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Listen and be heard to mobilize: soundscapes for ecosystem protection in a mining region in Arizona (USA) - case of the Sonatas project.

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Research project : Sonatas (Listening to the SOUNDS of NATURE to understand global environmental changes - funded by the LabEx DRIHM) is a pluridisciplinary research program bringing together ecology, geography and anthropology. It aims to understand **how sounds can inform on the state of an ecosystem and how local communities hear, respond and adapt to changes** in Southern Arizona. This area is prone to multiple sociological and environmental changes, including global warming, water scarcity, uncontrolled urbanization, and important mining projects with heavy environmental consequences.

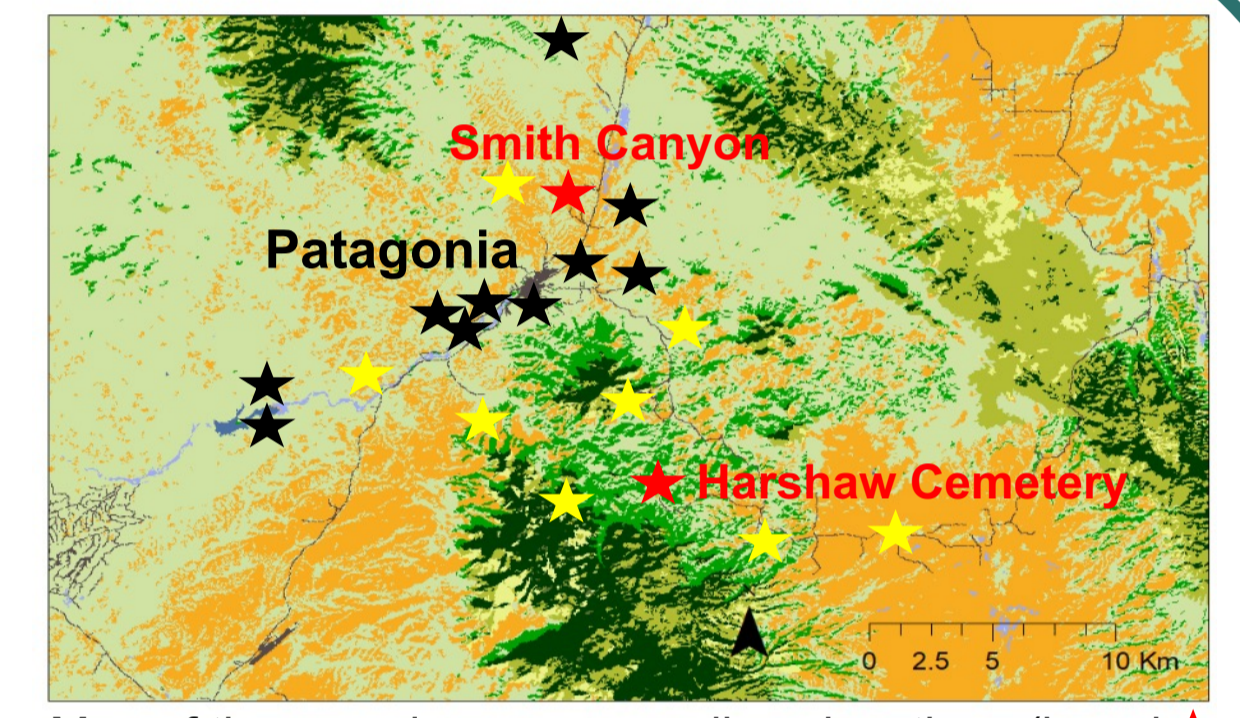
The study site : Patagonia, Southern Arizona



