Recreational pressure indicator for sustainable tourism in protected areas

The case of Mount Olympus, Greece

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A Tourism Carrying Capacity Indicator for Protected Areas

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ABSTRACT

The aim of this article is to develop a tourism Carrying Capacity Indicator for protected areas that could assist regional planners and park managers to promote an equitable form of the spatial distribution of visitors' environmental pressure. To measure the negative impact of visitors on an environmentally sensitive area, various indicators have been proposed, with regard to ecologically sustainable tourism. In this paper, we examine the unequal distribution of visitors to a protected area that causes significant additional environmental pressure on some sub-areas. This additional pressure, which may exceed the landscape's carrying capacity, cannot be measured by the commonly used indices that represent an average for the whole area. Our objective is to depict the variability of pressure intensity within a protected area. For this purpose we introduce an indicator adjusted to the Gini co-efficient resulting from the Lorenz curve, used by economists to measure the unequal distribution of income. The proposed indicator is applied to the Mount Olympus National Park, Greece.

Keywords: carrying capacity, indicators, sustainable tourism.

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The aim of this presentation is to develop a sustainable tourism indicator for natural protected areas, that could assist regional planners and park managers to promote a more equitable form of the spatial distribution of visitors' environmental pressure. An indicator is introduced that depicts the unequal distribution of the number of visitors to a protected area, an inequal distribution that causes significant additional environmental pressure on some sub-areas. This additional pressure, which may exceed the landscape's carrying capacity, cannot be measured by the commonly used indices for tourism pressure, since these represent a holistic view, an average for the whole area. In this presentation, we aim to further specify the intensity indicator so as to describe the variability of pressure intensity in a certain area.

For this purpose we introduce an indicator adjusted to the Gini co-efficient resulting from the Lorenz curve, which is used by economists to measure the unequal distribution of income.

The proposed indicator is being applied to the Mount Olympus National Park.

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The indicator of recreational pressure, measuring the level of environmental pressure that visitors exert on the protected area, together with the indicator of intensity of use, measuring the potential level of overexploitation of natural resources during certain periods, are considered by WTO as fundamental sustainable tourism indicators. However, visitor’s pressure and intensity of use are not evenly distributed over the protected area’s space. To ensure the sustainability of the ecosystem, park managers have traditionally used different approaches to organizing tourism and recreation. The most widely-used regulatory technique is zoning, where different areas are set aside for different activities. Zoning and visitors' preferences form overcrowding localities, leading to different levels of environmental pressure within the protected area.

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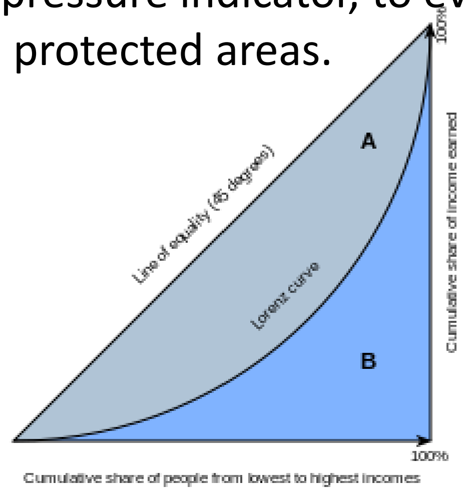
In this presentation we introduce a measure of central tendency and spatial variability in the visitors' pressure indicator, to evaluate the spatial pattern of recreational pressure on protected areas.



The Lorenz curve, traditionally used in depicting wealth distribution, is used here as a statistical tool to estimate the spatial variability of recreationists over the study area. The National Park of Mount Olympus is used to illustrate the proposed methodology.

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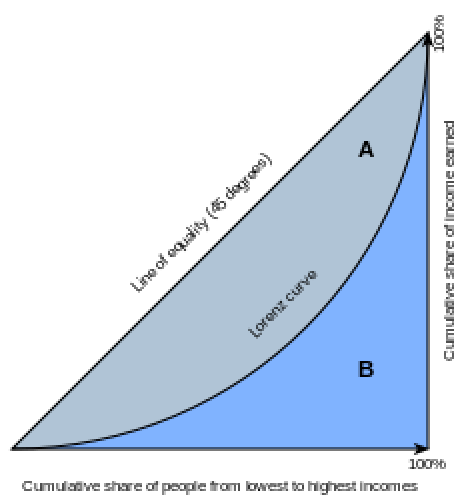
Survey area

Mount Olympus, home of the ancient gods in greek mythology, is the highest mountain of Greece (summit: 2918 m) and constitutes the symbol of modern European culture. The term "Olympos", known since Homeric times, means, "all-shining, sparkling", apparently because its summits are always covered by snow except for a short time in the summer.

