

## 50 Sounds like Norway: a review of research needs and future paths

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Many of us experience some surprise when we step off a beaten trail and into a wooded dell. Suddenly, we feel a bit closer to nature: not because we have finally arrived, but because we finally hear. There has been an emphasis in research and conservation policy about the visual features of landscape. Yet, we hear place as much as we see it. The weaving of sounds and perception within place is called the soundscape. Natural soundscapes (areas mostly free of undesirable anthropogenic sounds, i.e. noise) provision human wellbeing and influence positive behavior, whereas noise in nature severely degrades experiences connected to outdoor life (i.e. 'friluftsliv') and impacts wildlife. In Norway 2.1 million (40%) are exposed to outdoor noise exceeding 55dBA - a level known to drive adverse health effects- and has serious implications for effective conservation of biodiversity and diverse restorative experiences in national parks. Thus, parks have an increasing importance to harbor natural sounds and areas free of noise. This paper presents a possible series of steps to assess and monitor natural soundscapes, following guidance provided by the US National Park Service Division of Natural Sounds, and the work of

Ferraro et al. 2020, Levenhagen et al. 2020, among others: 1. establishing what sounds people expect or need to hear when recreating in particular national parks and what constitutes noise (national survey); 2. inventorying sounds using passive audio recorders (PARs) linked as a sensory array from remote to high access settings (ecological and human disturbance gradient); 3. linking reported friluftsliv experience with perception of place and sounds to collected acoustic data (attended listening survey); 4. mapping noise proliferation in parks (PARs); 5. experimentally modify noise levels via messaging or restricting recreation equipment use to examine effects on bird distributions (point counts) human perceived (bird) biodiversity, quality, wellbeing and support for natural sounds conservation efforts (survey); 6. bring in identified important natural sounds and noise sources as indicators of soundscape quality in a management by objective framework for natural resource managers. The paper highlights how these steps may be deployed in two case studies, Femundsmarka and Rondane national parks.