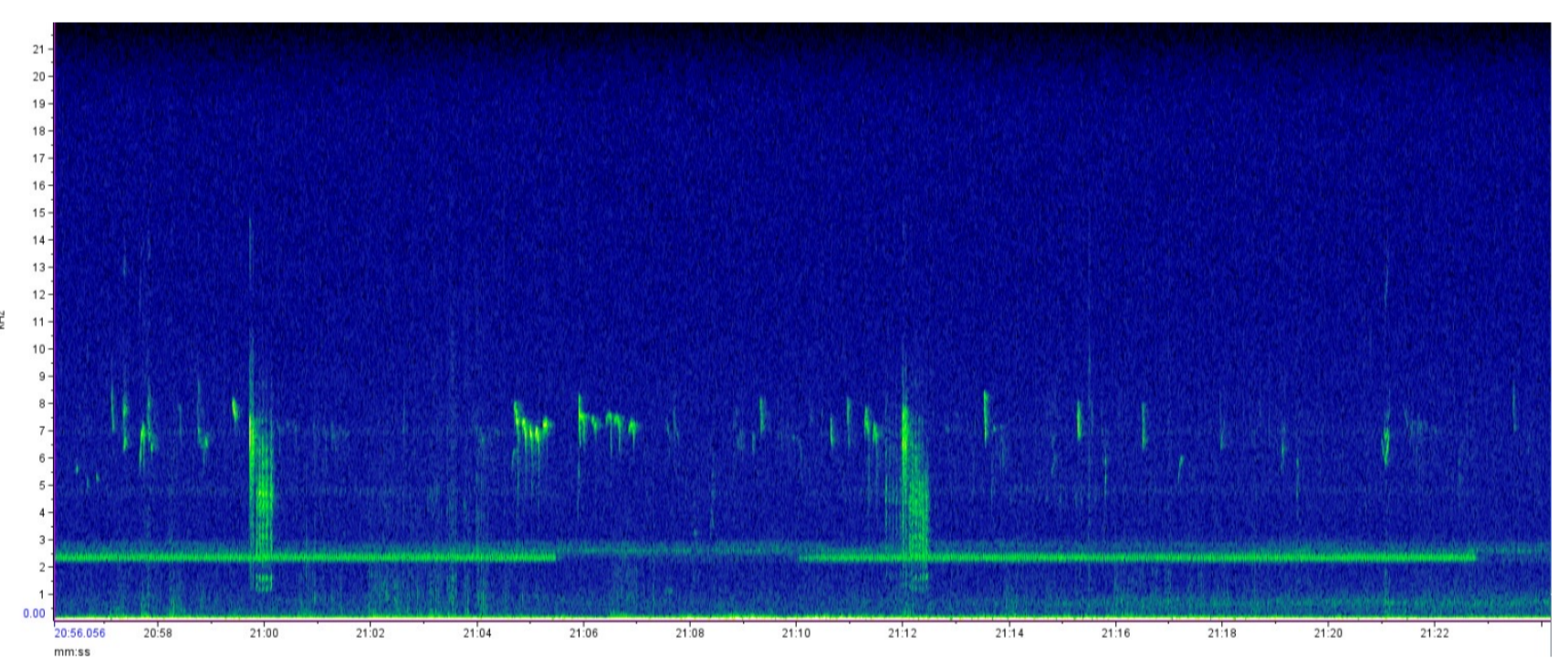
Patagonia is a town in the Santa Cruz county (804 inhabitants in 2020). It is well-known for its mountains, pristine landscapes and biodiversity, notably its avifauna, leading to the development of a strong and growing network of nature preservation organizations. Patagonia is also a **renowned ecotourism destination** and especially **attracts retired people**. It was **developed in the 19th century** following the settlement of mines and ranches as a **supply center**. Patagonia is now **facing new mining projects** which divide the local population.

Methods : Through **passive acoustic recordings of soundscapes** conducted near existing mining sites, we document the impacts of urbanization and mining operations on ecosystems and biodiversity. Through **ethnography and semi-directive interviews** we met with citizens to understand their perceptions (auditory but not only) of their land, the changes that affect them and to describe the multiple actions carried out collectively to accompany or face these changes.

From an ecological and ecoacoustic point of view : the mines have a strong effect on soundscapes and biodiversity leading to filtering of species that are the most sensitive to noise

