavesien rantasuot | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| lampien ja jarven rantasuot | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| jokiterassiuot, joki- ja purolaaksojen suot | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| rannikon ja saariston nuoret suot ja soiden kehityssarjat | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| puoistolaiset pienisuot, erityisesti korvet | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| jetro | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| lahtelaituri, lahtesuot ja muut pohjaviesivaikutteiset suot | 9 | 9 | 9 | 9 | 9 | 9 | - | 9 | 9 | - |
| Habitat Description                                      | Famo | Iuc | Catsu | PA | EN | NT | VU | LC |
|----------------------------------------------------------|------|-----|-------|----|----|----|----|----|
| Middle boreal lawn-surfaced aapa mires                  | 12   | 12  | 12    | 12 | 12 | EN | 12 | NA |
| Mire successional series of the land uplift coast        | 15   | 15  | 15    | 15 | 15 | CR | 15 | NA |
| Hollow bogs                                              | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Flark fens                                               | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Swamp fens                                               | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Ombrotrophic low-sedge bogs                             | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Minerotrophic low-sedge fens                            | 9    | 9   | 9     | 9  | 9  | VU | 3  | 3  |
| Tall-sedge fens                                           | 9    | 9   | 9     | 9  | 9  | VU | 3  | 3  |
| Sphagnum fuscum bogs                                     | 3    | 3   | 3     | 3  | 3  | LC | 3  | 3  |
| Dwarf shrub pine bogs                                    | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Eriophorum vaginatum pine bogs                           | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Ridge-hollow pine bogs                                   | 3    | 3   | 3     | 3  | 3  | LC | 3  | 3  |
| Tall-sedge pine fens                                      | 9    | 9   | 9     | 9  | 9  | VU | 3  | 3  |
| Flark pine fens                                           | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Open swamps                                              | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Sphagnum papillosum fens                                 | 9    | 9   | 9     | 9  | 9  | VU | 3  | 3  |
| Carex globularis pine mires                              | 9    | 9   | 9     | 9  | 9  | VU | 3  | 3  |
| Thin-peated pine mires                                    | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Tall-sedge spruce-birch fens                             | 9    | 9   | 9     | 9  | 9  | VU | 6  | 6  |
| Low-sedge pine fens                                       | 9    | 9   | 9     | 9  | 9  | VU | 6  | 6  |
| Rich flark fens                                           | 15   | 15  | 15    | 15 | 15 | CR | 6  | 6  |
| Birch swamps                                             | 9    | 9   | 9     | 9  | 9  | VU | 3  | 3  |
| Willow swamps                                            | 6    | 6   | 6     | 6  | 6  | NT | 3  | 3  |
| Herb rich sedge fens                                      | 15   | 15  | 15    | 15 | 15 | CR | 6  | 6  |
| Spruce-pine mires                                        | 9    | 9   | 9     | 9  | 9  | VU | 6  | 6  |
| Thin-peated spruce mires                                 | 9    | 9   | 9     | 9  | 9  | VU | 3  | 3  |
| Thin-peated rich spruce mires                            | 12   | 12  | 12    | 12 | 12 | EN | 6  | 6  |
| Herb-rich spruce mires                                    | 12   | 12  | 12    | 12 | 12 | EN | 6  | 6  |
