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Observatoire Montréalais de l'Environnement Sonore

# Policy Lab Project
# A Noise Observatory for Montreal

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Work presented to the City of Montreal
Under the supervision of Dr. Will Straw and Nathalie Duchesnay

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# Executive Summary

The City of Montreal mandated a team of Master of Public Policy students from the Max Bell School of Public Policy to assess the necessity and feasibility of a noise observatory in Montreal. This report answers to that mandate and highlights important elements to consider in establishing a noise observatory in Montreal.

Noise is increasingly an issue of public health, the environment, the economy and quality of life in Canada. In major cities like Montreal, governments are grappling with increased noise pollution and the subsequent health, economic, legislation, and abatement costs, while recognizing that some sounds can be pleasant and should be promoted in the interest of the populations' wellbeing.

Addressing these noise and sound-related issues represent a serious policy challenge that calls for a wide range of policy solutions.

In 2017, the Montreal administration officially proposed the creation of an observatory to monitor noise in Montreal. Noise and sound observatories are an emerging response to the recognition that addressing noise requires comprehensive, multidisciplinary strategies and data.

This report evaluates the issue of noise and its consequences and examines the range of noise management strategies across other international benchmark jurisdictions: Auckland, Australia, Barcelona, Brussels, Delhi, Japan, Lyon, London, Madrid, New York City and Paris. The report observes that while many urban jurisdictions have moved to address noise, it remains a persistent problem for growing cities that struggle to implement comprehensive approaches.

The report includes 37 recommendations on the potential structure of Montreal's observatory and on its daily operations and activities.

The recommendations support the principle that an observatory for Montreal should take the form of an independent, not-for-profit institution with key partners and stakeholders within its governance structure. It is also recommended that the main operations of an observatory in Montreal should include data collection, expertise building, collaboration, communications and public awareness, and cultural, heritage and Soundscaping promotion. With such a structure and design, the observatory established in Montreal will be an important step towards addressing noise and sound-related issues and improving the sound environment of the City of Montreal.

# 1.0 Introduction

In 2016, *Projet Montréal*, then the opposition party in Montreal, first proposed the creation of a noise observatory for the city.[1] This proposal came partly in response to the growth of noise pollution as a policy issue in Montreal, as well as the growing European movement of establishing observatories to collect, analyze and publish noise data.

Noise is increasingly an issue of public health, the environment, the economy and quality of life that governments are being called to address. Definitions of noise vary across jurisdictions, but it is generally understood as an unwanted or harmful sound, as well as a form of pollution. Other forms of pollution, such as air and water pollution, have demonstrably captured national attention, with international actions to address climate change and mitigate the pollution of our waters. However, noise pollution has had a lower profile. This may be because noise is ubiquitous and is a characteristic sign of urbanization, population growth, economic development and culture.

Urban noise is particularly on the rise as 68% of the world's population will live in urban areas by 2050.[2] As one of the most livable cities in the world, Montreal's population is projected to grow by 18.5% by 2041.[3] The city also faces unique challenges with regards to noise. More than 60% of the population on the island of Montreal report experiencing nighttime noise levels above the World Health Organization (WHO)-recommended level of 55 dB(A).[4,5] A 2014 survey found that nearly 20% of Montrealers reported experiencing sleep disturbance due to environmental noise.[6]

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[1] Ville de Montréal, "Procès-verbal de l'assemblée ordinaire du conseil municipal du 20 juin 2016," Summary of Proceedings of Municipal Council Meeting, Montreal, June 20, 2016, https://ville.montreal.qc.ca/documents/Adi_Public/CM/CM_PV_ORDI_2016-06-20_13h00_FR.pdf.

[2] United Nations Department of Economic and Social Affairs, "68% Of the World Population Projected to Live in Urban Areas by 2050, Says UN," May 16, 2018, https://www.un.org/development/desa/en/news/population/2018-revision-of-world-urbanization-prospects.html.

[3] Institut de la statistique du Québec, *Perspectives Démographiques Du Québec Et Des Régions, 2016-2066,* July 23, 2019, https://www.stat.gouv.qc.ca/statistiques/population-demographie/perspectives/perspectives-2016-2066.pdf.

[4] Note : A-weighted decibels (dBA) are the common measurement units, which approximates how sound is heard and experienced by the human ear and accounts for the human hearing thresholds. Decibels (dB) is the unit for unweighted sound pressure levels, which takes into account the entire range of sound frequency, including the very low and high frequencies that human ears may not hear equally.

[5] David Kaiser, Louis-François Tétreault, Sophie Goudreau, Stéphane Perron, Audrey Smargiassi, Céline Plante and Cong Dung Tran, *Le bruit et la sante: État de situation — île de Montréal,* Centre intégré universitaire de santé et de services sociaux du Centre-Sud-de-l'Île-de-Montréal, (2017). https://santemontreal.qc.ca/fileadmin/fichiers/professionnels/DRSP/sujets-a-z/Bruit/Feuillet_BRUIT_2017.pdf

[6] *Ibid.*

The economic impact of noise on society in Quebec was estimated to be $830 million in 2017.[7] The battle over noise has impacted neighbourhood harmony, forced the closure of businesses and led boroughs to develop local bylaws in an attempt to set guidelines over acceptable noise levels.[8]

Like all cities, Montreal has unique challenges in mitigating noise and managing its environmental soundscapes. Its world-renowned festivals and tourist attractions bring in over 11 million visitors per year.[9] The nightlife and arts industries, factories, construction, airports and road traffic are all leading causes of environmental noise pollution. Most recently, the COVID-19 pandemic has prompted a cultural reflection on urban noise as Montrealers experienced record quiet in the city's major arteries and commercial districts.[10]

In response to residents and organizations mobilizing over noise management, governments around the world have introduced noise policies predominantly through a regulatory and enforcement lens. Policies focus on fines for noise violations, establishing quiet zones, and increasing police and bylaw officers' resources to handle complaints. Yet, when cities develop noise policy, they are often unequally enforced and lack the data to be effective. Cities also tend to ignore the unique aspects of urban sound, such as moving water and open-air markets, which can positively impact cities' quality of life.

While they were more uncommon a few years ago, observatories are an increasingly popular response to address the issue of noise and noise policy development. Far from being passive witnesses to noise, observatories have become centres of expertise, data-driven policy, research and innovation.

This report aims to assess the need and feasibility for an observatory of environmental sound in Montreal. The report evaluates the issue of noise in the city and examines the range of noise management strategies used across other international jurisdictions. The report concludes that

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[7] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*, Gouvernement du Québec, 2019, https://www.msss.gouv.qc.ca/professionnels/documents/bruit-environnemental/19-214-02w_vision_orientation_bruit_complet.pdf.

[8] "Montreal Music Venue Divan Orange to Shut next Spring," *Montreal Gazette*, November 28, 2017, https://montrealgazette.com/news/local-news/montreal-music-venue-divan-orange-to-shut-next-spring.

[9] Tourisme Montréal, "Bilan Touristique Annuel 2019 à Montréal," 2019, https://toolkit.mtl.org/bynder/media/AD5A7131-00D8-463E-A7F5FFB28D104588/download?filename=Bilan-annuel-2019&extension=pdf.

[10] Mia Rabson, "Drop-in Noise Pollution Lets Earthquake Scientists Record New Data," *The Globe and Mail*, April 13, 2020, https://www.theglobeandmail.com/canada/article-drop-in-noise-pollution-lets-earthquake-scientists-record-new-data/.

Montreal should establish an environmental sound observatory using best practices from around the world. The report recommends potential key components and activities for an environmental sound observatory in Montreal, as well as a governance model to structure it.