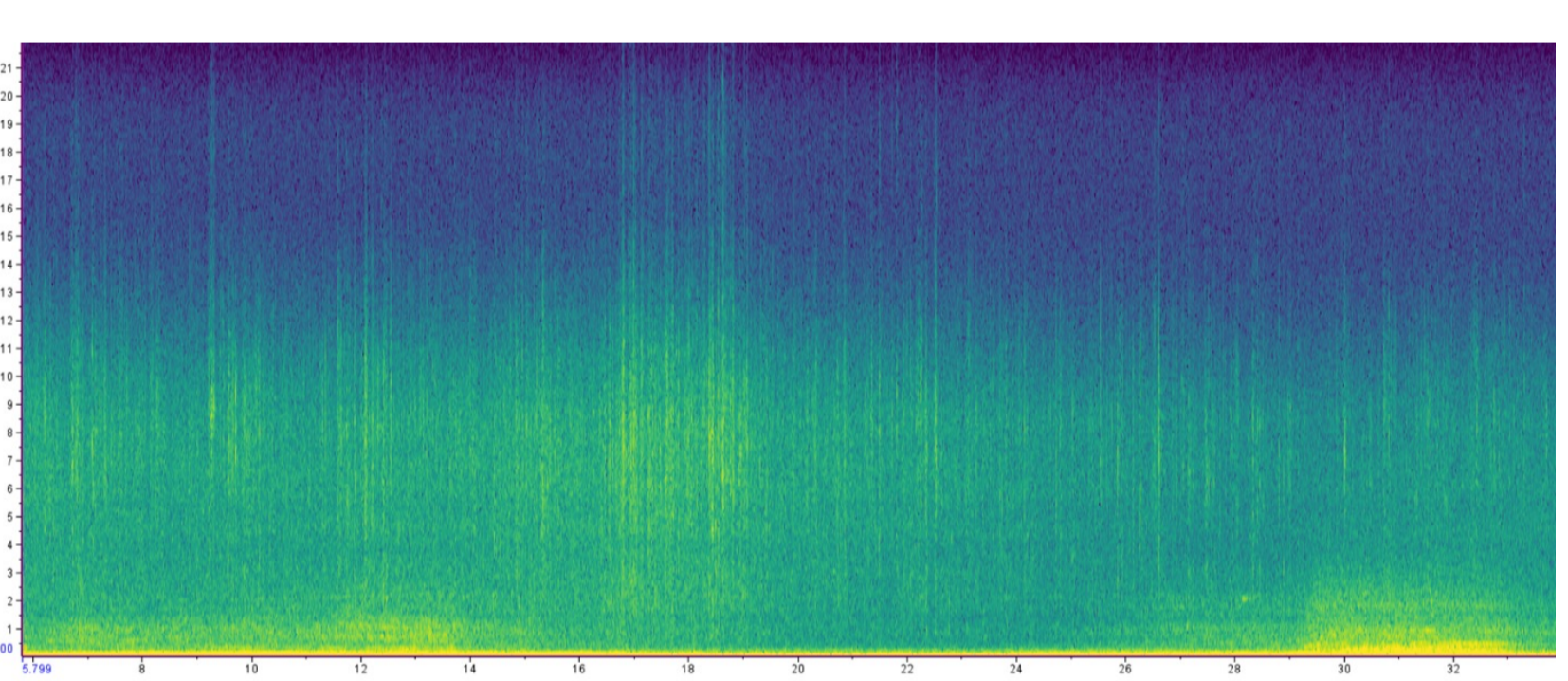


Map of the soundscapes recordings locations (in red ★ the ones that are cited below, in yellow ★ the future (late 2023) recordings locations (authorization in progress)



In Smith Canyon at Borderland Restoration preserves, in a late November morning, the spectrogram shows bird calls (bridled titmouses and chipping sparrows), insect stridulating and the silence beyond.

At the same time of day in Harshaw Cemetery, a few miles south of Patagonia and close to the mine, the noisy background can be seen on the spectrogram, where bird calls are lost on the ambient noise.



Typical desert birds with higher-pitched calls might be primarily affected by mine activities and traffic noise (such as verdins or broad-billed hummingbirds), as well as mammals with secretive behaviour (such as coyotes and coatimundis). **Local biodiversity is thus likely to decline through biotic homogenization.**

From an anthropological point of view : (nature related) sounds appear as crucial components of local ambiances and of the territory. The land has, for members of the community, a distinct sound signature which seems threatened by the mining activities.



« What characterizes Patagonia in terms of sounds? Well, it's the quiet, the silence of the mountains, all the animal sounds: the gruttings of the javelinas, coyotes at dusk, in spring the sound of hummingbird wings, the bird songs, winds, the night owls, also the sound of water flowing during the monsoon season... » (Nicole, local inhabitant)



« Due to the surrounding mining activities, and the traffic, the Sonoita Creek preserve has constant highway noise, instead of hearing the birds you hear traffic. » (Robin, Birder)

A threaten ambience... With consequences for local biodiversity

"Behind me you can hear the vehicles and that would increase. The wildlife I have always observed, they hear me coming, so their earing is extremely accute. It is their early warning system so it is an immediate impact for them and I am very concerned about their future." (Carolyn, funder of the Patagonia Area Resource Alliance)



Listen and be heard to mobilize



Soundscapes are emerging as a tool to inform socio-environmental transformations in rapidly changing territories. Citizens are organizing themselves to try to lower the impact of mine extractions on the environment, creating more or less institutionalized groups, promoting protection measures on the territories or collectively purchasing land to stop its progression. **Sonatas aims at showing how, in such situations, soundscape-scale investigation for ecological survey or mentioning noise pollutions could be a tool for action in public policies.**



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