

Tranquility mapping: A tool for the equitable allocation of soundscapes in protected areas

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Introduction

It is well recognised that advanced industrialised societies have become progressively 'noisy' over time. This has led to the health and wellbeing benefits of tranquil spaces becoming increasingly recognised - and valued - around the world. Indeed, the search for tranquil environments is often the chief reason people give for escaping urban settings for 'natural' environments.

Tranquillity in natural environments is a combination of both 'natural' landscapes - *and* 'natural' soundscapes. The preservation and conservation of natural environments therefore requires the management of not just natural landscapes and ecosystems, but also their associated soundscapes. Natural soundscapes are finite: at any place and time the soundscape is 100% 'natural' unless affected by 'unnatural' human-caused sounds. Therefore, the primary challenge to preserving and conserving natural soundscapes in protected areas is the management of unwanted human-caused sound - or 'anthropogenic noise'.

The predominant source of anthropogenic noise in New Zealand's protected areas derives from the use of motorised transport, most notably the commercial operation of aircraft and jet-boats for conservation management and tourism purposes. Because these movements of aircraft and jet-boats necessarily involve transiting across protected areas to access particular places of interest, the impact on natural soundscapes from this activity can be temporally and spatially extensive.

Current noise management practice in New Zealand's protected areas

The New Zealand Department of Conservation (DOC) develops statutory management plans that establish the nature, extent and scale of human activity permitted in protected areas. With respect to anthropogenic noise, to date these plans only address noise derived from aircraft activity. The sole management intervention to mitigate the impacts from noise is through the imposition of zones that control both the number of locations that may be accessed by aircraft, and the number and frequency of movements to those locations.

The effectiveness of this intervention is determined through ground-level monitoring at key sites using DOC's Standard Aircraft Monitor (SAM) (Booth, Jones & Devlin, 1999), based on 1994 work by the US National Parks Service (NPS). SAM focuses on subjective 'annoyance' level as the primary measure of social impact, with the 'acceptable' level of ground-based visitor annoyance arbitrarily capped at 25%.

Limitations of current practice

Annoyance is currently the only metric used by DOC to inform soundscape management, the purpose of SAM being to help identify those areas where aircraft noise may be compromising the quality of visitor experiences; however, the relationship

between visitors' annoyance with aircraft, and the effects of those aircraft on visitors' overall visit enjoyment has yet to be consistently demonstrated.

Furthermore, the level of reported annoyance is a function of visitors' expectations with respect to the presence and nature of tranquillity in protected areas – and results from SAM indicate these expectations are declining in parallel with the aforementioned increasing noisiness of the modern world. With annoyance the deciding measure, the management response to this trend has been to allow commensurate increases in aircraft activity.

In addition, SAM's sole focus on the subjective responses of ground-based visitors to aircraft over-flights imposes significant methodological, logistical and practical challenges that essentially constrain its use to sites where there are large numbers of ground-based visitors and high levels of aircraft movements. These sites tend to be the most accessible 'front-country' locations in protected areas – whereas, anthropogenic noise impacts are typically far more wide spread.

Finally, DOC statutory management plans and SAM do not explicitly address the impacts of anthropogenic noise with respect to cultural and historic heritage values and spiritual values at sites of particular significance.

A new approach

It can be concluded from the above that natural soundscapes are a resource deserving of management for their own sake - quite separate from the visitor experience. This important distinction reveals the essential challenge of the management task: the preservation and conservation of tranquil natural environments for the long-term benefits of the public; *and* the sustainable and equitable allocation of the same finite natural soundscapes between different stakeholders. Developing a robust, evidence-based management model and tools is therefore critical to meeting this challenge.

DOC is addressing this requirement through a combination of two threads of research. The first draws on work by Dumyahn and Pijanowski (2011) that conceives of soundscapes as Common Pool Resources (CPR) bound by time and space. This conception recognises that some visitors consume natural soundscapes in a manner that subtracts from the total soundscape available to others, with the management focus therefore on the equitable and sustainable allocation of the resource according to an agreed set of principles and objectives.

Dumyahn and Pijanowski observed such agreement necessarily involves incorporating the aspirations, preferences and obligations of a range of stakeholders in the development of a management regime based on a shared understanding of both the resource itself, and the mechanism by which it is to be allocated. For management purposes, such a mechanism would need to be able to represent the qualitative and quantitative allocation of the resource, both spatially and temporally.

The second research thread provides this mechanism: the Tranquillity Rating Prediction Tool (TRAPT) developed by Watts and Pheasant (2013, 2015). TRAPT enables the predictive site-specific mapping of tranquillity levels based on a formula of subjective and objective factors, and incorporates a qualitative scale of tranquillity levels to report the results. TRAPT is being calibrated for the New Zealand context,

including the historic, cultural and spiritual imperatives of DOC's statutory management plans. Input from stakeholder groups often seen as 'competing' for use of natural soundscapes is central to this work.

When deployed, TRAPT will facilitate engagement of all stakeholders in soundscape allocation based on a common frame of reference and shared responsibility. Incorporating GPS data from aircraft and jet-boat operations, TRAPT will be able to model alternative scenarios to achieve specified qualitative and quantitative levels of tranquillity at any given site. Use of TRAPT will therefore shift the focus of management from interventions intended to constrain annoyance levels, to interventions that preserve and conserve natural soundscapes - thereby ensuring all visitors can access locations where the wellbeing benefits from high levels of tranquillity may be enjoyed.



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