

Effects of Anthropogenic Noise & Natural Sound on Visitor Experiences

“An emerging natural resource”

Ed Krumpé – CSS 496

Key terms

- **Sound**
 - A physical concept referring to the fluctuation in atmospheric pressure that is capable of producing an audible sensation in the ear
- **Noise** -- a psychological evaluation of sound -- “unwanted sound”
- **Natural Ambient Sound** -- intermittent sounds of wind, water & animals (typically non-anthropogenic)

Key terms

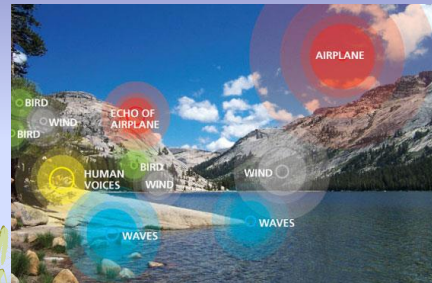
- **Natural Quiet (NPS)** – natural ambient sound plus the self-noise generated by visitors in non-motorized activities.
- NPS policy considers natural sound to be an **integral part of the visitor experience in backcountry & wilderness in National Parks** (and in caves, & in cultural sites having strong memorial values)

The screenshot shows a web article from sonian.com. The main headline is "Valuing the Soundscape: A new aspect of public lands management". The article discusses how the US National Park Service has begun a system-wide process to survey and manage the soundscapes of their lands. It mentions that in the early 2000s, the NPS contracted with outside specialists to develop systems for soundscape analysis and monitoring, which has since been expanded to include baseline soundscape recording and monitoring in many national park units. A quote from Wendy O'Sullivan-Jones, Science National Park, states: "All of a sudden, places that look the same as 100 to 200 years ago don't sound like they did". The article also mentions that two of the early consultants were Bernie Krause of WBS Sanctuary and Stuart Gage of the Michigan State University's Computational Ecology and Visualization Laboratory.

Key terms

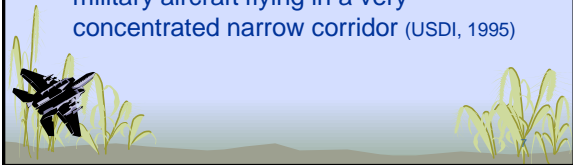
- **Natural Soundscapes** – NPS soundscapes can be managed in physical terms, for example, by restricting the intrusion of mechanical noises above a certain **loudness** or **duration** into protected areas.
- Could be mapped like a viewshed

What is a Soundscape?

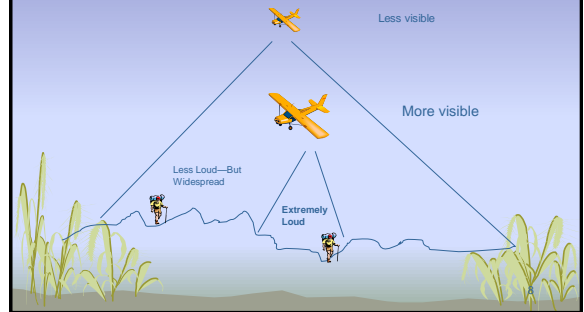


Natural Quiet & Startle Effect

- NPS describes *natural quiet* as the absence of mechanical as well as visitor generated self-noise (Sutherland, 1999)
- **Startle Effect** is caused by low flying military aircraft flying in a very concentrated narrow corridor (USDI, 1995)



Effect of Altitude on Flightseeing Noise



Noise Thresholds

Kariel, 1991

Decibels	Effect on Listener
160	Eardrum Rupture
140	Threshold of Pain
120	Threshold of Discomfort
90	Speech interference at 1 foot
85	Damage-Risk Noise Limit
65	Average Male Conversation
0	Threshold of Hearing

Gramann, 1999

Decibels	Sound Sources
83	Chainsaw @ 15.2m
74	Trail Bike @15.2m
73.6	Small Aircraft @ 100m
70	Aircraft Sightseeing, Grand Canyon
62	Wind in Trees
59.8	Campfire @ 2m
53.6	Train in Distance @ 1km
51.9	Persons Eating and Talking @ 15m
42-52	Road Traffic @ 100m
30	Wind Rustling Grass and Brush
22-27	Insects

What Affects Sound Propagation Across Landscapes?

- Spherical spreading
- Atmospheric absorption
- Foliage & ground cover
- Down/upwind effects,
- Topographic barriers & channels (terrain effects)
- Source – noise propagation

SPreAD-GIS: an ArcGIS toolbox for modeling the propagation of engine noise in a wildland setting

What affects judgment of noise?

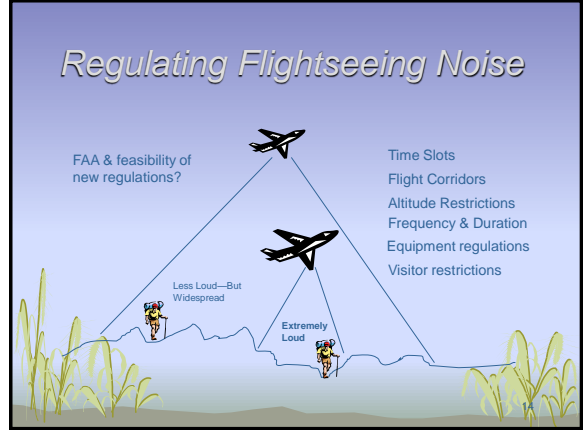
- Loudness
- Appropriateness for location
- Frequency
- Duration
- Location – front country vs backcountry
- Source — perceived appropriateness
- Social implications—illegal & inappropriate noises are judged negatively

Visitors' reactions to noise

- Annoyance
- Loss of tranquility
- Loss of solitude
- Displacement
- Nothing?

Yosemite National Park





- ### Noise Indicators
- Frequency of anthropogenic noise
 - Duration of anthropogenic noise
 - Closeness of anthropogenic noise (zones or categories)
 - % time anthropogenic noise present
 - Ratio of anthropogenic noise to natural
 - % time anthropogenic noise exceeds natural ambient noise

- ### Challenges
- May require expensive equipment
 - What if visitors don't care? (*who sets the standard? Historical to what date?*)
 - Attribution to anthropogenic & non-anthropogenic sources difficult
 - Sampling
 - How do you communicate results?