# 2.0 Noise in Montreal

Like many cities, Montreal is faced with various noise and sound-related issues that influence the daily lives of its population. Noise pollution is the product of many factors and sources of emission that require multiple public and private solutions. This section will present the current noise and sound issues facing Montreal, as well as the strategies mobilized by the city and other stakeholders to address them.

## 2.1 Current noise issues in Montreal

There is limited data on noise in Montreal. In 2010, the Montreal Direction of Public Health conducted a noise sampling at 87 sites in residential areas in Montreal and found that noise levels generally surpassed the WHO-recommended limit.[11] A 2014-2015 Quebec Population Health Survey found that 16.4% of the Montreal population over the age of 15 reported being greatly disturbed by at least one source of noise over the past year.[12] The key sources of excessive noise in Montreal are transportation, neighbourhood noise, construction, and aircraft.[13] Even though environmental noise in Quebec's urban centres is increasing as populations and densification increase, there is no systematic collection of noise data in the province.

Noise issues do not proportionately affect all Montrealers. Research investigating the link between socioeconomic status and environmental noise exposure in Montreal has found that exposure to noise is higher in socioeconomically disadvantaged areas.[14]

### Road and railway noise

Hundreds of thousands of residents are exposed to excessive transport noise during daytime and nighttime hours. Road noise is a leading source of noise globally and in Montreal, with proximity to major roads being a key factor in the excessive noise experienced by residents and

[11] Karine Price et al., "Avis De Santé Publique Sur Le Bruit Du Transport Et Ses Impacts Potentiels Sur La Santé Des Montréalais" (Montréal, Qc: Agence de la santé et des services sociaux, Direction de santé publique, secteur Environnement urbain et santé, 2014), https://doi.org/https://santemontreal.qc.ca/fileadmin/fichiers/professionnels/DRSP/sujets-a-z/Bruit/Avis_Bruit_01e5_web.pdf.

[12] Hélène Camirand, Issouf Traoré, and Jimmy Baulne, "L'Enquête Québécoise Sur La Santé De La Population, 2014-2015 : Pour En Savoir plus Sur La Santé Des Québécois. Résultats De La Deuxième Édition" (Institut de la statistique du Québec, 2016), https://www.stat.gouv.qc.ca/statistiques/sante/etat-sante/sante-globale/sante-quebecois-2014-2015.pdf.

[13]. Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.

[14] Laura M Dale, Sophie Goudreau, Stephane Perron, Martina S Ragettli, Marianne Hatzopoulou and Audrey Smargiassi, "Socioeconomic status and environmental noise exposure in Montreal, Canada," *BMC Public Health,* 15:205, (2015) DOI 10.1186/s12889-015-1571-2

businesses.[15] Railway noise is also an issue particular to Montreal because of its extensive railway network of commuter train services and freight train services.[16] In 2016, residents of the Mercier neighbourhood organized to oppose the proposed construction of a rail and road hub, citing noise and the loss of property value as key concerns.[17]

Of its 1.8 million households, about 175 000 households on the island of Montreal are located less than 50 metres from a major road, while 68 000 households are located within 150 metres of a railway track.[18]

## Aviation noise

Aircraft and airport-related noise is the most well-documented noise issue in Montreal. Approximately 34,000 households are located in areas that are highly exposed to air traffic noise near the airport.[19] In 2018, a class-action lawsuit that was filed by *Les Pollués de Montréal-Trudeau*, a citizens' group of homeowners living along the flight path of the Montréal-Trudeau International Airport, was authorized to move forward.[20] The lawsuit targeted the airport, the Federal Ministry of Transport and Nav Canada, the operator of Canada's civil air navigation system. Residents complained about loud, commercial airplanes flying over frequently, and the costs to homeowners for soundproofing to alleviate the noise exposure.[21] The *Aéroports de Montréal* has disputed the accuracy of citizens' noise level readings with its own noise readings, which are professionally calibrated and show noise levels within acceptable ranges.[22] The debate over aircraft noise in Montreal has become a high profile issue for communities under flight paths, including Ahuntsic, Saint-Michel, Rosemont, Villeray and Parc-Extension.

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[15] David Kaiser, et al, *Le bruit et la sante: État de situation — île de Montréal,* Centre intégré universitaire de santé et de services sociaux du Centre-Sud-de-l'Île-de-Montréal.
[16] Transport Québec, *Réseau ferroviaire Québécois*, May 2015, https://www.transports.gouv.qc.ca/fr/ministere/role_ministere/partage-responsabilite-activites/Documents/Reseau-ferroviaire-QC.pdf
[17] "Mercier Residents Fight Plan for New Industrial Park," *CBC News*, August 22, 2016, https://www.cbc.ca/news/canada/montreal/montreal-mercier-industrial-park-resident-worries-1.3730553.
[18] David Kaiser, et al, *Le bruit et la sante: État de situation — île de Montréal,* Centre intégré universitaire de santé et de services sociaux du Centre-Sud-de-l'Île-de-Montréal.
[19] *Ibid.*
[20] Verity Stevenson, "Class Action Lawsuit to Fight Montreal Airport Noise Pollution Gets Go-Ahead," *CBC News*, April 11, 2018, https://www.cbc.ca/news/canada/montreal/class-action-airplane-noise-1.4614458.
[21] *Ibid.*
[22] "Trudeau Airport Noise Regularly Exceeds 'Annoyance' Levels, According to Group," *CBC News*, August 19, 2015, https://www.cbc.ca/news/canada/montreal/trudeau-airport-noise-regularly-exceeds-annoyance-levels-according-to-group-1.3196409.

## Neighbourhood and Nightlife noise

Neighbourhood noise is a high-profile noise issue and can often be the most complex source of noise for cities to tackle. The interpersonal nature of neighbourhood noise complaints can impact communities' dynamics and culture as residents struggle to deal with noise abatement due to a lack of clear guidelines for unacceptable noise and remedies to address it.

Clubs, bars and music venues are a notable part of Montreal's sound culture and have historically been the focus of public debate and government intervention. The Plateau-Mont-Royal neighbourhood of Montreal has been a site of significant noise disagreements between residents and venue owners for many years.[23,24]

The borough has created guidelines to help bar and venue owners soundproof their property, but the noise has become a proxy for the debate on the location of venues, the plight of small businesses and Montreal's nightlife scene. There is another debate over who should pay for venues' soundproofing and other remedies, posing an additional challenge for businesses and government. Before it closed in part due to noise complaint fines, Plateau music venue *Le Divan Orange* was awarded municipal and borough grants to help install soundproofing.[25]

The closing of *Le Divan Orange* and other long-time music venues has sparked another debate around the loss of culture in Montreal and how noise interacts with urban planning, rising rents and economic development.[26,27] Without any systematic noise measurement or publicly available information on noise levels, noise exposure in the entertainment sector and residential areas persists. More recently, in re-imagining a post-COVID-19 nightlife scene, local artists and venue operators have called on the city to address the noise dilemma by creating a noise policy to help save Montreal's nightlife culture.[28]

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[23] "Montreal Music Venue Divan Orange to Shut next Spring," *Montreal Gazette*, November 28, 2017, https://montrealgazette.com/news/local-news/montreal-music-venue-divan-orange-to-shut-next-spring.
[24] Lorraine Carpenter, "The Plateau Noise Complaint Saga Continues," *Cult MTL*, March 10, 2014, https://cultmtl.com/2014/03/noise-complaints/.
[25] Nantali Indongo, "Soundproofing the Future of a Plateau Music Venue," CBC News, June 6, 2015, https://www.cbc.ca/news/canada/montreal/soundproofing-the-future-of-le-divan-orange-1.3102505.
[26] Cora MacDonald, "How Can Small Montreal Venues Avoid Shutting off the Lights for Good?" *Montreal Gazette*, March 9, 2018, https://montrealgazette.com/entertainment/music/how-can-small-montreal-venues-avoid-shutting-off-the-lights-for-good.
[27] Olivier Cardotte, "Small Music Venues Are Disappearing in Montreal: Fringe Arts," *The Link,* December 10, 2019. https://thelinknewspaper.ca/article/small-music-venues-are-disappearing-in-montreal.
[28] Léa Papineau Robichaud, "Un Conseil Pour Veiller Aux Intérêts De La Vie Nocturne Montréalaise," Le Journal de Montréal, June 9, 2020, https://www.journaldemontreal.com/2020/06/09/un-conseil-pour-veiller-aux-interets-de-la-vie-nocturne-montrealaise.

