Optimal pricing of recreation in the Czech protected areas

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With growing number of visitors in wilderness areas, the burden on touristic infrastructure increases together with the nature protection expenses. The management of protected areas is not able to fully cover these costs and their economy is partially or completely dependent on state subsidies. The pricing of recreation is one of the options how to manage the number of visitors entering the protected area, and how to enhance the budgetary self-sufficiency of the protected areas.

The contribution presents the model of the optimal entrance fees and potential revenues for the system of landscape protected areas and national parks in the Czech Republic. The model was transformed into a parametrized software tool available to the managements of Czech protected areas.

The optimization software tool

The economic model enables to set the optimal fee for three different forms of pricing, two direct forms of pricing (charging the fee for the entrance to small protected areas - e.g. natural monuments, nature reserves; and large protected areas - national parks and landscape protected areas) and one indirect form (parking fees). The pilot area for the model is the Šumava National Park, but the model was designed and is utilizable also for other Czech protected areas.

Methodology of the software tool

Optimal prices are derived by maximizing the objective social welfare function, which represents social benefits of visitors from the consumption of recreational services in a particular protected area. The optimization problem is set as a maximization of the sum of recreational benefits, revenues collected from entrance fees, positive spillover effect from tourism on local economy, while deducting variable costs and investments to tourist infrastructure and negative ecological impacts associated with tourism.

The optimization is based on the Lagrangean method (Alpízar, 2006). The objective function of the optimization exercise is given as follows (Ibid.):

$$\max f(p)$$

$$f(p)=\int_{p}^{\infty} x(v)dv + px(p) - C(x) - I - g(x) + T(x)$$

given the following constraints:

$$i: px(p) - C(x) - I - R \geq 0$$
$$ii: x > 0$$

where:

$f(p)$ – is the function of benefits to the society
p – is the price (entrance fee)
$x(p)$ – is the recreation demand for the natural area
$C(x)$ – is the variable cost to maintain the tourist infrastructure
I – is the fixed cost to build the tourist infrastructure
R – is the minimal revenue from pricing needed by the management of the natural area
$g(x)$ – is the external cost associated with the visitation in the natural area (negative effect on the ecosystems)
$T(x)$ – is the spillover effect of the visitation in the natural area

The optimization exercise consists of maximalization of the sum of recreation benefits that accrue to the visitors of the natural area, collected fees, spillover effect, after deduction of the variable and fixed costs associated with the tourist infrastracture and the management of the area, and external costs. The first part of the objective function above represents the consumer surplus of the visitors to the area, whose entrance is subject to a fee; the consumer surplus calculation is derived from recreation demand $x = x(p)$. Second part of the function is the producer surplus, i. e. the amount of revenue from the fee. Third part of the function is variable costs (marginal variable costs are assumed to be constant, $C(x) = c\,x$). Fourth part of the function is fixed costs, and the last two parts are the functions of external costs and spillover effect (both are assumed to be linear). The first constraint allows to generate an exogeneously specified revenue to the management of the protected area, the second constraint assumes that the recreation demand is positive.

The underlying recreation demand model in the optimization is the single-site model for the pilot site - the Šumava National Park, which is based on the results of the project Rec-Optim (Kaprová, 2015). The demand is available for the whole national park, and for smaller areas within the park (Jezerní moor, Tříjezerní moor and Prášily lake). The parameters for other Czech recreational areas originate in a random utility travel cost model for the Czech Republic (Kaprová and Melichar, 2016).

The information on the demand side are supplemented by the supply side data on the potential of recreation in the natural area. Example values for the parametrization are available for the pilot site in the application; the data on other natural areas have to be supplemented by the user of the application. The user also specifies the present visitation of the area - the estimation of the specific number may be inspired by the default values from the pilot site, or should follow the guidelines in Braun Kohlová et al. (2016) that will be soon available to the managements of protected areas in the Czech Republic.

The optimization using the tool results in the quantification of the effects of different scenarios of pricing and hopefully represents a valuable input into the discussion of the pricing in protected areas and its effects in the Czech Republic.

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