The role of ownership in public conservation decisions

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Abstract:

Scholars have studied the problem of optimal reserve-site selection. However, political pressures and other concerns may yield patterns of conservation activity that are far from optimal. This paper uses data on patterns of wetland conservation in Austria in order to ascertain the impact that simple ownership has on government decisions regarding which wetlands to protect. We look for evidence that political pressure from private landowners distorts conservation choices. We also explore the possibility that the difficulties associated with designing a compensation system makes conservation of private lands relatively more expensive, and leads the network of wetland reserves to be biased toward publicly-owned lands. We find that while conservation decisions are at least guided by ecological and cost considerations, there is a marked bias against conserving lands that happen to be privately owned, though that bias is actually attenuated when the private owners are large.

Keywords: wetland, conservation, political economy, ownership

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1 Introduction

In the quest to preserve biodiversity and ecosystem services, nations and international bodies have devoted increasing attention and resources to land conservation programs. Environmental groups have stepped up conservation efforts (e.g. the World Wildlife Fund's "Global 200" initiative) and countries have put in place new conservation policies such as the Wetland Reserve Program in the U.S. and the Natura 2000 program in the European Union.

Conservation is costly, since land preservation requires society to forego disruptive economic activity on protected lands. Scholars (e.g. Ando et al. (1998), Parks, Kramer, and Heimlich (1995), Polasky, Camm, and Garber-Yonts (2001)) have studied the problem of how to choose networks of conservation reserves to minimize the cost of accomplishing a conservation goal (or maximize the conservation benefits that can be attained for a given level of cost). However, as Wu and Boggess (1999) point out in their article on threshold and cumulative effects of conservation activity, political pressures may yield patterns of conservation activity that are far from optimal.

Wetlands are particularly important and productive ecosystems. Thus, we use data on patterns of wetland conservation in order to ascertain the impact that simple ownership has on government decisions regarding which wetlands to protect. We look for evidence that political pressure from private landowners distorts conservation choices. We also explore the possibility that the difficulties associated with designing a compensation system makes conservation of private lands relatively more expensive, and leads the network of wetland reserves to be biased toward publicly-owned lands.

The paper is structured as follows. Section 2 describes the conceptual framework on which the paper rests. Section 3.1 describes the data we use from Austria, and discusses the policy institutions relevant to that conservation milieu. Section 3.2 lays out the models that we estimate. Section 3.3 presents and discusses the empirical results. Section 4 concludes.

2 Framework: Conservation policies and ownership

In Austria, nature conservation policy is in the realm of provincial governments. Thus, each of the nine federal provinces has its own nature conservation act with nevertheless similar regulations. One crucial element of all nine provincial acts is that the reduction of the market value of the property due to conservation policies for the landowner is fully compensated. Contrary to the incentives established by the Endangered Species Act (ESA) in the U.S., there is thus no direct incentive for property owners to consciously deteriorate the ecology quality of the area in order to prevent more stringent regulations regarding the use of the property (Getzner, 2000). This system is not unique among nations; the new Wetland Reserve Program in the U.S., for example, is voluntary and compensates farmers for restoring marginal farmland to wetland status. Our task is to probe the literature on conservation policy for hypotheses regarding likely patterns in wetland conservation choice under such a system.

Analyses of the administration of the ESA (Ando (1999), Weitzman and Metrick (1997)) show that decisions about which species to protect do not reflect scientific considerations alone. Listing decisions are influenced by species charisma and pressure from those who bear the benefits and costs of species protection. Getzner (2002) does find evidence that Austrian wetland decisions are made at least in part on the basis of scientific considerations. However, other non-scientific factors could also be at work.

The question of what objective function policy administrators are trying to maximize dates back, in one form or another, to early work in the political economy literature by Stigler (1971) and Peltzman (1976). In the case of land conservation decisions, administrators could be maximizing the acreage obtained for a given conservation budget if political support for the administrators is tied to their ability to show that a large area of land is being protected. This strategy is not the same as maximizing the conservation benefits that accrue to society from a given level of conservation expenditures, since benefits vary with many features of a parcel of land other than its size. An acreage maximization strategy would reveal itself in the data by a propensity for wetlands to be conserved if they are large and if they are not being used for economic purposes (since such conflict will increase the payment needed to put the land into conservation status.) Such findings might also be expected if decision makers were maximizing total net conservation benefits, since costs play a role in any optimal reserve network design. However, acreage-maximization might distinguish itself by yielding a pattern of conservation in which features of the wetlands other than size do not play significant roles in determining whether lands are chosen to be protected.

Alternatively, administrators may be responding to political pressure from the users and owners of the parcels of land from among which they choose their conservation reserves. The theory of Stigler and Peltzman might imply that large landowners would be more effective in opposing land protection than small landowners because a fragmented group of small landholders may suffer from free-rider problems in the production of political pressure. If private landowners oppose protection of their land because the monetary compensation is inadequate, we might expect to see public lands protected more commonly than private, and land owned by large landowners to be least likely to be protected than land in any other ownership category.