| Other dwarf shrub spruce mires                           | 9    | 9   | 9     | 9  | 9  | VU | 6  | 6  |
| Rich spruce-birch fens                                   | 15   | 15  | 15    | 15 | 15 | CR | 9  | 9  |
| Sphagnum papillosum pine fens                            | 9    | 9   | 9     | 9  | 9  | VU | 6  | 6  |
| Rich pine fens                                            | 15   | 15  | 15    | 15 | 15 | CR | 9  | 9  |
| Rich spring fens                                          | 15   | 15  | 15    | 15 | 15 | CR | 6  | 6  |
| Rich birch fens                                           | 15   | 15  | 15    | 15 | 15 | CR | 6  | 6  |
| Alnus glutinoso swamps                                    | 9    | 9   | 9     | 9  | 9  | VU | 9  | NA |
| Plant and moss species | LC and otherwise interesting species | NT, RT and DD species | CR, EN and VU species | Birds | Streams and ponds |
|------------------------|-------------------------------------|-----------------------|-----------------------|-------|------------------|
| Equisetum sylvaticum spruce mires | 12 12 12 12 12 12 EN 9 9 VU | 15 15 15 15 15 15 CR 12 12 EN | 15 15 15 15 15 15 CR 15 15 NA | Emberiza pusilla | 1 1 1 2 1 1 - 1 1 - |
| Eriophorum vaginatum birch fens and Carex nigra birch fens | 12 12 12 12 12 12 EN/EN 6 6 NT/NA | 15 15 15 15 15 15 CR 12 12 EN | 15 15 15 15 15 15 CR 15 15 NA | Calidris falcinellus | 1 1 1 2 2 2 - 2 2 - |
| rich swamp fens | 12 12 12 12 12 12 EN/EN 6 6 NT/NA | 15 15 15 15 15 15 CR 12 12 EN | 15 15 15 15 15 15 CR 15 15 NA | Lymnocryptes minimus | 1 2 2 2 1 1 - 1 1 - |
| rich lawn fens | 12 12 12 12 12 12 EN/EN 6 6 NT/NA | 15 15 15 15 15 15 CR 12 12 EN | 15 15 15 15 15 15 CR 15 15 NA | Numenius arquata | 2 1 1 1 1 1 - 1 1 - |
| Myrica gale swamps | 12 12 12 12 12 12 EN/EN 6 6 NT/NA | 15 15 15 15 15 15 CR 12 12 EN | 15 15 15 15 15 15 CR 15 15 NA | Numenius phaeopus | 1 2 2 1 1 1 - 1 1 - |
| Alnus incana swamps | 12 12 12 12 12 12 EN/EN 6 6 NT/NA | 15 15 15 15 15 15 CR 12 12 EN | 15 15 15 15 15 15 CR 15 15 NA | Pluvialis apricaria | 1 2 2 1 1 1 - 1 1 - |
| Plant and moss species | 1 1 1 1 1 1 - 1 1 - | 2 2 2 2 2 2 - 2 2 - | 3 3 3 3 3 3 - 3 3 - | Tringa erythropus | 1 1 1 2 2 2 - 2 2 - |
| NT, RT and DD species | 1 1 1 1 1 1 - 1 1 - | 2 2 2 2 2 2 - 2 2 - | 3 3 3 3 3 3 - 3 3 - | Tringa glareola | 2 2 2 1 1 1 - 1 1 - |
| CR, EN and VU species | 3 3 3 3 3 3 - 3 3 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Tringa nebularia | 1 2 1 1 1 1 - 1 1 - |
| Birds | 3 3 3 3 3 3 - 3 3 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Anser fabalis | 2 2 2 2 2 2 - 2 2 - |
| Emberiza pusilla | 1 1 1 2 1 1 - 1 1 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Gavia stellata | 2 2 2 2 2 2 - 2 2 - |
| Calidris falcinellus | 1 1 1 2 2 2 - 2 2 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Lagopus lagopus | 2 2 2 2 2 2 - 2 2 - |
| Lymnocryptes minimus | 1 1 1 2 1 1 - 1 1 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Circus cyaneus | 3 3 3 3 3 3 - 3 3 - |
| Numenius arquata | 2 1 1 1 1 1 - 1 1 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Emberiza rustica | 3 3 3 3 3 3 - 3 3 - |
| Numenius phaeopus | 1 2 2 1 1 1 - 1 1 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Falco peregrinus | 3 3 3 3 3 3 - 3 3 - |
| Pluvialis apricaria | 1 2 2 1 1 1 - 1 1 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Phalaropus lobatus | 3 3 3 3 3 3 - 3 3 - |
| Tringa erythropus | 1 1 1 2 2 2 - 2 2 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Calidris pugnax | 4 4 4 4 4 4 - 4 4 - |
| Tringa glareola | 2 2 2 1 1 1 - 1 1 - | 2 2 2 2 2 2 - 2 2 - | 4 4 4 4 4 4 - 4 4 - | Streams and ponds | 2 2 2 2 2 2 - 1 1 - |
Table S3. Number of cells of each forest vegetation zone and zone-specific weight calculated by dividing number of cells by total number of cells.

