Article

Factors Affecting the Number of Visitors in National Parks in the Czech Republic, Germany and Austria

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Abstract: In the context of national-level strategies, the importance of tourism in national parks is on the rise. The objective of this study is to investigate the relationship between the number of visitors to national parks and five variables: area, number of employees, budget, average employee salary and number of researchers in 12 national parks in the Czech Republic, Germany and Austria. Analysis of factors influencing the number of visitors to national parks uses the method of retrospective analysis of the data contained in internal documents and questionnaires among managers of national parks. The number of candidate predictors is relatively high when compared with the number of observations. Due to this fact, the Gilmour method for statistical analysis is used. Statistical results represented by the parameter β_2 for number of employees is $-33,016$ (95% CI, $-50,592$–$-15,441$) and by the parameter β_3 for budget is 0.586 (95% CI, 0.295–0.878), showing that the number of visitors increases with budget, while it decreases with the number of employees. The results of this study are a useful starting point for managers in their efforts to focus on developing key areas in an appropriate way. In conclusion, results show that increasing the economic benefits accruing from national parks regional policy could aim at a qualitative upgrading of tourist services, increased marketing of the unique national park label and the promotion of a diverse regional supply base.

Keywords: national parks; analysis of determinants; visitors; Czech Republic; Germany; Austria

1. Introduction

Environmental issues—including environment, landscape and natural resource protection—belong among the areas experiencing the most dynamic growth in Europe in recent years. There is no clear-cut universal understanding of national parks, either on the international or national level. The concept of national parks is constantly evolving, which is reflected in the national park development strategy (hereafter "strategy"). The strategy works with the ever-changing perceptions of national parks, captures these changes and revises goals for national park development accordingly. The strategy takes into account modern trends and the current condition of the national parks in question.

According to the definition of the EUROPARC Federation (2009), a national park is an area designated for conservation. A national park is typically a reserve of land—whether natural, partly natural or developed—owned by a sovereign state and declared as such. Policies for national park designation vary from state to state, but the underlying idea is to preserve a valuable piece of nature for future generations [1]. Besides promoting the sentiments of shared heritage and national pride, national parks serve the following purposes: to preserve natural diversity, to preserve the climate of the area, to facilitate scientific research and development, to attract visitors for recreation and tourism and support the economy of the area [2,3].

The recreational and touristic significance is currently on the rise [4–6]. National parks are each year visited by millions of tourists, with varying lengths of stay. Hand in hand with the development

of tourism and recreation, however, there is a pressure to implement new development projects. For the sake of protecting the invaluable natural landscape, activities related to building recreational complexes, increasing accommodation capacities and building new infrastructure must respect the uniqueness of the area in question. The main economic contribution of national parks lies in the brand and the opportunity for sustainable tourism [7,8]. Tourists visiting the area make use of a variety of services. Furthermore, the administrations of national parks create jobs, directly and indirectly, in the form of orders from private companies. The national park brand means an easier access to public funding for municipalities as well as private companies. National parks boost the economy of the entire region; and municipalities located in national parks have a higher income than those located elsewhere [9]. Future strategic initiatives are focused on preparing the professional management of national parks for the benefit of the nature in and visitors to national parks and creating conditions to solidify an active cooperation with representatives of regions and local communities [1].