If compensation for "takings" is large enough to forestall such political wrangling, then one reason for bias against protecting private lands is removed. However, it is difficult to design a system of compensation which induces efficient landowner behavior and yet which is not extremely costly (see Innes, Polasky, and Tshirhart (1998) for a review of the literature on this issue). Given the deadweight cost of raising social funds, and the political unpopularity of large expenditures, the result may be that conservation choices are skewed away from private lands towards those held by government agencies. Public lands can be placed into protected status without compensating a landowner who has private information about her preferences and who has development and use incentives which are not aligned with the quest of social well-being. The resulting bias against protecting private lands should not be particularly sensitive to the size of the landowner.

Thus, there are several conceptual reasons for ownership to play a role in the process of selecting parcels of land for conservation. Insufficient compensation will yield political pressure that biases protection towards public lands, and particularly far from lands held by large landowners. Political wrangling is likely to yield other patterns of decisionmaking as well, as political pressure will be higher in regards to parcels with features that lend them relatively high use values. On the other hand, complete compensation will make conservation of all private lands expensive, and lead conservation decision makers to seek out parcels of land that are publicly owned and thus can be protected at lower cost. We turn now to data in order to investigate whether any such patterns are present in Autrian conservation decisions.

3 The role of ownership: empirical analysis

3.1 Descriptive overview of Austrian wetlands

The empirical basis of the current paper is a database of 2,997 Austrian wetlands (basically moors) with the purpose to build the foundations of ecological research on wetlands in Austria (Steiner, 2001). The database includes data on a number of geographic and ecological characteristics such as size of the wetland, elevation above sea level, exact location, wetland type (e.g. covered vs. flow-through wetland), acidity, trophic factor, ecological importance, conservation status and ownership. Only wetlands that are moors (swamps) are included in the database, other wetlands such as lakes, rivers or small creeks, do not count as wetlands in the current context.

The total size of all wetlands included in the database is 26,494 hectares (i.e. 0.3% of the total area of Austria). The geographic dispersion of the wetlands is uneven; most of the wetlands can be found in the Western parts of Austria (federal province (State) of Vorarlberg). *Figure 1* and *Table 1* show the distribution of wetlands in Austrian provinces. Out of 2,997 wetlands, some 1,110 wetlands can be found in Vorarlberg. Measured by the size of the areas, the federal province of Burgenland includes the largest share of wetlands due to the Neusiedler See National Park. If we leave out the Burgenland outlier, the share of wetlands in each province measured by the total area still mirrors the aforementioned distribution.

The ecological attributes of Austrian wetlands are briefly described in *Table 2* and *Table 3*. The most commonly found wetland class are (partially) flow-through wetlands were a small creek or a river feeds the wetland. The second most important type of wetland are wetlands that are fed by rain and do not have a direct inflow. Measured by the size of the area, siltation wetlands (moors) are the most common type in Austria (45%; around 10% without the Neusiedler See National Park), followed by wetlands fed by rain. Regarding the ecological “importance” measured as the uniqueness of the wetland, about 15% of Austrian wetlands are “internationally significant” while the majority are important on a local (32%) or regional (28%) level. Taking into account the area of the wetlands, there is a nearly even distribution (around 10 to 17% of wetlands fall in each category).[1]

Wetlands are protected by regional, national or international law only to a small extent. Most wetlands are not protected by law (82%; 43% measured by the area), while the most significant conservation status are State Parks (7%) and Protected Landscapes (5%). About 4% of wetlands are labeled "Natura 2000" sites according to European legislation on establishing a continent-wide network of areas important for species and ecosystem protection. Only two wetlands are part of a National Park (this concerns wetlands within the Neusiedler See National Park in the federal province of Burgenland). However, as wetlands in Natura 2000 areas[2] or national parks are substantially larger, the share of these categories is higher.

Regarding acidity, each about one third of wetlands are sour, basic and subneutral (with a more uneven distribution regarding the area of wetlands). 27% of wetlands are oligotrophic while the majority of wetlands is mesotrophic (64%). About 9% of wetlands are eutrophic. The natural state is wetland is natural (wilderness) or nearly natural in 43% of all cases, while there is a majority of wetlands that are more or less intensively used or affected by drainage. Regarding potential threats to the ecological integrity of the wetland, only 18% of wetlands do not face current threats. Agricultural and forestry use is the most often established form of potential deterioration. Regarding visitors and tourists, only 5% of wetlands are affected.

Wetlands are private property in 60% of all cases, followed by wetlands owned by the Austrian Federal Forests. (Mostly agricultural) co-operatives own about 15% of the land, while large property owners (4%), other public owners (3%) and the (Catholic) Church (1%) own significantly less areas of wetlands. Measured by the size of the area, private landowners are also the largest group of landowners; however, as the areas of the Neusiedler See National Park are owned by private landowners, the average size and the percent share are distorted by this single wetland.

3.2 The empirical model

We use these data to explore the influence of a number of potentially important variables on the conservation status of wetlands (moors) in Austria. In section two, the literature overview exhibited a number of potentially influential variables besides the influence of ecological attributes, a number of variables explaining the political processes proved to be determining the conservation decision. If the policy makers mirrored the picture of the "benevolent dictator" aiming at the best

[1] Classification and valuation has been done by the Department for Vegetation Ecology and Nature Conservation, University of Vienna.