## Other

In 2011, residents of the neighbouring municipality of Saint-Lambert formed a group that advocates for the reduction of noise coming from Montreal's Parc Jean Drapeau and surrounding areas.[29] In 2018, Montreal, Saint-Lambert and the *Société du Parc Jean-Drapeau* partnered on a project to measure decibel levels during large-scale events and concerts. The goal was to better understand how residents experienced noise in the Old Port and Saint-Lambert to develop measures to mitigate its impact.[30] The following year, noise mitigation measures were introduced for Parc Jean-Drapeau, including new noise level limits, a complaints mechanism, and noise measurement requirements.

Construction, outdoor activities, and the industrial sector are other key sources of excessive noise in Montreal. Noise complaints data from 2011 shows that the majority of resident complaints were about noise from mechanical equipment, followed by construction and outdoor events (See Figure 2). Complaints data highlight an interesting discrepancy. While road and aviation have empirically been found to be the biggest contributors to noise in Montreal, residents tend to complain about noise, which is less transient and has a fixed, identifiable emitter such as a business.

Tourism is a key industry in Montreal and impacts noise levels in certain areas, particularly in the downtown core. The growth of hotels and short-term rentals like Airbnb has led to increased noise complaints as visitor numbers continue to grow. Citizens' complaints about tourism-related noise have led, in part, to the city implementing new bylaws to limit short-term rentals.[31]

Factories and industrial activities have been identified as a noise issue for residents, particularly in the east end of the island.[32]

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[29] Silence Saint-Lambert, "Qui Nous Sommes," September 20, 2019, https://silencesaintlambert.org/about/.
[30] "Pilot Project Aims to Measure Concert Noise Levels in Saint-Lambert, Old Port," *CBC News,* July 25, 2018. https://www.cbc.ca/news/canada/montreal/st-lambert-concert-noise-1.4760702.
[31] "City Moves to Restrict Airbnb Short-Term Rentals Downtown," *CBC News,* April 12, 2018, https://www.cbc.ca/news/canada/montreal/city-moves-to-restrict-airbnb-short-term-rentals-downtown-1.4615578
[32] David Kaiser, et al, *Le bruit et la sante: État de situation — île de Montréal,* Centre intégré universitaire de santé et de services sociaux du Centre-Sud-de-l'Île-de-Montréal.

Figure 1 Noise in Montreal

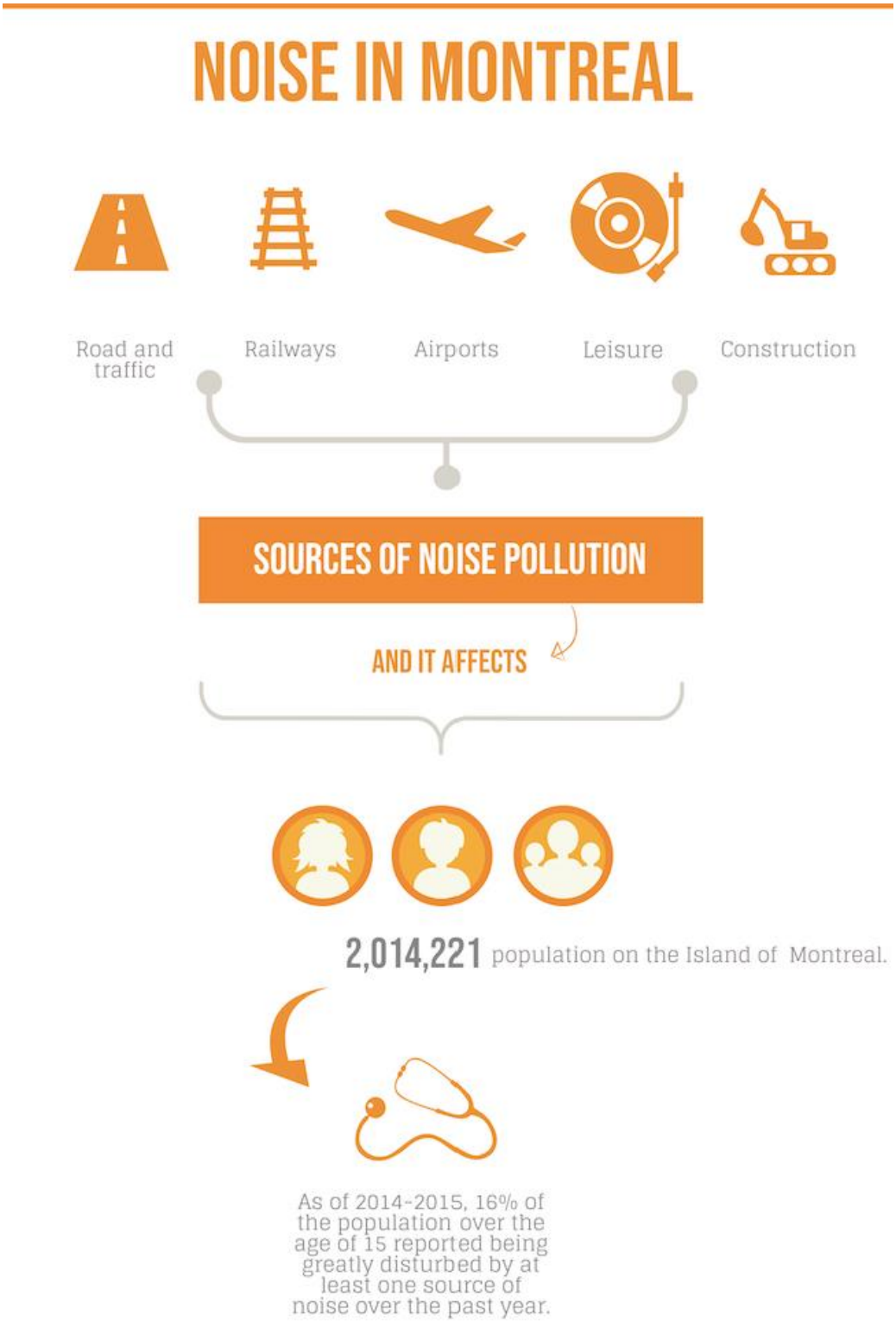
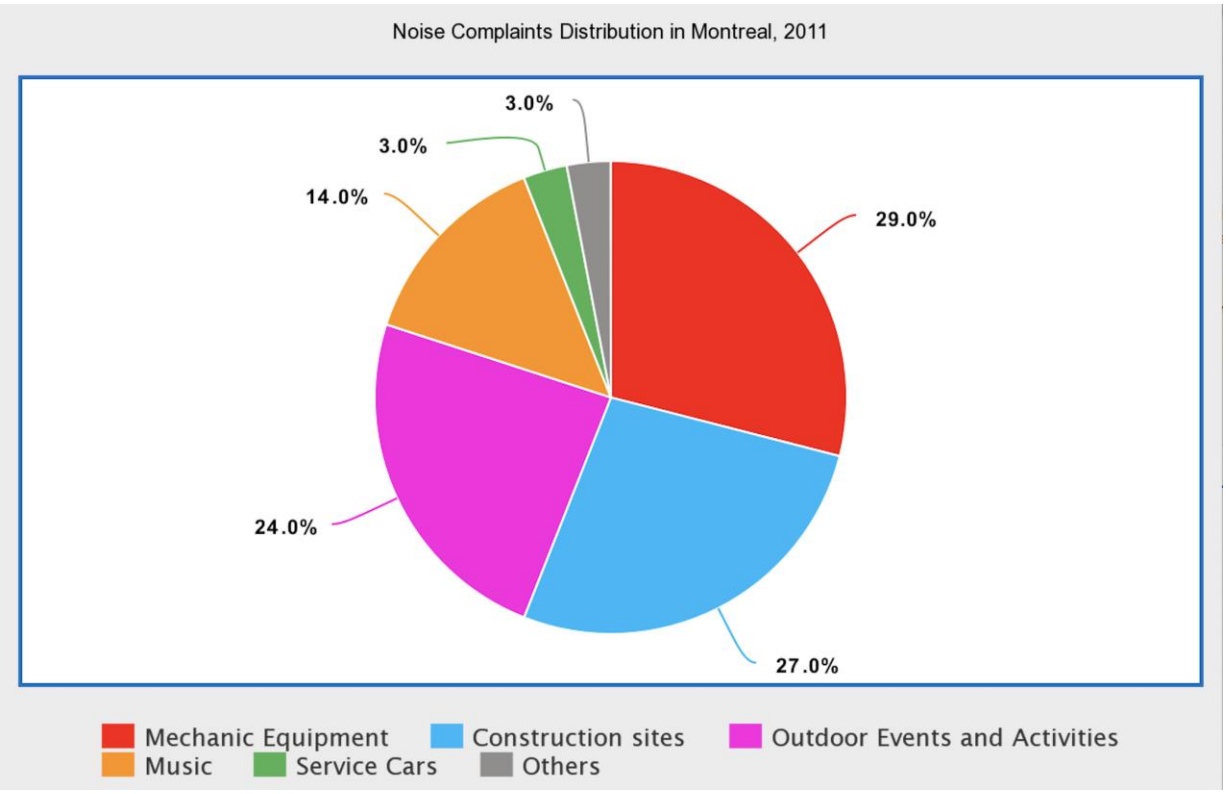


