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NATURE PROTECTION  
IN AN ECONOMICALLY DEPRESSED REGION

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**Nature protection in an economically depressed region**

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**Abstract**

We look at perspectives of nature protection in a wetland of international importance in South-Western part of Belarus. The region is economically depressed, which may prove to be a factor in local conservation initiatives. A theoretical model is developed to identify conditions for the local population to get involved in the fen mire conservation projects. The model is then verified by means of a choice experiment administered in villages neighbouring the site. The main outcome of the valuation experiments is to demonstrate that a carefully designed conservation programme is likely to enjoy the support of the local population who appreciates economic opportunities provided by saving the wetland.

**Keywords:**

wetlands, biodiversity protection, local development, ecological tourism, choice experiment (CE), random utility model (RUM)

**JEL:**

Q50, Q51

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## Background

The Zvanets fen mire is located in the South-Western part of Belarus, close to the Ukrainian border. The site's total surface is around 16 000 hectares of which 10 460 hectares are currently covered with the protection status of a state biological reserve. Spatial expansion of its protection regime is scheduled for the future.

For centuries the mire served as a pasture for cattle and as a source of biomass harvested by local farmers. As a result of regular harvesting, a unique ecosystem emerged. It has become a wetland of international importance and a habitat for a number of rare species, including aquatic warbler (considered a bird of international importance), corncrake, and greater spotted eagle (Kazulin *et al.*, 2005). In particular, one third of the world population of globally endangered aquatic warbler (*Acrocephalus Paludicola L.*) nests there (APB, 2009). Over the last decades agricultural significance of the site decreased. The cattle do not graze there anymore, and – because of unfavourable natural conditions and contemporary socioeconomic trends – almost nobody is interested in harvesting hay there.

Once triggered by a hydrological conditions' disturbance, the natural succession is likely to cover the wetland with bushes, trees and reeds thus eliminating the open undisturbed space that proved to be a unique habitat for a number of species. Global biodiversity is endangered unless a harvesting management programme is established to prevent the undesirable succession. Nature protection authorities in Belarus, as well as international environmental NGOs are aware of the fact, and they look for opportunities to involve the local population in a prospective protection project.

Annual biomass harvests of 1500 – 2000 hectares of the fen mire (with plots alternating each year, so that each place is harvested every few years) is expected to slow down the expansion of shrubs effectively. However, a vulnerable character of the habitat sets certain constraints upon applicable management practices. Three management scenarios based on the following harvesting techniques have been found matching the site requirements: hand scythe mowing, mechanical mowing and controlled burning of the dry biomass in winter.

Hand scythe mowing is considered the most environmentally friendly way of hay harvesting that does practically no harm to sedge tussocks which serve as an important element of the

landscape and crucial factor of the aquatic warbler breeding success. On the other hand, it is extremely demanding in terms of manpower resources. An additional technique of mechanical mowing was also contemplated, but respondents' answers to our survey proved that it was not given the same consideration as other ones. Both mowing techniques mentioned are inappropriate for use during birds' breeding season that starts in early March and lasts until late July. This fact makes traditional forage hay-mowing in two rounds unapplicable. Biomass harvested in autumn and winter has almost no value as a feedstuff. However it can be used locally as a source of solid fuel, if processed into biomass briquettes using special machinery. The calorific value of biomass briquettes is comparable to this of widely used peat briquettes and the fuel does no harm to locally used ovens.

Controlled burning of dry biomass in winter can imply negative consequences in terms of peat layer mineralisation. Besides, nutrients remain within the ecosystem to provoke an undesirable succession to follow. Energy resources of the biomass would be lost in this case as well.

Being one of the Europe's biggest intact fen mires, Zvanets is a natural attraction for both Belarusian and foreign birdwatchers. Open-space dependent aquatic warbler definitely plays a role of a flagship species here. Incomes derived from tourists' accommodation are gradually becoming a more noticeable factor in the local population welfare. Economic incentives for local people to contribute to conservation management programmes thus may emerge.