[2] Natura 2000 conservation sites and other (minor) conservation categories are not exclusive. EU regulations oblige all EU member states to make arrangements for the conservation of sites internationally important for the European network of areas (species, ecosystem and landscape protection). Thus, many areas formerly labeled "State Parks" or "Protected Landscapes" are now protected under the Natura 2000 regulations. However, Natura 2000 includes more stringent conservation and management frameworks.

outcome for society, species and ecosystems should have been protected merely on scientific evidence, for instance, ecological importance, endangerment, and chances for regeneration (economically speaking, the best outcome-cost ratio should be aimed at). However, the literature shows that variables describing elements of the decision process (such as interest group behavior, actual conflicts, charisma of species) provide significant explanatory power to models describing such processes.

Besides the paper by Getzner (2002) cited above, no paper has yet explored the conservation policies on Austrian wetlands from the point of view of political economy. The important extension to the Getzner (2002) paper in the current work is the use of a much more comprehensive database on Austrian wetlands (moors), the inclusion of more ecological variables, and the exploration of the role of ownership in conservation policies. The database used, the "Moorschutzkatalog", or "Catalogue of Moors", (Steiner, 2001) has the main advantage that ownership for 2,997 Austrian moors is declared. Thus, the main questions of the current paper to be answered by econometric analysis are:

1. Besides geographic, ecological and other variables, which role does ownership play in conversation choices?
2. Does conflict with economic activity lower the probability that a wetland will be chosen for conservation?
3. Controlling for factors such as ownership and economic conflict, are conservation choices still correlated in a desirable manner with ecological characteristics of the wetlands?

In order to explore possible answers to these questions, the basic empirical model can be captured by the following equation:

$$\text{Prob}\ (S_i) = \text{f}\ (G_i, E_i, C_i, O_i), \qquad (1)$$

Where the group of dependent variables S_i refer to two variables operationalizing the conservation status (see *Table 5*). The variable PROTECTED? is a dichotomous variable taking the value of '1' if wetland *i* is protected under regional, national or international law. As described above and shown in *Table 2*, 539 Austrian wetlands (around 18%) are protected. The variable PROTECTION TYPE describes the exact conservation status given to a wetland (PROTECTION TYPE take the value of '1' for wetlands including a "natural monument", while '5' stands for "National Parks"). These types of protection have been ordered in increasing rank of restrictiveness.

The dependent variables are grouped into four groups. Variable group G_i includes geographic variables (ELEV and HECTARES). The variable ELEV denotes the elevation above sea level of wetland *i*. Wetland elevation may play both an ecological and a political role in conservation decisions. Wetlands in higher (mountainous) regions are less endangered as the pressure to develop the area or use it for agricultural purposes is smaller. Thus, wetlands in higher regions might be protected to a smaller extent. However, as conflicts between conservation and development policies are more intense in lower regions, protection of wetlands in higher regions is more feasible from a political point of view.

The inclusion of variable HECTARES, denoting the size of the area measured in hectares, again can be justified by ecological and political arguments. Wetlands (moors) that are larger than the average might be more significant and important from an ecological point of view. Species and ecosystem conservation is generally more significant in larger ecosystems than in smaller ones. From an ecological viewpoint, it might consequently be reasonable to concentrate policy efforts on larger systems. However, opposition from interest groups to the protection of larger ecosystems might be larger. Thus, politicians and decision makers might be more reluctant to award a conservation status to large ecosystems as it is easier for them to protect smaller ones.

One might worry about multicollinearity arising due to negative correlation between ELEV and HECTARES, as the size of the area of wetlands is likely to decrease in higher regions. However, the correlation coefficient is only –0.14, indicating no strong correlation between these two variables.

The second group of variables, E_i, comprises a number of variables describing ecological attributes of wetlands (moors). The first two variables describe the wetlands in terms of their ecological importance and significance in an international and national context. INTERNATIONAL denotes wetlands that are ecologically significant in an international comparison, while NATIONAL includes wetlands that are significant in comparison to other Austrian wetlands (nationally important wetlands). All other wetlands such as those which are only regionally or locally important serve as the baseline. If the significance of wetlands in an international or national context is influential in conservation policies, we would expect that both variables exhibit a significant and positive coefficient in the econometric estimations. If politicians use the “international importance” as an argument in the decision process, the coefficient for INTERNATIONAL might be larger as decision makers might use the chance to shift the responsibility of conserving an area to international regulations. For instance, they might state that, in the case of opposition to the protection of a certain area, they would not protect the area or would pose less stringent regulations if they could act freely. However, as there would be international rules, they would not have another option but to protect the area according to the international rules.[3]

The next four variables describe wetlands in terms of their current ecological state. ECOSTATE1 takes the value of ‘1’ for wetlands that are in a natural state (wilderness), while ECOSTATE2 denotes wetlands in a nearly natural state. ECOSTATE3 includes wetlands in a reduced natural state or that are regenerating after a major disturbance (e.g. agricultural use or drainage).