| Forest vegetation zone     | Number of cells | Area in hectares | Weight  |
|----------------------------|-----------------|------------------|---------|
| 1a and 1b Hemiboreal       | 27 789          | 6 947            | 0.00748 |
| 2a Southern boreal         | 289 392         | 72 348           | 0.07788 |
| 2b Southern boreal         | 240 993         | 60 248           | 0.06485 |
| 3a Middle boreal           | 1 569 082       | 392 271          | 0.42226 |
| 3b Middle boreal           | 665 969         | 166 492          | 0.17922 |
| 3c Middle boreal           | 205 276         | 51 319           | 0.05524 |
| 4a Northern boreal         | 379 670         | 94 918           | 0.10217 |
| 4b Northern boreal         | 337 742         | 84 436           | 0.09089 |
| Total                      | 3 715 913       | 928 979          | 1.0     |

Some of the considered biodiversity features include significant south to north variation in their rarity and consequently have strongly differing habitat Red List statutes for northern and southern parts of Finland. For example, rich fens are among the most threatened habitats in Southern Finland, but without considering their local rarity in the south, their relatively large northern abundance would have been resulted in lowered rarity-based priority for them throughout the country. To be able to consider both national and local scale rarity and threatenedness of the biodiversity features, the analysis was executed in a way, where national priorities were balanced with local priorities using the administrative units approach (ADMU) (Moilanen and Arponen 2011). The used method calculates the irreplaceability of areas both locally (here forest vegetation zones) and globally (here nationally) and combines this information. The balance between local and global priorities can be adjusted and the analysis iterated accordingly. Consideration of local irreplaceability through the administrative units also leads to a more balanced division of protected areas among the regions. This kind of a more balanced spatial coverage of the protected area network in Finland was also supporting the goals of the CMPP.

The planning area was divided into 9 regions or administrative units according to forest vegetation zones. Using the method required us to calculate relative weights for each administrative unit by dividing each unit’s number of cells by the total number of all units’ cells (Table S3). The weights were used to ensure a balanced solution over the whole planning area (Moilanen et al. 2014). In addition to the national-scale weights of biodiversity features, we gave regional weights for
biodiversity features in each administrative unit according to their regional Red List statuses (Table S1). In the case of features unclassified in the habitat Red List, we used an expert opinion. We verified the balance between regional and national scale rarity of features by iterating the analysis and checking the biodiversity features’ performance curves, which showed that local rarity was affected as planned without overly compromising the national scale performance (i.e. emphasis on nationally threatened habitats and species).

Hierarchical masks

When prioritizing Obligatory and Balancing scenarios, we used a two-phase mask that removed first all the candidate mires and then the existing protected mires (for more information about masks, see e.g. Kremen et al. 2008; Moilanen et al. 2014). When prioritizing Voluntary scenario, we used a three-phase hierarchical mask to force the exclusion of the mires where even a single landowner resisted protection. The mask determined the removal order of the mires: first the resistance-free candidate mires, then the candidate mires having resistance, and finally the existing protected mires.

Effect of resistance in Balancing scenario

When prioritizing Balancing scenario, we included landowners’ resistance to protection as a feature layer, where the cell values were set as zero in the existing protected mires and between 0 and 1 in the candidate mires, according to their resistance proportion. To make the prioritization avoid resisted mires, we set a minus weight for the resistance layer (Moilanen et al. 2011). We iterated the analysis with weights of 0, –20, –50 and –100 for the resistance to investigate the relative differences of different weights and resulting trade-offs. Prioritization curves for resistance showed that using the weight of –100 would have been almost equivalent to the total exclusion of all resisted mires (Fig. S2). Instead, the weight of –50 effectively excluded resisted mires from the top fraction, still allowing valuable biodiversity features located in resisted mires to prevent all the
exclusions. On the other hand, biodiversity representation produced by the weight of −20 differed only little from that produced by the weight of −50, but caused almost double resistance. Therefore, we chose the weight of −50 to serve as a minus weight for the resistance layer in Balancing scenario.

**Figure S2.** Average representation of biodiversity features (green curve), landowners' total resistance (red curve), and costs of conservation (blue curve) for each prioritization testing the effect of different minus weights of resistance to protection. Small dotted lines represent zero weighting, medium dotted lines weight of −20, dash lines weight of −50, and solid lines weight of −100.

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Appendix S4

Figure S3

See below.
Figure S3. Average representation of biodiversity features (%) (green curves), landowners’ resistance to protection (%) (red curves), and costs of protection (million euros) (blue curves) for each conservation scenario. Thick black arrows point out the values produced by Voluntary scenario against which other solutions are compared to. Black solid lines and arrows represent Voluntary scenario, black dotted lines and arrows Balancing scenario, and black dashed lines and arrows Obligatory scenario. a) Feature representation protected is that of Voluntary scenario, i.e. 67.7%. b) Costs for protection are those of Voluntary scenario, i.e. 97.9 million euros. c) Area for protection is that of Voluntary scenario, i.e. 35.3% of the candidate mires’ area. Average feature representation does not reach 100% because the included mire complexes and habitats suffer from decreased condition caused by drainage, expressed by the curves.