Unlike in many studies aimed at 'ecological tourism', here the problem is not to analyze substitution between conservation measures and development (e.g. commercial agriculture) options (Wossink and Swinton 2007; Börner *et al.* 2007). The local population cannot easily intensify the agricultural production, so nature protection does not conflict with any realistic development aspirations. Neither the central government has sufficient resources to drain the wetland and put it into an industrial use. The policy dilemma is whether to do nothing and face the destruction of the fen mire or to mobilize local resources in order to preserve the natural capital and earn a dividend. It is not sufficient to determine that the latter option is closer to the social optimum than the former. The contribution of this paper is to demonstrate how such a local mobilization can be achieved.

We do not make a feasibility study of investing in tourist infrastructure. There were analyses of how local revenues may depend on a specific type of tourism, with, say, backpackers offering higher returns than campers (Becken and Simmons 2008). Decisions faced by stakeholders seem to be much more fundamental at this stage. If the conservation option gains momentum, then the agenda will be broadened to include technical and logistical questions. For the time being, however, it is sufficient to simply acknowledge that households can benefit from preservation, in principle.

## **The model**

We look at a mechanism to let the local population maximize their welfare by contributing to the protection of the site. In a typical setting, one assumes that rationally behaving agents maximize their utility over a set of feasible alternatives. Assuming further that the utility is a concave function of its variables, one derives First Order Conditions that are to be satisfied for an interior solution.

The problem at hand, however, does not seem to fit that typical setting. There is no question of saving the wetland 'partially'. Its value is in preserving the unique habitat entirely, or letting it be irreversibly lost. Thus, instead of assuming that the utility is a differentiable function of some policy variables, and calculating First Order Conditions, it is more natural to assume that the local population faces a dichotomous choice. It can either let the wetland be lost, or let it exist and derive some advantages. The choice is to identify a variant that yields higher benefits net of costs.

In our model we assume that the utility enjoyed by a local household is the sum of income derived from selling labour,  $L$ , savings on fuel purchases,  $F$ , and hosting ecological tourists,  $T$ . There are two positions that the household can be found in: (1) with the wetland preserved, and (2) with the wetland lost. Let us denote its income in either case:

$$U_1 = L_1 + F_1 + T_1, \text{ and}$$

$$U_2 = L_2 + F_2 + T_2, \text{ respectively.}$$

Furthermore, we can assume that  $F_2 = T_2 = 0$ . The preservation variant is more attractive than letting the wetland disappear, if  $U_1 - U_2 > 0$ . In other words, if  $\Delta L + F_1 + T_1 > 0$ , where  $\Delta L = L_1 - L_2$ ,

or – alternatively  $-L_2-L_1 < F_1+T_1$ .

While  $F_1$  and  $T_1$  are obviously positive numbers, it is conceivable that  $\Delta L$  is negative (i.e.  $L_1 < L_2$ ). The latter means that people may choose to be hired for harvests at the rate lower than for alternative settings. However, in Belarus, there is a system of social security which may reduce incentives for seeking employment. More importantly, other characteristics of economically depressed rural areas may work in the same direction. Additionally, some people may place a high value on their leisure or other not strictly commercial activities which makes the condition

$$L_2-L_1 < F_1+T_1$$

far from trivial.

It is also possible that some people may free ride on the activities of others, since  $T_1$  does not depend on their own choices, but rather on choices of other inhabitants who prefer to save the wetland. Once the protection regime is successful, also those who did not contribute to it, may enjoy the increased tourist attractiveness of their area. The nature of benefits from inexpensive fuels (biomass briquettes) is a bit more complicated. It is conceivable that only those who cooperate in harvesting are allowed to buy such briquettes and hence to benefit from their low price. Nevertheless – given the complicated system of fuel rebates in Belarus – it would be administratively cumbersome to make sure that indeed households who do not cooperate are deprived of this opportunity. Therefore it is difficult to *a priori* judge if the savings  $F_1$  are private or public.