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3 Such argumentation is often heard in Austrian policies. When politicians are reluctant or when they face inner-Austrian opposition, they are likely to blame “European legislation” or just the European capital “Brussels” to be responsible for legislation in order to shift the weight of arguing or enforcing a rule to decision makers outside their “sphere of influence”.

ECOSTATE4 finally describes wetlands that are largely transformed and/or used as pasture. The baseline are wetlands which are deteriorated or significantly affected by development, forestry, land fills, pollution etc. The sign of the coefficients for these variables might go in several directions. Protecting wetlands with a natural state might be easily arguable than wetlands where the ecological quality is deteriorated. Additionally, wetlands that are protected might exhibit an increased natural state (as this is the main aim of conservation policies). On the other hand, for areas where the natural state is not endangered, the need for conservation policies is lower than in areas where the ecology has to be improved. Thus, we might argue for a positive relation between the ecological state of the wetlands as well as for a negative one.

Conservation policies might also be influenced by the type (class) of wetlands. The variable CLASS includes all wetlands which are covered or are arid or swale wetlands (and thus might face more threat due to drainage or resource extraction such as turf than other moors). The baseline includes all wetlands that are water-rich such as flow-through wetlands or wetlands continually fed by springs. The coefficient for the variable CLASS might be hypothesized to be positive as threats to the ecological quality of the area due to drainage and the need for more intensive conservation efforts might be larger.

In order to describe wetlands also regarding their trophic factor and their acidity, two more variables are accounted for. The variable TROPHIC denotes wetlands which are oligotrophic (i.e. they are poor in nutrients) compared to other wetlands which are mesotrophic or eutrophic. The variable ACIDITY accounts for pH-value of the water body, denoting wetlands with a sour pH-value (the baseline are wetlands which are basic or subneutral). For these two variables, there are no a priori hypotheses regarding the sign and significance of the coefficients.

The third group of variables describes threats or conflicts that challenge the ecological integrity of moors in more detail. While the baseline is wetlands without any threat to their ecology, the variable AGRICULTURE denotes wetlands endangered by agricultural use (such as pasture and afforestation). USE accounts for more diverse uses or changing uses and includes a variety of human activities in the agricultural and tourism sector as well as development activities. DRAINAGE denotes wetlands endangered by drainage in and around the area. Regarding the size and sign of the coefficients, we might on the one hand expect a negative coefficient (presumably of significantly different size) mirroring the diverse interests of economic sectors opposing the protection of the area. Furthermore, the ecological quality might be deteriorated and thus, the "worth" of wetland *i* for conservation policies might *ceteris paribus* be lower. However, on the other hand, we might also expect a positive sign as policy makers could aim at preventing wetlands from further deterioration. Regarding arguments of political economy, a negative sign for the aforementioned variables could be interpreted as prevalence of interest group pressure or concern about the economic costs of conservation, while a positive sign might indicate that the dominant force is the increased benefits associated with protecting wetlands that are threatened by economic use.

The final group of variables describes the ownership of the moors in the database. As discussed in section 2 above, ownership might add more explanatory power to a model describing conservation policies. The baseline is the large group of small private property owners in the country (e.g. farmers); three other ownership categories are included.

The (Catholic) Church is one of the largest single property owners in Austria. Regarding the long-term stability of that institution, sustainability and Christian motivation ("Protection of the Creation") might lead to a comparatively higher conservation status (variable CHURCH). However, as companies owned by the Church also pursue market-oriented business policies, the opposite might also be adequate as the Church has strong links to regional policy makers.

The variable FEDERAL denotes wetlands owned by the Austrian Federal Forest and other federal entities; the former is now a company organized according to business rules but owned by the federal government. We can expect that the federal government pursues ecological policies at least on the land that is federal property, and thus the coefficient might be significantly positive. However, also the contrary might be argued as the Austrian Federal Forests are committed to pursue market oriented management policies and might thus face an incentive to exert pressure against conservation policies in order to achieve their business targets. As the Austrian Federal Forests are only organized as a more or less autonomous company from 1997 on, an interest group influence on political decisions regarding conservation policies might not have materialized in the database including also decisions made in the decades before 1997.

The variable PRIVATE_BIG accounts for large private property owners such large estate owners, owners of large areas for hunting and commercial forestry companies. Such owners, using their property commercially, might have a great interest in preventing too stringent regulations regarding the use of their property and thus might be a strong interest group. Politicians might in particular be open to arguments by this interest group as such property owners offer a comparatively great number of jobs in peripheral regions (often the geographic areas where ecologically sensitive and important wetlands are located). Thus, we might expect a negative sign of the coefficient for the variable PRIVATE_BIG.

Alternatively, the expense of takings compensation might yield a bias against all forms of privately-owned moors in the country. Under this scenario, FEDERAL lands should be most commonly preserved, yielding a positive coefficient on that variable and an insignificant coefficient on PRIVATE_BIG.

3.3 Results of econometric estimations

3.3.1 The decision to protect wetlands

The econometric results in **Fehler! Verweisquelle konnte nicht gefunden werden.** refer to explaining the dichotomous variable named PROTECTED? which takes the value of '1' if wetland *i* is protected at all (and '0' otherwise; n=2,997). The estimation presents the equation with the "best" statistical fit based on the available data, using a standard logit model. The first group of variables exhibiting significant explanatory power are the geographical variables (G_i). The coefficient of the variable ELEV (elevation above sea level) is significantly negative; wetlands in higher regions are protected to a lesser extent than wetlands in lower regions. This result indicates that policy makers choose areas to protect that are subject to greater levels of threat (and thus are in greater need of protection), even though the opportunity cost of protecting those wetlands may be higher.