The number of visitors to national parks is the most salient indicator of the contribution of these protected areas to the local economy [9–12]. It is essential to discover and analyse the drivers that determine the number of visitors to national parks so that an effective strategy for national park designation and management can be developed [13]. Generally, a number of earlier studies have examined determinants influencing the use and the number of visitors to different types of national parks in order to establish how to utilize the potential of national parks most efficiently [14–16]. Among the aspects examined were subjective factors, such as visitor opinions, public government policies, and characteristics of particular national parks. Xu and Fox [17] pose the question as to whether the value a person attaches to the environment influences that person's attitude towards sustainable tourism development in national parks. Puhakka [18] inquires into the sociocultural sustainability of tourism as perceived by local stakeholders of the Oulanka National Park in northeastern Finland. Hanink and Stutts [19] explore the impact of different factors on the number of visitors drawn to US national battlefield parks. These factors include the date of establishment of the national park, its area, its causalities, its competitiveness, and its market potential, which is affected by the proximity of large cities. It is apparent that said factors reflect geographical specificities of the United States and the specificities of battlefields as national parks. The results of an empirical test of the model indicate that a battlefield's location—relative to population centers and to other battlefield parks—is a critical factor in the number of visitors received [19]. Another study identified viable target markets at South Africa's most renowned nature reserve, the Kruger National Park, using market segmentation based on demographic characteristics [20]. Bateman et al. [11] studied the effects of national park characteristics, particularly their spatial context, on the total number of visitors that these national parks receive. Schägner et al. found that among significantly positive influences that increase the attractiveness of these areas for visitors are the presence of water bodies, availability of trails and minor roads, and population. In contrast, broadleaf and coniferous forests, wetlands and grasslands, as well as the availability of other national parks in proximity count among negative factors that tend to decrease visitor numbers [13]. Another study found that other important characteristics contributing to higher visitor numbers are accessibility and linkage (GAL), degree of comfort and image (DCI), use and activities (UAC) and sociability (SOC) [21]. Push factors for tourism in national parks are chiefly 'recreation and knowledge seeking', 'appreciating wildlife' and 'feeling close to nature' [22]. The motivation of visitors to visit national parks may vary according to their demographic profiles. Tourists coming to national parks seek experience, and in order to provide it, park management should ensure that there are sufficient opportunities for visitors to learn about wildlife and that they can truly experience it, which requires mechanisms to be put in effect that reduce poaching and habitat destruction. These measures will enhance the experience of the visitors and ultimately increase their satisfaction [22]. Furthermore, Zhang et al. [23] analyse a theme park's tourism-carrying capacity (TCC) and devise a conceptual framework that categorizes determinants of TCC on three levels as fundamental, mediating, and direct determinants. To conduct the research, data was collected from questionnaires, social media [24] or publicly accessible databases. The authors in other studies used

regressions models [13,25] of visitor numbers. Primary data relevant to European national parks combined with additional spatial variables derived from GIS data [13]. Furthermore, the authors combined their own predictions of visitor numbers with a mean value estimate per recreational visit in the given area [12]. Choice models predicting recreational behaviour at the individual level are another commonly utilised approach [26–28]. Randle & Hoye [29] employ a Generalized Method of Moments (GMM) estimator, which they apply to monthly US national park attendance data to measure the effect of recession on the number of visitors to national parks. The results obtained show that recession, regardless of the macroeconomic measure used, had a negative impact on national park attendance [29].

Overall, more procedures are available for selecting a subset of a set of candidate predictors in multiple linear regression problem. If the number of candidate predictors is relatively high when compared with the number of observations, such as in this study, then no predictor could be significant in practice. The Gilmour method [30], which uses modified Mallows's statistics [31], would be successful. The aim of this study is to investigate the relationship between the number of visitors to national parks and five variables: area, number of employees, budget, average employee salary and number of researchers in 12 national parks in the Czech Republic, Germany and Austria.

2. Methods

2.1. Data Collection

Within each country, four national parks were selected based on their location and date of establishment. All national parks in the Czech Republic were included. In Germany and Austria, national parks lying in mountainous regions and parks in alluvial river landscapes were selected. These included recently established national parks, as well as comparatively older parks with stable development since their establishment. These national parks have also undergone different historical and political developments.

Analysis of determinants influencing the number of visitors to national parks uses the method of retrospective analysis of the data contained in internal documents and questionnaires among managers of national parks. Data collection using the questionnaire method spanned the period between March and June 2016. Based on the objectives of our research, data concerning six variables were gathered:

- Area—x_1
- Number of Employees—x_2
- Budget—x_3
- Average Salary—x_4
- Number of Researchers—x_5
- Number of Visitors—y (as explained variable)

Data set contains 12 national parks and five possible predictors.

2.2. Data Analysis

The number of candidate predictors was relatively high for the number of observations. The standard method of least squares (LS) would not be successful, and other procedures are available for selecting a subset of a set of candidate predictors in a multiple linear regression problem. If the number of candidate predictors were high, relative to the number of observations, then an alternative Mallows's method [31] could be used. The method used C_p-statistic, which could be defined for a particular model with p parameters in the following relationship:

$$C_p = \left[\frac{SSE_p}{\hat{s}^2}\right] - n + 2p \tag{1}$$

where p it is the number of variables plus constant, SSEp is the error sum of squares from the model being considered in LS, $\hat{s}^2$ is an estimate of the error variance σ^2 and n is the number of observations. The Gilmour method used adjusted the Mallows statistic $\overline{C}_p$ 30, which could be a better tool. Generally, it is defined for all possible submodels:

$$\overline{C}_p = C_p - 2 \cdot (k - p + 1)/(n - k - 3) \tag{2}$$

where k is the number of predictors without constant in the basic full model with all candidate variables. According to the method, plot $\overline{C}_p$ against p is created for all possible combinations of predictors and all submodels. The null hypothesis that all predictors are important in the best-extended submodel with p = q + 1 is tested using the following definition of F:

$$F = \overline{C_q} - \overline{C_{q+1}} + \frac{2 \cdot (n - k - 2)}{n - k - 3} \tag{3}$$

where q + 1 is the number of parameters in the new full model and q = p is the number of parameters in the submodel with the lowest adjusted Mallows statistic $\overline{C}_p$ (the letter q is used for formal reasons at this step). The critical values of the test were calculated in the original study [31]. If the empirical value of F is below the critical value, then the null hypothesis that all important regressors have been included would be rejected, and the submodel with q would be assumed.

The results were discussed in consultation with experts at managerial posts at national parks. Six interviews with experts concerning the analysis results were conducted, out of which four experts represented Czech national parks and the remaining two represented Austrian national parks.

2.3. Data Processing

All data unification and statistical calculation was performed using Microsoft Excel 2016 for Windows 10 Enterprise. LINREGRESE function of MS Excel was used for the calculation of SSEp (the result in the sixth row and in the second column of the result matrix). Namely, the error sum of squares SSEp and all derived quantities were calculated for all possible submodels using LINREGRESE function of MS Excel and using the Formulas (1)–(3). A significance level of 5% was used here.

3. Results

3.1. Data Description

Table 1 presents the collected data for 12 national parks and 6 variables: area, number of employees, budget, average salary, number of researchers and number of visitors (explained variable). The variability of the quantities in the table was evaluated by coefficient of variation, and X4-average salary had the smallest value, at 0.48. On the other hand, area-X1 and dependent variable Y had bigger values, at 1.42 and 1.69, respectively. Applying the Bonferroni correction, the specific value 0.05 was divided by the number of tests, 3, to obtain the Bonferroni critical value of 0.017. The three countries differ only in average salary according the *p*-values in Table 1. Furthermore, national parks were studied in all countries combined.

3.2. Analysis of Number of Visitors

The analysis examined the dependence of the number of visitors on all possible variables. At first, point estimators of β_1, β_2, β_3, β_4, β_5 parameters, representing budget, average salary, number of employees, number of researchers, and number of students, respectively, and their 95% confidence intervals in the following full linear model, were calculated:

$$y = \beta_1 \cdot x_1 + \beta_2 \cdot x_2 + \beta_3 \cdot x_3 + \beta_4 \cdot x_4 + \beta_5 \cdot x_5 + \text{constant} \tag{4}$$

where y is number of visitors, x_1 is area, x_2 is number of employees, x_3 is budget, x_4 is average salary, x_5 is number of researches. The results are summarized in Table 2. It shows that all confidence intervals include zero, and there is no significant candidate that could explain the number of visitors according to the standard LS method.

Table 1. Collected data of national parks in the Czech Republic, Austria and Germany.

National Park	x_1	x_2	x_3	x_4	y_5	y
Czech Republic						
NP Sumava	69,030	264	16,063,512	867	13	213,262
NP Krkonose	36,300	230	12,989,493	1013	16	68,060
NP Podyjí	6259	44	1,903,793	935	7	30,229
NP Bohemian Switzerland	7900	49	3,753,221	927	5	44,962
Austria						
NP Donau-Auen	9300	21	2,719,951	2356	4	42,707
NP Kalkalpen	20,856	42	2,532,324	2257	4	101,967
NP Hohe Tauern	185,600	31	2,920,000	2467	1	92,522
NP Thayatal	13,300	9	1,197,648	2187	3	25,912
Germany						
NP Schwarzwald	10,062	85	7,200,000	2750	6	26,000
NP Bayerischer Wald	24,217	197	15,040,000	3300	30	2,000,000
NP Vorpommersche Bodenlandschaft	78,600	40	6,400,000	3875	3	3,100,000
NP Berchtesgaden	20,800	95	7,700,000	3450	4	1,600,000
Coefficient of variation	1.42	0.95	0.79	0.48	1.02	1.69
Test of difference of means between countries, *p*-values						
Czech Republic/Austria	0.211	0.066	0.083	0.000	0.017	0.315
Czech Republic/Germany	0.190	0.275	0.461	0.001	0.472	0.044
Austria/Germany	0.310	0.052	0.023	0.003	0.159	0.042

Notes: x_1—area, x_2—number of employees, x_3—budget, x_4—average salary, x_5—number of researchers, y—number of visitors.