## Survey

A questionnaire was designed to estimate the minimum compensation for participating in the scythe mowing program that is aimed to protect the fen mire from the succession of trees and bushes. For this purpose a simple choice experiment was prepared. The valuation exercise was composed of four alternatives: scythe mowing, mechanical mowing, burning and status quo (SQ) situation. Respondents were asked to rank all alternatives. Two attributes were used to describe the mowing alternative: area mowed and remuneration offered. The burning alternative was described only by area, there was no remuneration offered for this alternative. One reason for this was that controlled burning can be performed by the nature reserve staff;

no extra labour is needed. However, an even more important reason was to convey the message that – contrary to the scythe and mechanical mowing – this alternative does not provide the local residents with direct earnings.

Table 1. Attributes and levels used in the exercise

	Scythe Mowing	Mechanical Mow.	Burning	SQ
Area, hectares	2, 3, 4, 5	200, 400, 600, 800	200,400, 600, 800	0
Remuneration rate, 1000BYR/ha	30, 70, 110, 150	0.4, 0.8, 1.2 , 1.6	0	0
Rank (1,2,3,4)				

The questionnaire contained three parts. The first one described ecological importance of stopping the succession of trees and bushes at the mire. A special emphasis was placed on the importance of protecting the current habitat for the population of rare bird species. This was made in the context of aquatic warbler, a species that is endangered and the survival of which is strongly linked to protecting fen mires in Palesie. The central part of the questionnaire contained a contingent ranking exercise. The final part had some debriefing questions and collected various socio-demographic characteristics of respondents. Table 1 presents the attributes and levels finally used in the questionnaire.

An orthogonal experimental design was used to structure choice sets. The final experimental design consisted of 16 pairs of program alternatives. The 16 pairs were grouped into 4 blocks of 4 choice sets of three labelled program alternatives: Scythe mowing, Mechanical mowing, and Burning. The status quo option was always included to form the choice sets.

### **Data and econometric model**

The questionnaire was administered to a sample of the local population of the Zvanets Mire area. Personal interviews were conducted in respondents' houses. The four versions of the CE questionnaire were randomly assigned to the total sample of 140 individuals who represented their respective households. The average participation rate in the CR was 95 per cent (i.e. the refusal rate was 5%). Data collected from 134 respondents were used in the modelling. Table 2 presents the basic socio-demographic characteristics of the sampled population.

Table 2. Socio-demographics

Variable	
Average age	51 years
Males	69%
Households hosting tourists	18%

As revealed by comments made to interviewers, many households did not consider mechanical mowing as a feasible option, because of the lack of adequate skills, certificates etc. In principle, everybody could have chosen this option irrespective of their personal predicament, since it is theoretically possible to hire a substitute, pay a market rate, benefit from the conservation (in terms of tourists and/or fuel), and still enjoy an economic surplus. Actually, however, respondents did not consider such an alternative unless they personally could operate a mechanical harvester. Having realized this, we decided to eliminate the mechanical harvest option from further modelling.

In a CE (*Choice Experiment*) exercise individuals are asked to identify their preferred choice  $i$  among a given set of  $J$  alternatives. The data analysis follows a RUM (*Random Utility*) model (McFadden, 1974). Under RUM, it is assumed that the observed choice from an individual  $n$  is the one she expected to provide her with the highest utility. Her utility function,  $U_{ni}$ , can be decomposed into a systematic part,  $V_{ni}$ , and a stochastic part,  $\varepsilon_{ni}$ , such that:

$$U_{ni} = V_{ni} + \varepsilon_{ni}$$

The probability  $P_{ni}$  that individual  $n$  chooses alternative  $i$  instead of another alternative  $j$  of the choice set is:

$$P_{ni} = \Pr(V_{ni} + \varepsilon_{ni} > V_{nj} + \varepsilon_{nj} \forall j \neq i).$$

If  $\varepsilon_{nj}$  is assumed to be independently and identically distributed extreme value type I, this probability has a closed form expression,

$$P_{ik} = \frac{e^{\beta'x_{ni}}}{\sum_j e^{\beta'x_{nj}}} .[1]$$

where  $x$  is a vector of variables and  $\beta$  – a vector of parameters. The expression [1] is often referred to as a logit choice probability function.