Mount Olympus has always been an area of international interest. In 1979, European Community's Directive 79/409, article 4., declared Mount Olympus as a Special Protection Area. In 1981, UNESCO declared Mount Olympus National Park as part of its international network of Biosphere Reserves and Mount Olympus in the Man and Biosphere Program, aiming to protect and conserve nature in the most important ecosystems of the world. In 1985 Olympus has been declared "archaeological-historical site" as its natural environment is directly linked to important historical and congenial anthropogenic activity. The Greek government declared Mount Olympus a National Park, in 1938.

Methodology

Lorenz curve is used in depicting the nature of any distribution, like wealth. It is, however, usually used to depict the income distribution of a country. The Lorenz curve is derived by plotting the cumulative proportion of people (ranked from the poorest up) against the cumulative share of total income which they receive. If there were perfect equality in the distribution of income, the Lorenz curve would be a 45^o straight line, whereas, for the case of absolute inequality, it would form the bottom and right side of the square. Any actual income distribution falls between these two hypothetical extremes and is represented by a sagging line, where the greater the sag of the curve, the greater the inequality of the distribution. The degree of inequality, that is the proportion of the triangular area which is between the curve and the diagonal, is known as the Lorenz coefficient or the Gini index.



Methodology

The "adjusted Lorenz curve", as we call the curve depicting the unequal distribution of visitors in a unit, is created by dividing the study area into a number of smaller sub-areas of equal size. Classifying these sub-areas from the least to the most visited, we then place them as cumulative percentages at the base of the horizontal axis. Similarly, the vertical axis depicts the percentages of visitors. The curve thus created shows the total percentage of visitors in relation to the corresponding cumulative percentages of the surface area.

If the distribution of visitors to all sub-areas were equal, the curve would be identical to the diagonal bisecting the angle of the two axes. The more it curves away from the diagonal, the more unequal the distribution. The area of the field between the diagonal and the curve gives the measure of inequality. The ratio of this area to the total area beneath the diagonal gives the "adjusted Gini coefficient", with values between 0 (absolute equality) and 1 (absolute inequality).

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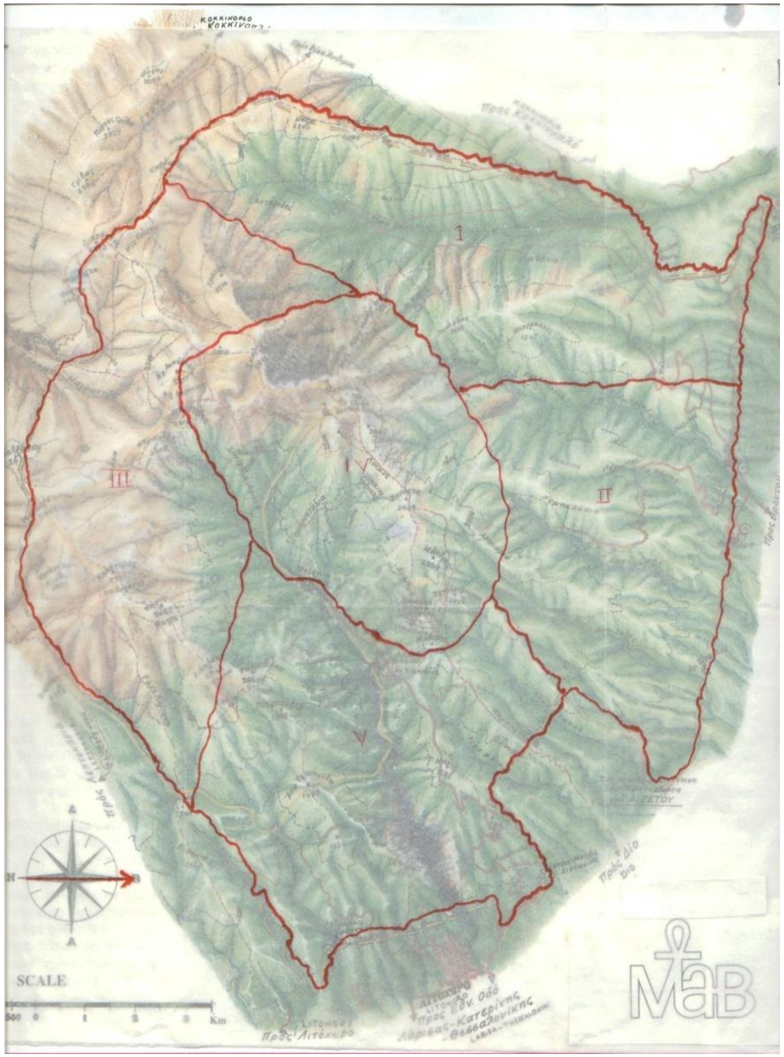