Figure 2 Noise complaints distribution in Montreal




Source: Arrondissement de Ville-Marie. *Bilan sur le bruit 2011.* Direction de l'aménagement urbain et des services aux entreprises. February 2012.

## 2.2 Current policy and regulatory context

The government, public and private stakeholders have designed different strategies to address noise and sound-related issues. These strategies and policies fall under a municipal, provincial and federal framework. They are briefly presented and analyzed below, along with the respective regulatory framework that supports them.

### Government policy responses

Noise management in Quebec falls under the portfolios of at least 10 provincial ministries, 11 governmental organizations, and over 1000 municipalities.[33] The diffused responsibility for noise makes it a particularly complex issue to tackle.[34] In 2019, the *Ministère de la Santé et des Services sociaux du Québec* (MSSS) launched a consultation on environmental noise in Quebec, noting the organizational, health, policy and public awareness challenges of mitigating noise. The report

[33] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.
[34] *Ibid*.

proposed key areas of focus for the government, including establishing a collaborative and coherent approach to noise management, the building of expertise on noise and its impacts on communities, and increased public awareness and stakeholder engagement.[35]

While federal and provincial acceptable noise levels are publicly available, noise data is not regularly collected in Quebec. Citizens' groups and activists have been calling on governments to collect and publicly release noise data, particularly in areas where noise exceeds the WHO-recommended levels.[36]

Local noise level guidelines in Montreal differ between boroughs, making noise a highly decentralized issue without a comprehensive city strategy. The 311 complaints system is based on a decentralized approach to noise management where individual boroughs handle noise complaints in some cases, and centralized services like the police will respond in other situations. Regulations are enforced by borough staff or the police, depending on the type of noise. Police are the first responders to most noise complaints, responding to complaints about entertainment establishments, restaurants, neighbours and commercial waste collection. Noise from activities such as construction, heavy vehicle deliveries and excessive barking is often handled by the borough public servants. Between 2016 and 2020, the 311 line received more than 4200 calls regarding noise.[37] Half of those calls were directed to a specific borough, while the other half were directed to services centers at the city level.

In recent years, the boroughs of Le-Plateau-Mont-Royal and Ville-Marie have employed sound technicians to handle certain noise complaints. Most boroughs rely on city employees without specific noise expertise, who usually have training in urban planning or infrastructure management, to respond to local noise complaints. The *Service de Police de la Ville de Montréal* (SPVM), who is often the first responder to noise complaints, especially during nighttime hours, has only one manager in charge of specifically overseeing noise and related nuisances. When responding to noise complaints, police officers are not equipped with sound meters to determine whether noise exceeds decibel limits and must use their discretion in deciding to issue a fine.[38]

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[35] *Ibid*.

[36] One notably vocal group has been the RQCB; RQCB, "Lois Québécoises – Pour une politique nationale du bruit digne de ce nom, " Le Regroupement québécois contre le bruit, "Lois Québécoises - Pour une Politique Nationale du Bruit Digne de ce nom," accessed July 7, 2020. http://www.rqcb.ca/fr/reglements.php.

[37] Ville de Montréal, "Demandes de services citoyennes (Requêtes 311), " Portail données ouvertes, Last modified July 6th, 2020, http://donnees.ville.montreal.qc.ca/dataset/requete-311

[38] Lorraine Carpenter, "The Plateau Noise Complaint Saga Continues," Cult MTL, March 10, 2014, https://cultmtl.com/2014/03/noise-complaints/.

Since there is no central noise department in the City of Montreal, there is a lack of administrative coordination between various boroughs and the SPVM when it comes to noise management strategies.

Recently, Montreal's Economic Development department hired its first Noise and Nightlife Commissioner. The Commissioner's mandate includes the creation of a noise observatory for the city, as well as handling night policy. This new role is the first of its kind in the city and represents a new orientation towards developing specific policies for noise and nightlife in Montreal. The city needs a coherent approach to managing noise issues in order to coordinate between the various government bodies.