Table 2. Results calculated in the full model using linear regression.

Slope	β_5	B_4	B_3	B_2	$B1_5$
Point estimation	2569	299	0.401	−21,502	0.1
SD	48,166	452	0.319	19,603	4.7
Lower 95% CI	−115,289	−807	−0.380	−69,470	−11.4
Upper 95% CI	120,426	1405	1.183	26,465	11.6

Initially, the most appropriate submodel according to the Gilmour method (1996) was determined and the Mallows statistic $\overline{C}_p$ was calculated by the method of least squares (LS) for all possible linear submodels. Plot of $\overline{C}_p$ versus p is shown in Figure 1.

The lowest value of $\overline{C}_p$ was −1.06, obtained for the model with two predictors, number of employees and budget (p = 3). The following candidate reduced submodels combined with another single predictor are further evaluated:

- x_2—Number of Employees ($\overline{C}_2$ = 11.25);
- x_3—Budget ($\overline{C}_2$ = 9.38);

The test of the F statistic defined by the Equation (3) for the model with the lowest value ($\overline{C}_3$ = −1.06) and for the model with a single predictor, budget ($\overline{C}_3$ = 9.38), was calculated. The null hypothesis that all predictors in the full model with $\overline{C}_p$ = −1.06 are important was not rejected, and

consequently, the resulting model contains the number of employees x_2 and budget x_3 as two important predictors, and is valid in the model:

$$y = -33{,}016.x_2 + 0.586.x_3 - 271{,}241 \tag{5}$$

The parameter β_2 for number of employees is $-33{,}016$ (95% CI, $-50{,}592$–$-15{,}441$) and the parameter β_3 for budget is 0.586 (95% CI, 0.295–0.878). The two predictors are significant in opposite directions, and the model is shown in Figure 2.
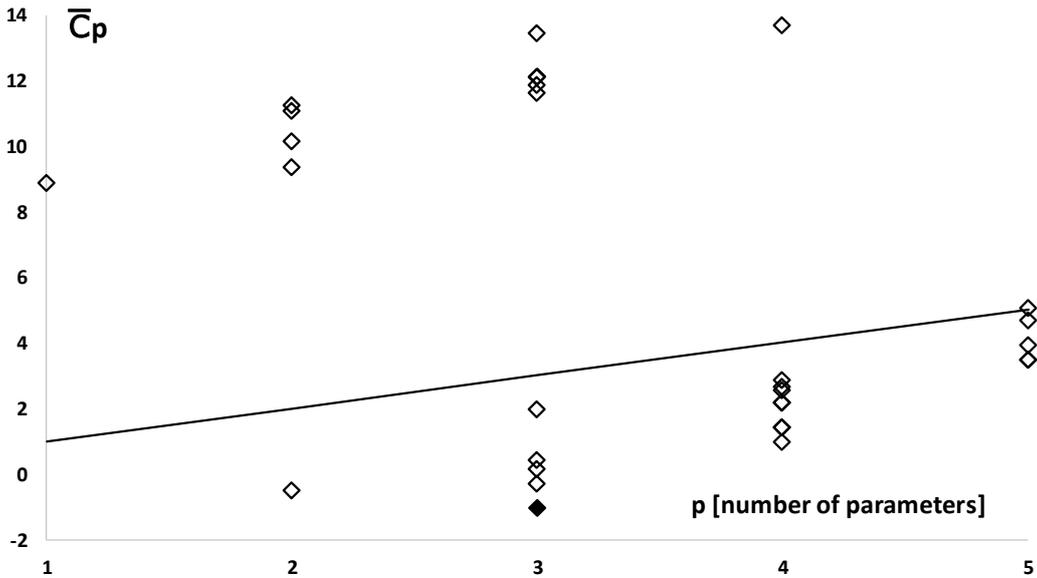