Under the assumptions applicable to the standard logit model, the probability of any ranking of the alternatives from best to worst can be expressed as the product of logit formulae (Train,



2003). For example, if a respondent was presented with four alternatives labeled A, B, C and D then Prob(ranking C, B, D, A) can be expressed as:

$$P_{(Ranking C, B, D, A)} = \frac{e^{\beta'_{AC}}}{\sum_{j=A, B, C, D} e^{\beta'_{Aj}}} \frac{e^{\beta'_{AB}}}{\sum_{j=A, B, D} e^{\beta'_{Aj}}} \frac{e^{\beta'_{AD}}}{\sum_{j=A, D} e^{\beta'_{Aj}}}$$

## Results and discussion

The data collected did not allow for a strict verification of the condition  $L_2 - L_1 < F_1 + T_1$ , as it proved impossible to quantify its right hand side. Nevertheless we developed several tests to verify two related hypotheses.

***(i) All households who consistently ranked burning alternative before the Status Quo situation (SQ) expect rates lower than market ones.***

We assume that ranking burning alternative before the SQ situation indicates households which care about protecting the wetland. They derive extra utility from the fact that the wetland is protected and are expected to require lower compensation for mowing than other households. Apart from selling labour, they derive additional benefits from the mire protection which can either be in the form of additional income due to hosting 'ecological' tourists or might be simply related to the non-use value e.g. existence value.

To test hypothesis (i), households in the sample were divided in two groups:

- Those who for all choices ranked burning alternative before SQ and thus apparently demonstrated their concern about Zvanets.
- Remaining households, most of which were households that systematically ranked SQ before burning. There were, however, few households unstable in their preferences, that in some choice-sets ranked burning before SQ and preferred SQ over burning in the remaining choice sets.

A general model in which two sets of separate coefficients were assumed was tested in the beginning. Because the alternatives were specific, all estimated coefficients are alternative-

specific. The coefficients by *area* in the mowing and burning alternatives were found to be statistically not different from zero for the two groups and were restricted to be equal in the final model. As far as socioeconomic variables are concerned, gender and age were included into the model, but none of these variables turned out to be statistically significant. Most of the respondents did not report their incomes, and therefore this variable was not included in any of the models.

Restricting coefficients by area and removing 'socioeconomics' had a small impact on the fit of the model. The likelihood ratio test statistic was 5.54, whereas the critical value is  $\chi_{0.05; 4} = 9.48$ .

On this ground, the null hypothesis that coefficients by area are equal between the two groups and that socioeconomic parameters are jointly equal to zero could not be rejected.

The alternative specific constants (ASC) of the mowing alternative have been found to be negative for the two groups. However, only for the households that placed SQ before burning the coefficient was statistically different from zero. Coefficients by remuneration are positive and highly significant for both groups. The ranking results are reported in table 3.

Table 3. Ranking result

<b>Burning before SQ</b>	
ASC-mowing	-.01332 (.4357)
Remuneration	.1484D-04*** (.2645D-05)
ASC-burning	2.9033*** (.3068)
<b>Other</b>	
ASC-mowing	-4.7401*** (.5301)
Remuneration	.3892D-04*** (.3690D-05)
ASC-burning	-3.4088*** (.3493)
<b>Joint coefficients</b>	

Area-mowing	.09518 (.07719)
Area-burning	.000209 (.000490)
Log-likelihood	-515.644
n	134

Based on these results, minimum remunerations for both groups were calculated and are reported in table 4. Minimum remuneration for the group supporting protection (those who placed burning before SQ) is equal to 900 BYR and is statistically not different from zero. The minimum remuneration for the second group is 122,700 BYR which is close to the market rate.