In 2013, Québec formed the *Groupe d'Experts Interministériel sur le Bruit Environnemental au Québec* (GEIBE), which has contributed to the formation of more comprehensive approaches to provincial noise management.[39]

Other noise issues, such as aircraft or railway, are handled at the federal level. Aircraft and railways complaints fall under the national portfolio of Transport Canada, the Canadian Transportation Agency and individual airports.[40, 41]

## Non-governmental policy responses

Non-governmental organizations have also developed policies in response to growing noise concerns. The Port of Montreal receives noise complaints from residents regarding excessive noise from ships and dockings. It has introduced various noise mitigation measures to reduce noise exposure during port operations, including noise buffers and low-frequency noise alarms.[42]

In 2018, *Aéroports de Montréal* constructed a $5.5 million sound wall to mitigate noise from Montréal-Pierre Elliott Trudeau International Airport for nearby residents.[43] With the growing

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[39] "The GEIBE gathers experts from the Ministry of Health and Social Services, the Ministry of Transport, the Ministry of Municipal Affairs and Housing, the Ministry of the Environment and the Fight against Climate Change, the Ministry of Energy and Natural Resources as well as the INSPQ and two public health departments."
[40] Ville de Montréal, "Le bruit," Accessed July 7, 2020, http://ville.montreal.qc.ca/portal/page?_pageid=7297,102521573&_dad=portal&_schema=PORTAL.
[41] Canadian Transportation Agency, "Complaints about Rail Noise and Vibration," August 29, 2016, https://www.otc-cta.gc.ca/eng/complaints-about-rail-noise-and-vibration.
[42] Port of Montreal, "Mitigation and environmental protection measures," accessed July 6, 2020. https://www.port-montreal.com/en/the-port-of-montreal/community/mitigation-measures-and-environmental-protection.
[43] John Meagher, "Dorval Residents Critical of New $5.5. Million Airport Sound Wall," *Montreal Gazette*, October 3, 2018. https://montrealgazette.com/news/local-news/west-island-gazette/dorval-residents-critical-of-new-5-5-million-airport-sound-wall.

evidence of aircraft and airport noise impacting Montreal residents, *Aéroports de Montréal* also launched a noise management action plan in 2019. The plan includes new noise mitigation requirements for air carriers and pilots. The project has also committed to supporting the implementation of a noise observatory by the City of Montreal.[44]

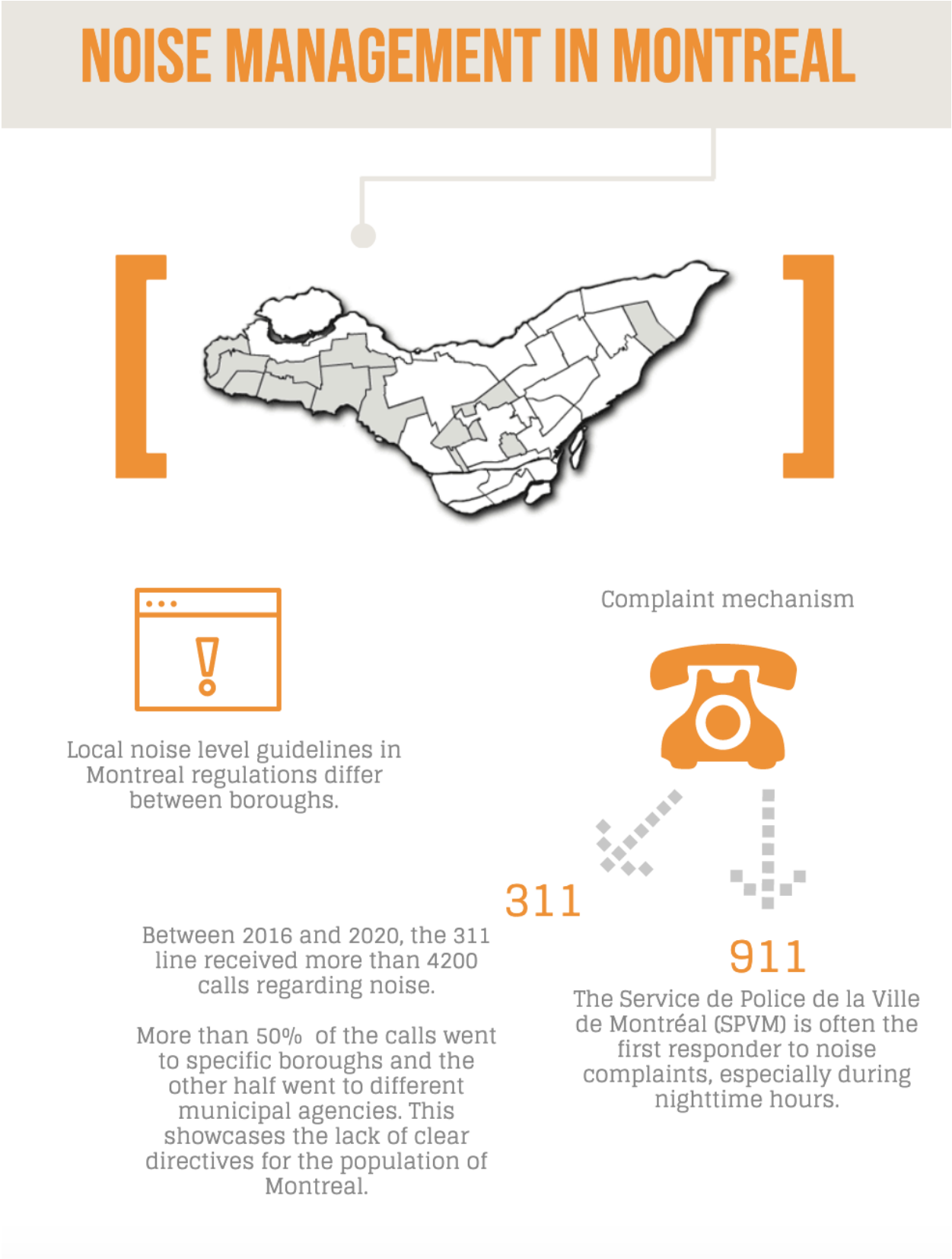
In 2019, Purolator announced a collaboration with the City of Montreal called Project Colibri that aims to implement a zero-emission delivery option to reduce noise and air pollution on its streets.[45] The project is an innovative private-public sector response to pollution concerns and highlights the growing focus on noise pollution along with other forms of pollution.

Local community groups have also become active in advocating for Montreal to adopt a strategy for noise management. The *Regroupement Québécois Contre Le Bruit* gathers individuals together from across the province with the goal to express their concern about noise pollution and demand that cities take concrete actions.[46]

Other key stakeholders in Montreal's noise debate that have developed policy with respect to noise include *Tourisme Montréal*, the *Sociétés de Développement Commerciales*, *Canadian Pacific, Canadian National* and *Quartiers des Spectacles Montréal*.

[44] Aéroports de Montréal, "Plan D'action Sur La Gestion Du Climat Sonore," Accessed July 7, 2020, https://www.admtl.com/fr/consultation.
[45] "Montreal Launches Zero-Emission Delivery Option to Reduce Truck Traffic," *CBC News,* September 13, 2019, https://www.cbc.ca/news/canada/montreal/montreal-zero-emission-deliveries-1.5282124.
[46] Le Regroupement québécois contre le bruit, "Lois Québécoises - Pour une Politique Nationale du Bruit Digne de ce nom," accessed July 7, 2020, http://www.rqcb.ca/fr/reglements.php.

Figure 3 Noise management in Montreal



# 3.0 Impacts of noise

The WHO defines noise as unwanted sound as well as sound whose level is sufficient to cause adverse health effects.[47] This is the definition that has been generally adopted in Quebec.[48]

Part of the fundamental difficulty with understanding noise is how relative and non-linear it can be. Human reactions and hearing sensitivities are diverse and subjective. Humans' reported annoyance with noise and their awareness of it has been correlated with higher income, higher education and proximity to major streets.[49] In a quiet area, the introduction of a single noise such as a car alarm or a noisy stereo can be disturbing while such a noise is barely noticeable in a noise-blighted area.

The primary debate around noise pollution centres on its adverse public health impacts. Along with health, research on the economic and environmental impacts of noise pollution has made it clear that noise has adverse impacts on many aspects of society. Nevertheless, noise falls under a broader category of sound. It is important to recognize that some sounds have positive impacts on humans and offer great potential to improve residents' wellbeing. This section explores the negative and positive impacts of noise and sounds.