Table 1

AREA	Valid Percent of Area	Visitors
Sub-area I (west side)	20%	0.6%
Sub-area II (north side)	20%	1.7%
Sub-area III (south side)	20%	3.9%
Sub-area IV (park center)	20%	22.6%
Sub-area V (east side)	20%	71.2%
Total	100%	100%

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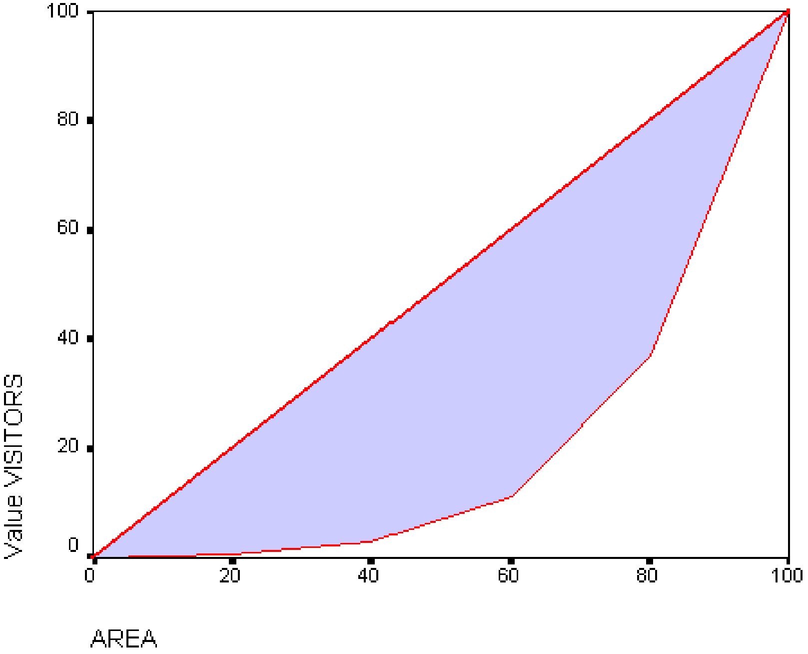
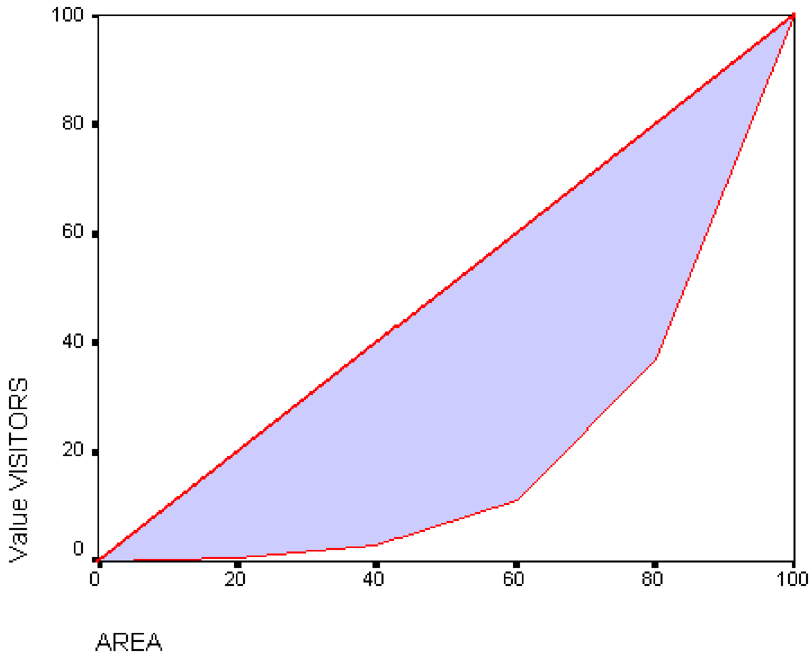
Table 2