Table 4. **Minimum remuneration**

	Minimum remuneration Mean (std error) [95% confidence interval]
Burning before SQ	897.43 (29270.42) [ -58266; 56472]
Other	121772.03*** (9105.23) [ 103926; 139617]

Standard errors were approximated by the use of the delta method (Greene, 2003).

*(ii) Households who plan to earn income by hosting 'ecological' tourists are willing to participate in hay harvests requiring rates lower than those who do not plan to host such tourists.*

Similarly like in the previous case, a general model, in which two sets of separate coefficients – for households which host and do not host 'ecological tourists, respectively – was tested in the beginning. Like in the previous model, the socioeconomics were found to be statistically insignificant, and were removed from the model. The coefficient by *area* was found to be statistically different from zero for the burning alternative and not significant for the mowing

alternative. ASCs for the mowing alternative have been found to be negative and statistically different from zero for both groups. Coefficients by remuneration are positive and highly significant for the two groups. The ranking results are reported in table 5.

Table 5. Ranking results

<b>No Tourists</b>	
ASC-mowing	-1.1051*** .3439
Remuneration	.124D-04*** .1741D-05
ASC-burning	.06139 .18663
Area-burning	-.0004112 .0003399
<b>Tourists</b>	
ASC-mowing	-1.8766*** .6316
Remuneration	.588D-04*** .9813D-05
ASC-burning	.8589 (.6485)
Area-burning	.005532*** .0009339
<b>Joint coefficients</b>	
Area-mowing	.06068 .06516
Log-likelihood	-866.32
n	134

The results for burning alternative are less obvious than those for the mowing alternative. The ASCs are not statistically different from zero for the two groups, but the coefficient by *area* for the households that host tourists has been found positive and highly significant. This

indicates that unlike in the households which do not host tourists, households that do host 'ecological' tourists, on average derive positive utility from the controlled burning program. Within the area range used in this exercise, the utility of burning alternative is positive and statistically different from zero for this group.

To verify (ii) the following form of the hypothesis was tested:

$H_0$ : Remuneration (No tourists) = Remuneration (Hosts tourists)

$H_1$ : Remuneration (No tourists)  $\neq$  Remuneration (Hosts tourists).

The test statistics is equal to 2.18 whereas the critical value is equal  $t_{0,05;126}=1.98$ .

Given the test statistics, the null hypothesis:

Remuneration (No tourists) = Remuneration (Hosts tourists)

is rejected against the alternative hypothesis:

Remuneration (No tourists)  $\neq$  Remuneration (Hosts tourists)

at the 0.05 level.

Based on these estimates, minimum remuneration for the scythe mowing alternative has been estimated. The estimated minimal remunerations or WTA are reported in table 6.

Table 6. **Minimum remuneration**

	Minimum remuneration Mean (Standard error) [90% confidence interval]
No tourists	89050.40*** (24902.63) [48210; 129889]
Host tourists	31901.73*** (7976.42) [18820; 44981]

As before, standard errors were approximated by the use of the delta method.

The mean acceptable rate for households that ranked burning before SQ is statistically not different from zero and is equal to 897 BYR per ha, i.e. 0.21 EUR per ha. On the other hand, households that ranked SQ before burning require remuneration of almost 122,000 BYR per ha i.e. 29.67 EUR per ha which is comparable with the market one, even though the latter is a rather vague concept, as there are hardly any scythe mowing activities at the mire now. This makes the hypothesis (i) impossible to reject. The results obtained indicate that households which revealed interest in preserving the wetland (ranked burning before SQ) require statistically lower compensation for mowing than other households. The 95% confidence intervals for the two groups do not overlap. More than 50% (52.5%) of the households in the sample ranked burning alternative before SQ option. This indicates that more than half of the sample supports (at least passively) conservation of the wetland.