## 3.1 Public health impacts

Human ears represent one of the primary defence mechanisms that warn us about nearby danger or immediate harm. As such, our ears are said to "have no eyelids"; they operate 24/7. While humans can adjust to listening to high levels of noise, the human ear itself cannot adjust without suffering damage. For those reasons, many organizations around the world consider noise pollution to be the second biggest environmental threat to people's health after air pollution.[50]

The specific noise exposure thresholds for negative health impacts on humans vary.[51] Figure 4 demonstrates human thresholds for noise.

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[47] World Health Organization Europe. Rep. *Burden of Disease from Environmental Noise*, 2011, https://www.who.int/quantifying_ehimpacts/publications/e94888.pdf?ua=1.

[48] David Kaiser, et al, *Le bruit et la sante: État de situation — île de Montréal,* Centre intégré universitaire de santé et de services sociaux du Centre-Sud-de-l'Île-de-Montréal.

[49] Saad Abo-Qudais, and Hani Abu-Qdais, "Perceptions and Attitudes of Individuals Exposed to Traffic Noise in Working Places," *Building and Environment* 40, no. 6 (2005): 778–87, https://doi.org/10.1016/j.buildenv.2004.08.013.

[50] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.

[51] World Health Organization Regional Office for Europe, *Environmental Noise Guidelines for the European Region*, 2018, https://www.euro.who.int/__data/assets/pdf_file/0008/383921/noise-guidelines-eng.pdf

Figure 4 Noise level scale and human perception

| **Acoustic phenomenon** | **Noise level (dB)** | **Subjective perception** |
|---|---|---|
| Airplane takeoff (50m distance) | 140 | Pain |
| Airplane takeoff (300m distance) | 120 | Pain threshold |
| Concerts, clubs | 110 | Dangerous level, bearable for a short period of time |
| Jackhammer (10m distance) | 100 | Dangerous level |
| Lawn mower | 90 | Dangerous level, uncomfortable, ear plugs recommended |
| Animated street | 70 | Normal to noise |
| Normal conversation | 60 | |
| Restaurant | 50 | Normal |
| Normal human conversation | 40 | Calm |
| Forest | 30 | |
| | 20 | Very calm |
| Acoustic laboratory (insulated from external sounds) | 10 | |
| | 0 | Hearing threshold |

Adapted from Sophie Goudreau, "Bruit environnemental et inégalités d'exposition sur l'ile de Montréal," (Master's thesis, Université de Québec à Montréal, 2015), https://archipel.uqam.ca/7886/1/M13997.pdf.

Amongst the different sources of noise, road traffic and aircraft noise are reported as the most disturbing noise sources. Studies have established causal links between these sources of noise and various health problems.[52,53] In addition, the sources of excessive urban noise continue to

[52] Richard Martin, Pierre Deshaies and Maurice Poulin, *Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains*, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.
[53] Wolfgang Babisch, "Updated exposure-response relationship between road traffic noise and coronary heart diseases: A meta-analysis," *Noise and Health* 16, no. 68 (2014): 1-9, http://www.noiseandhealth.org/article.asp?issn=1463-1741;year=2014;volume=16;issue=68;spage=1;epage=9;aulast=Babisch

evolve and increase as cities develop. Noise sources are specific to their geography and other contextual elements. For example, air conditioning units are a seasonal noise source, while drones are a relatively new urban sound that generally does not exceed noise levels but can annoy nearby listeners.

The *MSSS* has identified noise as an environmental pollutant which poses risks for the population's health and quality of life.[54] More specifically, noise has been linked to a wide array of negative health consequences by the *MSSS* and the *Institut National de Santé Publique du Québec (INSPQ),* as summarized in Figure 5.[55, 56, 57,58]

[54] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.
[55] *Ibid*.
[56] Richard Martin, Pierre Deshaies and Maurice Poulin, *Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains*, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.
[57] Richard Martin and Mathieu Gauthier, *Meilleures pratiques d'aménagement pour prévenir les effets du bruit environnemental sur la santé et la qualité de vie,* l'Institut national de santé publique du Québec, September 2018, https://www.inspq.qc.ca/sites/default/files/publications/2450_meilleures_pratiques_amenagement_effets_bruit_environnemental.pdf.
[58] World Health Organization Regional Office for Europe, *Night noise guidelines for Europe.*

Figure 5 Negative health impacts of noise pollution

| **Impact** | **Information** |
|---|---|
| Disturbance in sleep and daytime sleepiness | The noise threshold for sleep is lower than daytime thresholds. Quality sleep is essential for maintaining good health. Noise pollution is known to impair sleep at night significantly and to have enduring impacts the day following a poor night of sleep. Sleep disturbance can cause concentration and memory problems, as well as other physiological issues like muscle tension and high blood pressure. Children and shift workers are vulnerable groups with regard to sleep disturbance. |
| Hearing impairment | Hearing impairments caused by a lasting exposure to high noise levels are common and well documented. They include hearing loss of various magnitude, tinnitus and hissing and buzzing impairments, amongst other issues. |
| Cardiovascular disorders and disease | Chronic exposure to high noise levels is linked to hypertension in adults, as well as to myocardial infarction. Other documented effects of high noise level exposure include strokes, type 2 diabetes and obesity. |
| Mental health issues | High noise level exposure is presumably linked to increased anxiety and depression symptoms. |
| Annoyance | The World Health Organization recognizes annoyance regarding noise pollution as a public health issue, as it can lead to behavioural changes and negative emotions that impact individuals' overall wellbeing. Annoyance usually increases when noise interferes with daily activities such as communicating with other people, concentrating or relaxing. |
| Children cognitive performance and memory | Noise pollution is known to impact reading capacities, memory and speaking abilities in children, specifically in their academic environment. Studies suggest lower academic results by children in classrooms that are more exposed to noise pollution, in part because some children might simply not be able to hear some words pronounced by their teacher. Exposure to noise pollution has also been studied in relation to attention disorders. |
| Stress | Noise exposure can generate a physiological stress response in humans. Additionally, dealing with the interpersonal nature of noise (complaints, conflict) can also contribute to stress, unhappiness, and frustration. |

Sources: MSSS, *Vision Et Orientations Gouvernementales*; Richard Martin, et al., *Avis sur une politique québécoise;* Richard Martin and Mathieu Gauthier, *Meilleures pratiques d'aménagement;* WHO Regional Office for Europe, *Night noise guidelines for Europe.*

The impact of noise on school children's cognitive performance and memory has been well documented and is believed to be even more significant for children that live and go to school in economically disadvantaged areas, as they suffer from noise pollution 24 hours per day.[59]

The Montreal *Direction régionale de santé publique (DRSP)* concluded a five-year review of noise on the island in 2014. They concluded that Montrealers were being exposed to potentially harmful levels of noise that must be mitigated.[60] More than 60% of the population on the island of Montreal is exposed to night-time noise levels that are higher than recommended limits. Roughly 17% of Montrealers are strongly disturbed by transportation-related noises, while 6% of Montrealers are disturbed by non-transport related noises such as commerce, nightlife, manufacturing and construction. The study also notes that roughly 20% of residents reported sleep disturbance caused by environmental noise. Another Montreal study looked at where Montreal cyclists are exposed to the most air and noise pollution, drawing a connection between the type of cycling infrastructure in the city and the level of harmful noise exposure cyclists are subject to.[61]

## 3.2 Economic impacts

Noise can impose considerable healthcare costs to society. The MSSS has estimated the cost to Quebec of transport-related noise pollution for 2017 was $830 million.[62] This is in comparison to Canada, where the cost of transport-related noise pollution is unclear and was estimated to fall between $345 million and $3 billion in 2015.[63]

In 2011, the WHO estimated that 1 million healthy life years are lost every year because of traffic noise in Western Europe through cardiovascular disease, cognitive impairment and stress-related illnesses.[64]

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[59]. Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.