The coefficient for the second geographical variable, HECTARES, is significant and positive. Again, this makes sense from an ecological point of view. Since biodiversity, the size of an ecosystem and the stability of the system are often positively correlated (Patrick, 1997), it is rational to protect larger systems.

Two variables denoting the "importance" of wetlands in different contexts exhibit significant positive coefficients (variable group E_i). Wetlands that are considered to be nationally or internationally important are more likely to be protected than those that are only regionally or locally prominent. However, the coefficient for the variable INTERNATIONAL (for internationally relevant moors) is significantly smaller than the one for the variable NATIONAL (for nationally prominent wetlands) (a Wald coefficient test exhibits a F-statistic of 7.7154 which is significant at the 1% significance level). It is thus fair to say that the ecological prominence of wetlands plays an important role in legally protecting wetlands, but that decision makers apparently are more likely to base their decisions on intra-Austrian arguments than on the significance of areas in an international context.

The current ecological integrity of the areas has also been hypothesized to be influential in conservation policies. While the variable ECOSTATE1 (for wetlands in a wilderness state) does not exhibit significant explanatory power, wetlands in a nearly natural state (variable ECOSTATE2) are protected with a significantly lower probability. It seems that wilderness areas do not need protection in terms of additional ecological management, but they are, however, more likely to be protected than areas in a nearly natural state. Moors in a reduced (deteriorated) natural state or regenerating from intensive use (ECOSTATE3) are significantly more likely to be protected than other ecosystems, perhaps in order to aid the process of regeneration by means of ecological management.

The variable CLASS, denoting wetlands which are more arid (covered, arid or swale wetlands) compared to the baseline, are ceteris paribus more likely to be protected than wetland that are rich in water supply such as flow-through or spring wetlands. As water supply is a crucial ingredient for the functioning of wetland ecosystems, it is thus rational to protect wetlands which might have problems with drying up or drainage. The trophic factor additionally contributes to the explanatory power of the model. Wetlands with a low nutrient supply (oligotrophic moors; variable TROPHIC) are protected to a smaller degree than mesotrophic or eutrophic wetlands.

Five of the conflict variables (C_i) prove to be significant. If the ecological integrity of a wetland is endangered by or is in conflict with agricultural use, general intensification, drainage, landfills or turf extraction, that wetland is less likely to be protected than wetlands whose protection is not in conflict with economic development. This finding could indicate that decision makers are unduly influenced by wetland-user interest groups (such as farmers, who constitute an important group in peripheral areas where most of the wetlands are located). Alternatively, it could reflect a pattern in which decision makers are taking reasonable account of the opportunity costs of conservation in their choice-making processes. As shown in Ando et al. (1998), cost effective reserve-site selection must include cost in the decision-making algorithm.

Finally, the variables denoting ownership (variable group O_i) do exhibit significant influence on the probability of protection. Wetlands are most likely to be protected if they are owned by the Austrian Federal Forests or other federal entities (variable FEDERAL). Among privately owned wetlands, the holdings of small private owners and the Catholic Church are least likely to be chosen for protection. This is the opposite of what we would expect if the bias towards protecting federal lands came from political pressure, which is typically thought to be more effectively wielded by large interests. It may be that decision makers are avoiding expensive compensation to private landowners and are able to negotiate conservation agreements more easily in areas owned by large property owners (variable PRIVATE_BIG). Luzar and Diagne (1999) found that owners of large wetlands were more likely to offer wetlands for enrollment in the U.S. Wetland Reserve Program; similar dynamics could be at work in Austria as well.

Having explored the determinants of the principal decision of whether to protect a moor at all, we now investigate patterns of influence on the stringency of protection afforded these Austrian moors.

3.3.2 The stringency of conservation policies

The (statistically significant) determinants of the stringency of conservation policies are presented in **Fehler! Verweisquelle konnte nicht gefunden werden.**. The dependent variable PROTECTION TYPE is a discrete dependent variable (n=539) denoting the conservation status of wetland *i*. PROTECTION TYPE takes the value of ‘1’ for wetlands within which only a natural monument is protected, and ‘5’ for the most restrictive category of protected area (national parks). The results again are based on the available information in the database, and stem from estimating a standard ordered probit model.

Turning again to the first group of variables, the results are similar to those found in our analysis of whether or not a wetland had been given any protection at all. Wetlands in higher regions are less stringently protected than areas in lower regions, and conservation stringency tends to increase with the size of a wetland. We also continue to find that “importance” plays a sensible role; the stringency of protection is significantly higher in internationally acknowledged areas than in other wetlands (variable INTERNATIONAL). This result maybe driven by the fact that the international “Natura 2000” designation is fairly stringent. Internationally prominent wetlands might thus be protected to a higher extent.