AREA	Cumulative Percent of Area	Cumulative Percent of Visitors
Sub-area I	0%	0%
Sub-area II	20%	0.6%
Sub-area III	40%	2.3%
Sub-area IV	60%	6.2%
Sub-area V	80%	28.8%
Total	100%	100%





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Simple mathematical computations are then used to calculate first the area beneath the curve and then the shaded area.

$$\overline{E} = 20 \cdot \frac{0+0.6}{2} + 20 \cdot \frac{0.6+2.3}{2} + 20 \cdot \frac{2.3+6.2}{2} + 20 \cdot \frac{6.2+28.8}{2} + 20 \cdot \frac{28.8+100}{2} = 1758$$

and $E = 5000 - \overline{E} = 3242$

so the adjusted Gini coefficient is $3242 / 5000 = 64.8\%$

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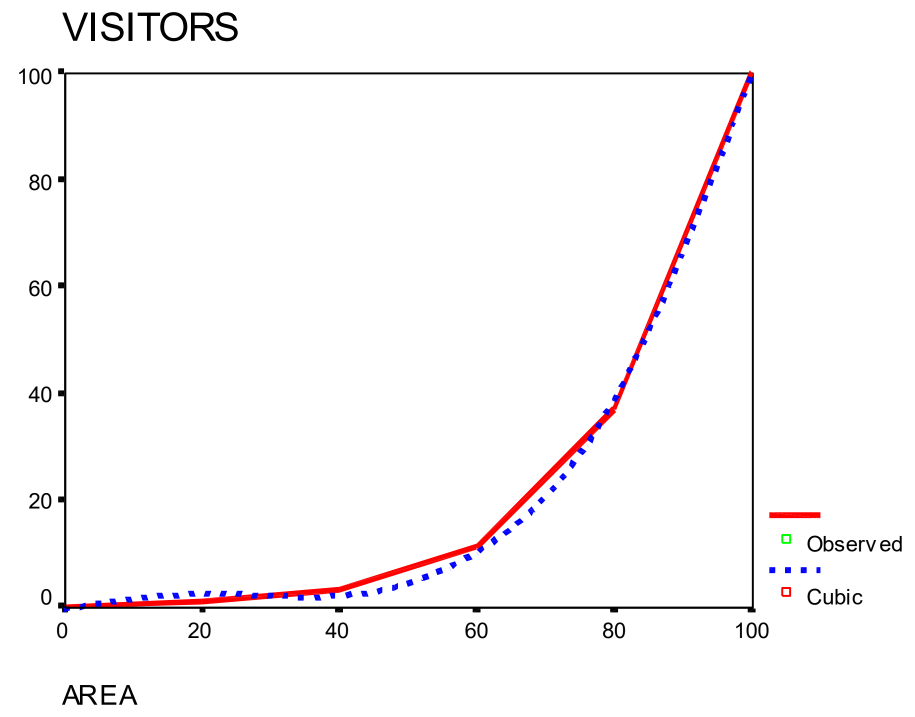
LS // Dependent Variable is VISITORS
Date: 07/28/03 Time: 11:03
Sample: 2000 2005
Included observations: 6

Variable	Coefficient	Std. Error	t-Statistic	Prob.
AREA^3	0.000332	5.98E-05	5.556878	0.0309
AREA^2	-0.030335	0.009104	-3.332121	0.0795
AREA	0.711931	0.366381	1.943144	0.1915
C	-1.036508	3.772439	-0.274758	0.8093

R-squared	0.996153	Mean dependent var	22.98333
Adjusted R-squared	0.990382	S.D. dependent var	39.25335
S.E. of regression	3.849593	Akaike info criterion	2.930656
Sum squared resid	29.63873	Schwarz criterion	2.791829
Log likelihood	-13.30560	F-statistic	172.6230
Durbin-Watson stat	2.928962	Prob(F-statistic)	0.005765



Conclusions

While the pressure indicator (visitors per hectare) displays a low value of 4.6 for the approximately 110,000 visitors and the 23,841 ha of the Mt Olympus National Park, the analysis gave the fairly high value of 64.8% for the adjusted Gini coefficient. This result must be further evaluated, correlated with observed pressures on the landscape and, above all, compared to values from other natural areas that attract tourist traffic so that this comparative analysis may begin to yield useful conclusions.

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