[60]David Kaiser, et al, *Le bruit et la sante: État de situation — île de Montréal,* Centre intégré universitaire de santé et de services sociaux du Centre-Sud-de-l'Île-de-Montréal.

[61] Philippe Apparicio and Jérémy Gelb, "Cyclists' Exposure to Road Traffic Noise: A Comparison of Three North American and European Cities," *Acoustics* 2 no.1 (2020): 73-86, https://doi.org/10.3390/acoustics2010006

[62] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.

[63] *Ibid.*

[64] World Health Organization Regional Office for Europe, *Burden of disease from environmental noise. Quantification of healthy life years lost in Europe*, 2011, https://www.euro.who.int/en/publications/abstracts/burden-of-disease-from-environmental-noise.-quantification-of-healthy-life-years-lost-in-europe

Another source of cost is noise mitigation. When excessive noise exposure is identified post-construction, the costs of correcting it are usually high. Corrective sound insulation is more expensive than when sound insulation is introduced at the design stage, and costs will vary greatly depending on the noise reduction target and the source of noise being mitigated.[65] Mitigation costs to governments and businesses become expensive as they introduce noise abatement measures such as sound barriers, policing, acoustic experts, sound limiters and staff to handle 311 noise complaints.

There is some Canadian data on noise pollution and real estate prices. An assessment by *MSSS* shows the estimated depreciation rate for residences near seven Canadian airports was around 0.82% per decibel, while depreciation for properties affected by road noise was estimated to be 0.55% per decibel.[66] Property depreciation is correlated with social inequalities as the sectors that are most exposed to noise have lower rent prices, attracting more low-income households.[67] Studies from other jurisdictions demonstrate a similar relationship. A study in The Netherlands found that traffic noise had a significant impact on property prices up to a maximum of 12% decrease in prices. Properties in quiet areas could sell at a premium of up to 6.5%.[68]

## 3.3 Environmental impacts

Underwater noise is an emerging issue for port cities whose activities impact underwater animals and local ecosystems. Noise from tourism, industry and leisure vessels has effects on the surrounding marine life of cities. Recent studies that show Quebec's water as being too loud for whales to communicate have increased public concern around the impact of noise on the environment.[69][70] Emerging acoustics research on fish indicates that increases in sound are likely to affect fish, and may cause temporary or permanent hearing loss, disrupt their breeding habits, and mask their ability to detect predators.[71]

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[65] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.
[66] *Ibid.*
[67] *Ibid.*
[68] M.A.J. Theebe, "Planes, Trains, and Automobiles: The Impact of Traffic Noise on House Prices," *The Journal of Real Estate Finance and Economics* 28 (2004): 209–34, https://doi.org/https://doi.org/10.1023/B:REAL.0000011154.92682.4b.
[69] "Are Quebec's rivers getting too loud for belugas?" *CBC News, July 31, 2016,* https://www.cbc.ca/news/canada/montreal/belugas-drones-noise-endangered-1.3702408
[70] Whales Online, "Threats," Accessed July 7, 2020, https://baleinesendirect.org/en/discover/whales-future/threats/.
[71] Arthur N. Popper, and Anthony D. Hawkins, "An Overview of Fish Bioacoustics and the Impacts of Anthropogenic Sounds on Fishes," Journal of Fish Biology 94, no. 5 (March 12, 2019): 692–713, https://doi.org/10.1111/jfb.13948.

Noise pollution particularly impacts marine mammals due to their dependence on sound to communicate, navigate and find food. Researchers at the Leigh Marine Laboratory at the University of Auckland are looking to identify the unique sounds of underwater species, understand the threat posed to marine life by ships and other human-generated noise, monitor ecosystems and use sounds to revive marine environments.[72] They have installed underwater microphones in five places in the Hauraki Gulf in New Zealand to monitor and record the sound of the marine ecosystem.

An 18-month underwater sound recording study found that noise pollution from ships in the Hauraki Gulf reduced the space whales could communicate with other whales by 87% and reduced fish communication space by 62%.[73] Sound can be used to repair ecosystems as well. Research conducted in the Great Barrier Reef demonstrated that broadcasting sounds underwater of healthy reefs attracted fish back to barren reefs and revived the habitat.[74]

There is evidence that ships' 10-knot speed limits can significantly reduce the impact of noise pollution on marine life. European Union's Marine Strategy Framework Directive 2008/56/EC is an attempt to better understand Europe's seas and oceans' current environmental status and create measures to protect them. [75]

It is not just marine life that is affected by noise. Studies find that noise impacts practically all species.[76] Noise impacts the way animals communicate, find shelter, hunt, reproduce and raise their young. Noise levels greater than 50 dB are considered a disturbance that can impact migratory birds' nests.[77]

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[72] "Meet the reef whisperer," *University of Auckland News,* April 21, 2020, https://www.auckland.ac.nz/en/news/2020/04/21/meet-the-reef-whisperer.html

[73] Rosalyn L. Putland, Nathan D. Merchant, Adrian Farcas and Craig A. Radford, "Vessel noise cuts down communication space for vocalizing fish and marine mammals," *Global Change Biology* 24, no. 4 (November 2017): 1-14, DOI: 10.1111/gcb.13996

[74] Timothy A. C. Gordon et al., "Acoustic enrichment can enhance fish community development on degraded coral reef habitat," *Nature Communications* 10, no. 5414 (2019), https://doi.org/10.1038/s41467-019-13186-2

[75] European Commission, "The Marine Strategy Framework Directive," July 2, 2020, https://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm

[76] Hansjoerg P. Kunc and Rouven Schmidt, "The effects of anthropogenic noise on animals: a meta-analysis," *Biology letters* 15, no. 11 (November 2019), https://doi.org/10.1098/rsbl.2019.0649.

[77] "Guidelines to reduce risk to migratory birds," Government of Canada, last modified September 19, 2019, https://www.canada.ca/en/environment-climate-change/services/avoiding-harm-migratory-birds/reduce-risk-migratory-birds.html#toc2

Even in urban Montreal, its island location and nature areas inside and outside the city means the ecological impacts of noise pollution are particularly relevant. Noise affects animals living in the city green spaces and spills over into the surrounding natural habitats.

### 3.4 Soundscaping

While noise is known to negatively impact health and other outcomes, it is not categorically harmful. Soundscaping has emerged as a relatively new field seeking to explore how environmental sound is not de facto negative and how sound can be leveraged to create positive environments that improve residents' quality of life.

The global Soundscaping movement seeks to bring together experts to shape a research agenda for the conservation of soundscapes that are being threatened due to human and natural causes. The network also seeks to increase public awareness among ecologists and social scientists of the importance of soundscapes.[78] In cities, the soundscape approach calls on city planners to look at how sound is perceived and experienced by different groups in the population and work towards more positive outcomes.