The ecological integrity of the wetland exhibits an interesting pattern. While wilderness areas (ECOSTATE1) tend to be given less binding conservation status than other wetlands (perhaps there is less need for comprehensive management measures), wetlands of deteriorated ecological quality (ECOSTATE4) are more stringently protected (if they are protected at all; see the discussion above in section 3.3.1). It may be that wetlands with reduced ecological quality particularly need the protection status within which extensive ecological management is pursued.

The last ecological variable exhibiting influence is the variable ACIDITY denoting wetlands with a sour water body. Wetlands with such sour water face more stringent regulations than other wetlands. Acidity did not play a significant role in the equation describing the probability that a wetland was protected at all, but it is difficult to know what significance this finding has here.

Conservation status is significantly influenced by conflicts with economic development. The variable AGRICULTURE (denoting extensive agricultural use as a major threat to the ecological integrity of the area) exhibits a similar pattern to the equation presented in **Fehler! Verweisquelle konnte nicht gefunden werden.**. Wetlands in conflict with agriculture are not only protected to lesser extent; their conservation status, if they are protected, is lower than average. However, other categories of economic conflict do not act to depress the expected stringency of wetland protection. In fact, wetlands threatened by landfills tend to fall into relatively strict categories of conservation. Farmers may be particularly adept at exerting pressure to water down the limitations that are placed on the legal use of protected moors.

Finally, the vigor with which moors are protected is influenced by ownership, and in much the same way as we saw in the previous results. Wetlands owned by the Austrian Federal Forests (FEDERAL) and large private landowners tend to fall into relatively strict conservation categories, while lands held by small private interests are subject to the least restrictions.

4 Summary and conclusions

Wetland conservation decisions in Austria seem to be driven by a menu of considerations. First, ecologically considerations play a desirable role in this process. “Important,” ecologically useful, and easily threatened wetlands are more likely to be protected, and garner greater levels of protection once chosen.

However, wetlands are also more likely to be protected if they are not in conflict with economic activity, and wetland protection seems to fall into weaker categories if the land is subject to claims by agricultural interest groups. To some extent, this pattern may reflect reasonable inclusion of opportunity costs into the decision-making process. However, it is not clear that cost considerations, and not sheer political power, can explain the differential influence of the agriculture lobby.

While there is a bias in favor of protecting federal rather than private lands, this does not seem to be driven by standard political maneuvering. In particular, moors owned by large landholders are more likely to be chosen for protection and tend to be placed in more restrictive conservation categories than the wetlands owned by small private entities. It may be that decision makers favor public lands because they can be conserved without costly compensation to private owners, and that administrators are better able to overcome informational asymmetry in the process of bargaining over compensation with large landowners. Alternatively, those who own a great deal of land may simply be more sympathetic to conservation goals and demand smaller payments in exchange for land-use restrictions. This intriguing finding is worthy of further study, perhaps by looking to see if similar patterns appear in the conservation reserves of other nations that do not have similar compensation regimes.

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Figure 1: Geographical distribution of wetlands (moors) in Austria

