Soundscape Conservation in U.S. National Parks: Implications for Adjacent Land Use Planning

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Abstract
Humans have altered the Earth’s ecosystems and biodiversity significantly. With the conversion of land and the loss of biodiversity, the world loses its natural sounds. The loss of natural sounds is compounded by the growing intrusions of motorized noise. Noise pollution is a ubiquitous problem in cities around the world, but the issue is spreading to more remote areas due to expanding transportation networks, motorized recreation and urban sprawl. The U.S. National Park Service (NPS) recognizes park soundscapes, or entire acoustic environments of a given area, as resources just as air and water are resources. However, national park resources are only provided protection within a legally defined boundary separating it from surrounding land uses. To better understand the acoustic resources and noise issues in parks, the U.S. NPS Natural Sounds Program sent a survey to each of the park units (n=391) in 2009. There were 149 respondents representing 141 different park units. We analyzed the data using qualitative theme identification and quantitative analyses. The primary noise impacts for parks were from motorized noise sources (n=97), and specifically road noise was reported by 36 respondents. Adjacent land uses were identified as causing specific impacts by 15 respondents. We demonstrate how Geographic Information Systems can be used to quantify the noise impacts from surrounding development. Responding park units showing high levels of urban land use as airports.

Methods
The National Park Service Study
National Park Service Survey
Survey distributed to all parks
Four open-ended questions:
•Acoustic resources
•Noise sources
•Impacts
•Mitigation and conservation
149 responses representing 141 different park units
•Response rate of 36%

NPS Land and Use and Mapping
•ArcMap10 used for analysis
•Responding park units selected
•NPS boundary layer
•Created a 10 km buffer
Data used:
•NCLC 2001
•National Road data set (USGS 2006)
•National Airports (USGS)

Results

Park Mitigation Measures
• Aircraft regulations (n=29)
• Adjacent land use planning (n=14)
• Sound barriers (n=12)
• None (n=51)

Land Use Analysis
Total urban area within 10 km is 14331.6 km²
<mean=1225.06 km², SD=1558.13 km²>

Road Analysis
Total road area within 10 km is 435.1 km²
<mean=3.82 km², SD=6.74 km²>

Airport Analysis
24 park units have airports within 10 km
1 park has 4 airports

Mean difference analyses have no significant difference (p>0.05) between parks implementing mitigation measures and surrounding land use.

Soundscapes Defined
•U.S. National Park Service definition: “All the natural sounds that occur in parks, including the physical capacity for transmitting those natural sounds of different frequencies and volumes” (NPS 2006).

Land Use Mapping

Responding park units showing high levels of urban land use, but high numbers of airports.

Conservation

1 Linking national park soundscapes with land use data aids in recognizing the impacts to this resource and the values associated with it. National park soundscapes are an important and relevant starting place to address soundscape conservation.

2 Park respondents indicated that noise generated outside park boundaries

3 Understanding how the components of soundscapes change with land use and other factors, such as climate change is an important consideration for park managers

4 Park visitor expectations, goals, and experiences are important considerations for managing soundscapes.

5 Interactions of different park users, noise and wildlife, and land use and sounds are just a few of the many factors that are part of this issue.

6 The outcomes from the various interactions have led to initial conservation measures by the National Park Service. A better understanding of the issues can be achieved through acoustic monitoring and social science research.

References

Photo credits: Natural Sounds Program, National Park Service