At the same time, there is also a difference in rates expected by households who plan to host 'ecological' tourists; their average rate is 2.85 times lower than for other households. Therefore hypothesis (ii) cannot be rejected, unless one requires a lower than 0.03 p-values.

The comparison of coefficients by burning between these two groups when testing hypothesis (ii) gives some interesting insights. ASCs are not significant for both groups; however the coefficient by Area-burning is significant at 0.01 level for households that host tourists while it is insignificant for others. This means that within the ranges of Area used in the questionnaire (200-800 ha) the burning alternative provides positive utility for households that host tourists and provides negative utility (however statistically insignificant) for other households. This means that households which host tourists do not just require much lower compensation but also on average prefer burning to SQ situation – i.e. prefer the wetland to be saved.

Less than 30% (29.7 %) of respondents chose the *status quo* as the preferred option. While the survey does not allow to indicate whether the majority (who did not choose the *status quo*) were motivated by the positive  $F_1+T_1$  or by the value placed on nature protection, the bottom line is that there is (at least passive) support for the conservation. Likewise, burning was selected as the preferred option 1.28 times more frequently than the *status quo*. Like other possible research hypotheses, this suggests that respondents look favourably at the conservation project. It is also consistent with the finding that only 10 % indicated that they

would be willing to participate in the project to drain the wetland rather than to save it. These results, however, cannot be proved rigorously on the grounds of the CE model.

Additional hypotheses taking into account fuel savings cannot be verified, since – as expected – respondents do not seem to pay much attention to the availability of energy carriers. Energy prices in Belarus are relatively low, and the government policy is to assist people in meeting their energy demand. Besides at least a part of the local population, according to respondents, meet their energy demand by logging shrubs at the mire. Even though this is formally forbidden, in fact it does contribute to preserving open space ecosystems. This fact may also have contributed to respondents' apparent lack of interest in cheap energy supply provided by biomass briquettes.

## **Conclusions and policy recommendations**

The results of our study point at several conclusions. First, the local population seems to be aware of the uniqueness of the Zvanets fen mire; people seem to be proud of their natural heritage. Second, the respondents have understood the predicament and the need for active protection measures called for. Third, they are willing to pay for, and co-operate towards, the protection which, in turn, opens a possibility for improved livelihoods due to the growing interest in the protected habitat. Fourth, there are numerous obstacles disturbing an otherwise obvious 'win-win' strategy.

Belarus is a former centrally planned economy which retained much of a peculiar social philosophy of welfare state. Therefore many of its citizens expect that the state is responsible for their subsistence and often reveal little interest for opportunities of optimizing behaviour. An example of such an attitude was low interest in the supply of an inexpensive fuel. On the other hand, among our respondents, those who had some previous experience with hosting 'ecological' tourists revealed a very much different attitude towards the protection (manifesting in significantly lower earnings expected from hay harvests). This proves that respondents are responsive to stimuli emerging from development patterns built on the natural capital preserved.

One policy recommendation implied by our study is that in protecting the valuable habitat in an economically depressed region environmentalists and/or authorities can rely on the local population support, as revealed in some earlier studies (Zylicz, 2000). If properly designed, a protection programme will improve rather than impede the local development opportunities. To some degree this conclusion depends on the fact that the region does not have alternative attractive employment options. Therefore people clearly see that protection does not deprive them of anything. On the contrary, it offers perspectives for earnings from the mowing programme, and – perhaps not very convincingly – for an additional benefit from increased attractiveness for tourists (although the benefits may flow to a very narrow group of residents – see e.g. Schellhorn, 2010). To appreciate the latter, it is crucial that respondents have some prior experience with hosting tourists. This helps to convince them about the value of preserving the natural heritage.

The protection of the fen mire can thus be initiated by authorities and NGOs with relatively modest subsidies for the mowing programme. However, in order to win a popular support for the idea, it would be wise to invest in developing a tourist infrastructure and to undertake an outreach effort to attract environmentally-motivated visitors.



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