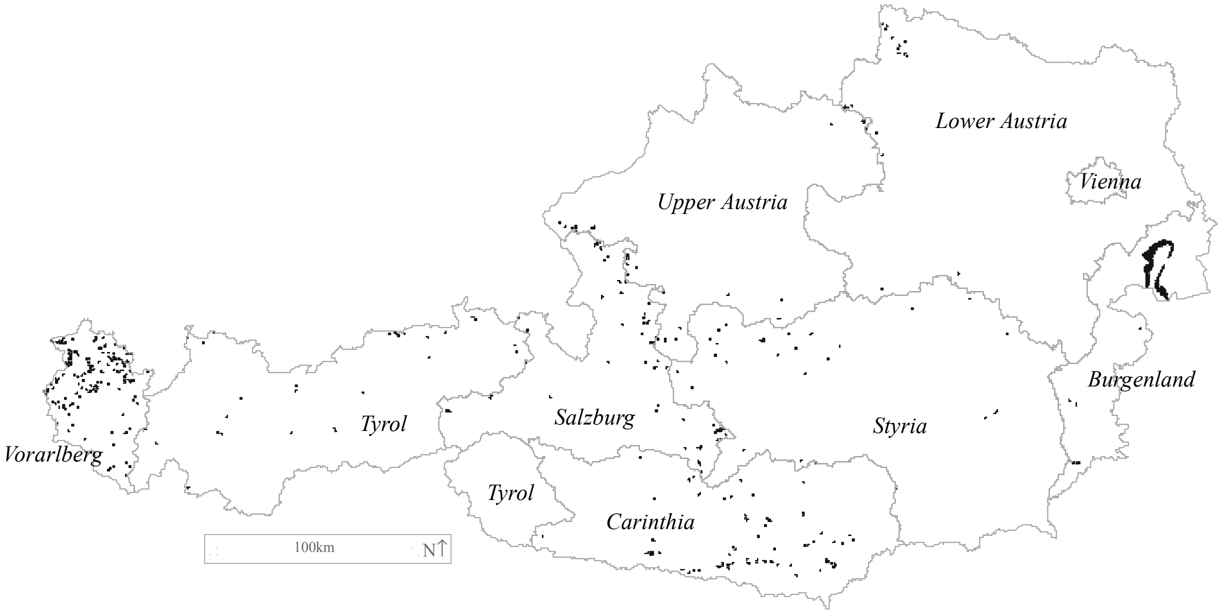

Table 1: Geographic distribution of wetlands (moors) in Austria

Federal province (State)	*No. of wetlands*	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
Vienna	0	0.00%	0	0.00%	0.00
Lower Austria	87	2.90%	748	2.82%	8.59
Burgenland	32	1.07%	9,833	37.12%	307.29
Upper Austria	217	7.24%	1,255	4.74%	5.78
Styria	321	10.71%	1,484	5.60%	4.62
Salzburg	427	14.25%	2,119	8.00%	4.96
Carinthia	354	11.81%	3,166	11.95%	8.94
Tyrol	449	14.98%	1,277	4.82%	2.84
Vorarlberg	1110	37.04%	6,612	24.96%	5.96
Total	2997	100%			

Source: Steiner (2001), authors' calculations.

Table 2: Ecological attributes of wetlands (moors) in Austria, part I

Type of wetland					
	No. of wetlands	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
Siltation wetland	267	8.91%	11,862	44.77%	44.43
Covered wetland	14	0.47%	164	0.62%	11.74
Transient wetland	132	4.40%	679	2.56%	5.14
Condensation water wetland	12	0.40%	30	0.11%	2.47
Marsh wetland	207	6.91%	1,458	5.50%	7.04
Complex wetland	18	0.60%	161	0.61%	8.93
Fed by rain	665	22.19%	3,942	14.88%	5.93
Swale wetland	20	0.67%	40	0.15%	1.99
Partially flow through wetland	805	26.86%	3,052	11.52%	3.79
Spring wetland	109	3.64%	278	1.05%	2.55
Flow through wet-land	483	16.12%	2,389	9.02%	4.95
Flooded wetland	265	8.84%	2,440	9.21%	9.21
Ecological importance of the wetlands on the ... level					
	No. of wetlands	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
local	940	31.36%	3,352	12.65%	3.57
regional	831	27.73%	4,503	17.00%	5.42
provincial	376	12.55%	2,794	10.55%	7.43
national	410	13.68%	2,885	10.89%	7.04
international	440	14.68%	12,960	48.92%	29.45
Most stringent protection					
	No. of wetlands	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
Protected landscape parts (incl. nat. mon.)	43	1.43%	255	0.96%	5.93
Protected landscape	164	5.47%	1,853	6.99%	11.30
State park	218	7.27%	1,877	7.08%	8.61
Natura 2000	112	3.74%	9,320	35.18%	83.21
National park	2	0.07%	1,696	6.40%	847.78
Sum of protected areas	539	17.98%	15,000	56.62%	27.83
No protection	2458	82.02%	11,494	43.38%	4.68
Acidity					
	No. of wetlands	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
basic	900	30.03%	14,786	55.81%	16.43
subneutral	984	32.83%	5,725	21.61%	5.82
sour	1113	37.14%	5,984	22.59%	5.38

Source: Steiner (2001), authors' calculations.

Table 3: Ecological attributes of wetlands (moors) in Austria, part II

Trophic factor					
	No. of wetlands	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
oligotrophic	811	27.06%	4,549	17.17%	5.61
mesotrophic	1917	63.96%	10,428	39.36%	5.44
eutrophic	269	8.98%	11,517	43.47%	42.81
Ecological state of wetland					
	No. of wetlands	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
Natural state, wilderness	229	7.64%	731	2.76%	3.19
Near natural state	1048	34.97%	15,235	57.50%	14.54
Regenerating	27	0.90%	364	1.37%	13.48
Reduced natural state	145	4.84%	1,158	4.37%	7.99
Partially intact	197	6.57%	1,525	5.76%	7.74
Turf partially extracted	44	1.47%	414	1.56%	9.42
Partially afforested	16	0.53%	89	0.34%	5.56
Partially drained	101	3.37%	733	2.77%	7.25
Partially intensive use	714	23.82%	4,068	15.35%	5.70
Pasture	395	13.18%	1,961	7.40%	4.97
Eutrophication	54	1.80%	110	0.41%	2.03
Heathland	20	0.67%	83	0.31%	4.16
Polluted	6	0.20%	19	0.07%	3.09
Buildings in the wetlands	1	0.03%	5	0.02%	4.83
Threats to wetland					
	No. of wetlands	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
None	552	18.42%	2,862	10.80%	5.18
Agricultural use	20	0.67%	138	0.52%	6.89
Afforestation	256	8.54%	1,343	5.07%	5.25
Development area	40	1.33%	341	1.29%	8.52
Waking, visitors	158	5.27%	10,525	39.73%	66.62
Pasture	752	25.09%	3,588	13.54%	4.77
Landfill	20	0.67%	126	0.48%	6.31
Drainage	550	18.35%	2,473	9.33%	4.50
Intensification of use	255	8.51%	1,665	6.29%	6.53
Change of use	233	7.77%	2,176	8.22%	9.34
Turf extraction	45	1.50%	460	1.74%	10.23
Change of adjacent areas	116	3.87%	796	3.00%	6.86

Source: Steiner (2001), authors' calculations.