Figure 1. $\overline{C}_P$ versus number of parameters p in possible submodels.
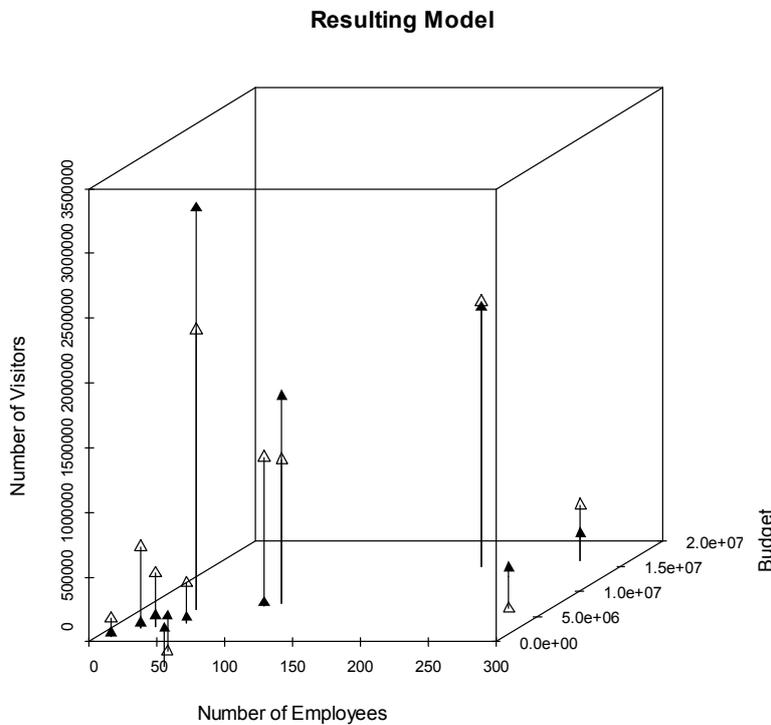
Figure 2. Number of visitors versus two important predictors. Notes: Full triangles represent empirical data and empty triangles represent the resulting model (5).

4. Discussion

The aim of this article was to explore determinants influencing the number of visitors to national parks in selected European national parks. Analysis of determinants influencing the number of visitors to national parks used the method of retrospective analysis of the data recorded in internal documents and derived from expert interviews among managers of national parks.

The resulting model of retrospective analysis demonstrates that national park attendance tends to increases with budget, but decreases with the number of employees. Relationships between personal environmental values and environmental and social perceptions are complex and interactive in the context of park visitation. In the Czech Republic, this finding is confirmed by data from the Krkonose National Park and the Sumava National Park, where the average salary is the highest among Czech parks. Austria shows a direct link between the number of visitors to national parks and the budget of these parks. An exception is the Kalkalpen National Park, which manifests the highest attendance despite its limited budget. On the other hand, this national park employs the highest number of employees and specialists who provide data and knowledge required for the professional management of the national park. The oldest national park in Germany, the Bayerischer Wald National Park, has the largest number of employees and the highest budget, as well as the highest total attendance.

To gain insight into the above-mentioned results, expert interviews were conducted with managers representing Sumava, Krkonose and Donau-Auen National Parks. The interviews indicated that relevant dependencies may also occur in other factors that were not considered in this research. These include particularly the natural characteristics of the protected area, as discussed below.

The attractiveness of the Sumava National Park is based on the fact that the region was inaccessible for almost 50 years, making it an area veiled in mystery. Sumava also comprises the largest area of wild nature in Central Europe, lies within reach of large cities, and is comparatively easily accessible to visitors. Giant Mountains has a much higher total attendance than the data recorded by the national park administration, but these extra visitors come to ski resorts that are incidentally located in the national park. The significantly smaller Podyjí and Bohemian Switzerland National Parks have a regional rather than national importance with respect to tourism. This is true particularly for the deep Dyje river valley in the Podyjí National Park. It is therefore of interest to what extent this increased publicity translated into an increase in visitor numbers, and thus into economic benefits for local communities [32]. In Austria, the attendance of the Donau-Auen National Park remains singularly unaffected by the proximity of Vienna. The other national parks compete with their attractiveness (the Alps of the Kalkalpen National Park) or their large area (the Hohe Tauern National Park). The Thayathal National Park prides itself in the greatest biotope variety on a small area, which makes the park more attractive to visitors. The Bayerischer Wald National Park has a great number of experts managing a particularly extensive database of data and information derived from research. Furthermore, much attention is devoted to presenting this knowledge to the public. For this purpose, visitor centres were built in the areas to attract more tourists. The Bayerischer Wald National Park is surpassed in the number of visitors only by the seaside Vorpommersche Bodenlandschaft National Park, which draws visitors who are often not directly interested in the national park located here. The Berchtesgaden National Park is the only German Alpine national park; hence, its attractiveness and attendance are high. The Schwarzwald National Park is a newly established park, and the region has so far not offered many nationwide attractions. However, in connection with the designated and gradually internationally recognized national park (moving towards category II according to the IUCN criteria), this forested area can hope for more visitors in the future.

Based on the findings of the research—that is, the higher the budget, the more visitors are likely to come to the national park, and the higher the employee number, the fewer visitors are likely to come—and on the expert interviews, the primary objectives of national park management were formulated as follows. The foremost objective is to protect the natural biodiversity of the national park area while promoting recreation, education and research (Dudley, 2008). Apart from protecting wildlife, the objectives of national parks should include effectively managing the use of the area by the

public, which involves educating visitors, promoting environmental protection and actively ensuring that visitors use the areas appropriately and do not damage their unique characteristics. Building infrastructure and investing in tourism are activities primarily aimed at visitors who have already decided to come to the national park, but these factors naturally also influence the decision of the visitors when choosing their destination. It can be assumed that national parks with a higher budget spend a greater part of the budget (whether an absolute total or even a total percentage) on investing in the use of the area, that is, in tourism, which ultimately attracts a greater number of visitors. A more detailed analysis of national park management spending would most likely confirm this assumption. A further analysis of the employee structure of national parks would provide an explanation for our finding that the more employees the park has, the fewer visitors it attracts. This finding, however, cannot be considered to be generally applicable. Given the difficulty of analysing the employee structure according to their expertise and job description, it would be more appropriate to focus on other factors that impact the visitor numbers of large protected areas, especially national parks. According to IUCN (Dudley, 2008), the category of protected areas designated as national parks only includes areas consisting of 75% or more of natural systems or systems that are being restored to their natural state. Other factors that would be helpful to examine in more detail with respect to visitor numbers include the proportion of wilderness in national parks—that is, areas left entirely to their natural development—and what proportions of the budget and human resources are dedicated to managing the public use of the area.

Following on from the data obtained in expert interviews, it is necessary to include further factors in determining the visitor numbers to national parks, such as factors illustrated in [25]. Research shows that factors increasing the number of visitors include particularly recreation opportunities, number of biotopes, availability of trails and the age of the national park. The location of the area with respect to population is only relevant in the case of southern Finland. Further research will not be focused on the types of recreation opportunities, because previous studies have shown that variations in visitor numbers based on this factor are given by different evaluation methodologies, rather than by differences in recreation opportunities. This indicates significant measurement errors. Moreover, it is difficult to determine whether there is a relevant dependency between visitor numbers and highly unstable spatial variables. Meta-analyses of the recreational value of national parks with respect to biophysical, socioeconomic and regional or national dummy variables document only a few dependencies, which are, furthermore, of low significance [32–39]. The chief limiting factor of this study, therefore, is the limited number of factors under examination. Furthermore, from the point of view of methodology, the data set represents an illustrative example for an alternative method when LS is not successful. It is clear that possible relationships could be weak, and actually the *p*-value is higher than 0.99 in the F test calculated in the full model in the standard multiple linear regression. Simultaneously, every 95% confidence interval of possible parameter contains zero.

In conclusion, these results are important for park management and geographic research. To increase the economic benefits accruing from national parks regional policy could aim at a qualitative upgrading of tourist services, increased marketing of the unique national park label and the promotion of a diverse regional supply base. From the point of view of further research, attention should be paid to analyses of tourist-related service industry operations, especially carrying capacity, spatial linkage application to tourist area development, and regional historical research, to mention some.

Nevertheless, higher management efficiency should not be the primary purpose of national parks. Rather, these areas should serve to protect and conserve unique wildlife, so that it can be experienced and enjoyed by future generations as well. The visibility of national parks must be subject to the preservation of their ecologically stable natural ecosystems corresponding to the habitat and the achievement of their natural biodiversity. Management efficiency and recreational opportunities can be perceived as an additional benefit of national parks, which is a sound argument for allocating adequate resources to already established and newly designated national parks alike.

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