Table 4: Ownership of Austrian wetlands (moors)

	No. of wetlands	*Percent (n=2,997)*	*Total size of area (in ha)*	*Percent (100%= 26,494 ha)*	*Average size of area (in ha)*
Private	1810	60.39%	20,968	79.14%	11.58
Public land	94	3.14%	524	1.98%	5.58
Church	32	1.07%	242	0.92%	7.59
Property of large owners	124	4.14%	633	2.39%	5.11
Cooperatives	454	15.15%	2,446	9.23%	5.39
Federal Forests	483	16.12%	1,678	6.34%	3.48
Total	2,997	100%	26,494	100%	8.84

Table 5: Dependent and explanatory variables

Dependent variables (S_i)	
PROTECTED?	Conservation of wetlands (=1 if wetland is protected by provincial, national or international rules); n=2,997
PROTECTION TYPE	Conservation status of wetlands that are protected; 5=national park, 4=state park, 3=protected landscape, 2=protected landscape part, 1=natural monument; n=539
Explanatory variables	
Geographic variables (G_i)	
ELEV	Elevation above sea level (natural log, in meters)
HECTARES	Size of the area (in hectares, natural log)
Ecological variables (E_i)	
INTERNATIONAL	=1 if protection and ecology of wetland is important on an international level
NATIONAL	=1 if protection and ecology of wetland is important on a national level
ECOSTATE1	=1 if wetland is in a natural state (wilderness)
ECOSTATE2	=1 if wetland is in a nearly natural state
ECOSTATE3	=1 if wetland is in a reduced natural state or regenerating
ECOSTATE4	=1 if wetland is largely transformed and used as pasture
CLASS	=1 if wetland is a covered, arid or swale wetland (contrary to spring or flow-through wetlands)
TROPHIC	=1 if wetland is an oligotrophic wetland (contrary to mesotrophic or eutrophic wetlands)
ACIDITY	=1 if wetland is sour (contrary to basic or subneutral wetlands)
Conflict variables (C_i)	
AGRICULTURE	=1 if wetland is endangered by agricultural use
USE	=1 if wetland is endangered by intensifying and/or changing use
DRAINAGE	=1 if wetland is endangered by drainage
LANDFILLS	=1 if wetland is endangered by landfills
TURF	=1 if wetland is endangered by turf extraction
Ownership (O_i)	
FEDERAL	=1 if wetland is owned by the Austrian Federal Forests or other Federal entity
PRIVATE_BIG	=1 if wetland is owned by large private property owners
CHURCH	=1 if wetland is property of the (Catholic) Church

Table 6: Determinants of conservation choices in Austrian wetlands

Dependent variable: PROTECTED?		
Independent variables:	Coefficient	z-Statistic
Constant	4.9122	5.0800***
ELEV	–1.0273	–7.4200***
HECTARES	0.2832	5.8948***
INTERNATIONAL	0.7132	4.5844***
NATIONAL	1.1659	8.0032***
ECOSTATE2	–0.4320	–3.3944***
ECOSTATE3	0.4260	2.7024***
CLASS	0.9104	6.2538***
TROPHIC	–0.2864	–1.8893*
AGRICULTURE	–0.5049	–3.8578***
USE	–1.6504	–7.2205***
DRAINAGE	–1.0275	–5.8329***
LANDFILLS	–2.7492	–2.5590**
TURF	–0.6231	–1.7327*
FEDERAL	0.6724	4.9809***
PRIVATE_BIG	0.3852	1.6109*
S.E. of regression	0.3445	
Log likelihood	–1143.7300	
Restr. log likelihood	–1412.0690	
LR statistic (13 df)	536.6765***	
Akaike info criterion	0.7739	
Schwarz criterion	0.8059	
Hannan-Quinn criter.	0.7854	
Avg. log likelihood	–0.3816	
No. of observerations	2,997	

Estimation based on a standard logit model

*** p<0.01, ** p<0.05, * p<0.1.

Table 7: Determinants of intensity of conservation status in Austrian wetlands

Dependent variable: PROTECTION TYPE		
Independent variables:	Coefficient	z-Statistic
ELEV	-0.6346	-5.3082***
HECTARES	0.1312	3.0853***
INTERNATIONAL	0.6593	5.2205***
ECOSTATE1	-0.6449	-3.9173***
ECOSTATE4	0.4909	2.7087***
ACIDITY	0.3232	3.0515***
AGRICULTURE	-0.2761	-1.8970*
LANDFILLS	2.8293	2.0223**
FEDERAL	0.4621	3.9021***
PRIVATE_BIG	0.7210	1.9405*
CHURCH	-0.4033	-1.9018*
Log likelihood	-595.6681	
Restr. log likelihood	-688.3689	
LR statistic (13 df)	185.4016***	
Akaike info criterion	2.2659	
Schwarz criterion	2.3853	
Hannan-Quinn criter.	2.3126	
Avg. log likelihood	-1.1051	
No. of serverations	539	

Estimation based on a standard ordered probit model
*** p<0.01, ** p<0.05, * p<0.1.