Canada is a leader in the global soundscape movement. In the late 1960s, the World Soundscape Project was established at Simon Fraser University. It was the first of its kind in Canada, aiming to understand the relationship between humans and their acoustic environment. It recognized that while policymakers were focused on noise, a broader interest in sound was necessary to create a comfortable and healthy sound environment.[79]

A study from 1984 also highlighted the policy relevance of Soundscaping. It found that patients whose hospital window faced a park recovered faster than the patients whose window faced a brick wall.[80] Since then, there has been much research identifying the positive psychological and physical health effects of being exposed to nature and nature sounds, including lower stress, better sleep and improved cognitive function.[81]

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[78] Catherine Guastavino and Bryan C. Pijanowski, "Soundscape Ecology: A Worldwide Network," *The Journal of the Acoustical Society of America* 130, no. 4 (2011): 2531–31, https://doi.org/10.1121/1.3655106.
[79] R. Murray Schafer, "The Book of Noise," 1970, http://www.sfu.ca/sonic-studio-webdav/WSP_Doc/Booklets/BookOfNoise.pdf.
[80] R. S. Ulrich, "View Through a Window May Influence Recovery From Surgery," *Science,* (April 1984), DOI: 10.1126/science.6143402.
[81] Jesper J. Alvarsson, Stefan Wiens, and Mats E. Nilsson, "Stress Recovery during Exposure to Nature Sound and Environmental Noise." *International Journal of Environmental Research and Public Health* 7, no. 3 (2010): 1036–46, https://doi.org/10.3390/ijerph7031036.

Cities have generally been slow to adopt soundscape planning and design as an important element of urban sound.[82] This approach is relevant not only for cities and policymakers but for a variety of stakeholders, including researchers, community groups, businesses and residents. Soundscaping demonstrates that noise reduction should not be the only goal for managing urban noise. The soundscape and noise observatory of Greater Lyon, Acoucité, integrates research on the sound environment into its projects.[83] Japan has also been a leader at integrating Soundscaping by designating certain locations across the country as sites of acoustic importance to its heritage and culture.[84]

Montreal is a part of the global soundscape ecology network thanks to local projects such as Sounds in the City, Montreal Sound Map and Villeray Acoustique. These projects aim to improve Montreal's acoustic understanding through research, urban planning, noise regulations, and memorializing sounds of historical and cultural importance. The Sounds in the City project has developed partnerships with local governments to design a better environmental sound policy that integrates residents' experiences of sound.

A key learning from the Soundscaping approach is that various communities must be integrated into the discussion on sound quality, given how relative the perception of sound can be. Soundscaping also calls on governments to be proactive in creating positive sound environments for their population. This means increasing city resources to develop internal sound expertise, policy research and environmental sound training for municipal employees.

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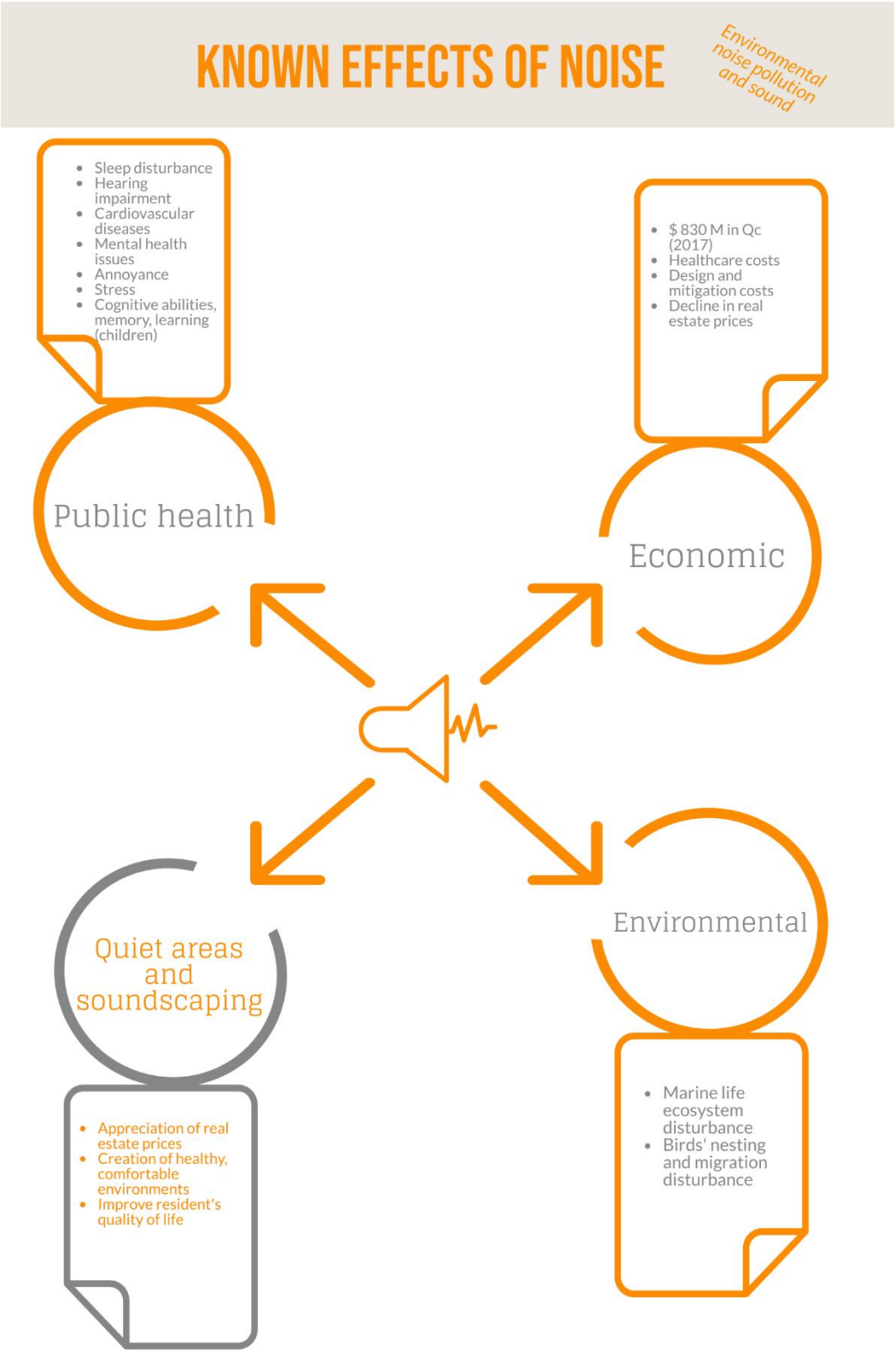
[82] Daniel Steele, *"Bridging the gap from soundscape research to urban planning and design practice: how to professionals conceptualize, work with, and seek information about sound?"*. (PhD thesis, McGill University, School of Information Studies, 2018). https://escholarship.mcgill.ca/concern/theses/cj82k958s

[83] Acoucité. *"Soundscape and noise observatory - What is your perception of sound environment during the lockdown period?"*. http://www.acoucite.org/?lang=en

[84] Mike Goldsmith, *Discord: the story of noise*, (Oxford University Press, 2012).;
Krista Rogers, "The 100 Soundscapes of Japan: A list of Japan's greatest natural, cultural, and industrial sounds," *Sora News 24,* May 14, 2016, https://soranews24.com/2016/05/14/the-100-soundscapes-of-japan-a-list-of-japans-greatest-natural-cultural-and-industrial-sounds/

Figure 6 Known effects of noise



# 4.0 Structural approaches to managing noise

Around the globe, different approaches exist in managing noise. This section will analyze and compare three of these approaches, the regulatory and enforcement approach, the night mayor approach and the noise observatory approach.

## 4.1 Regulatory and enforcement approach

For many jurisdictions, including Montreal, the default method of managing noise is through regulatory and reactive enforcement mechanisms. Regulatory mechanisms are laws or directives created by the government and are legally binding. Enforcement mechanisms are the methods by which the government compels compliance with the regulations. In the context of noise management, regulations can indicate maximum permitted levels of noise for noise emitters and overnight "quiet hours." Enforcement in many jurisdictions, as in Montreal's case, takes the form of noise complaints filed with the city by residents. These noise complaints may result in fines or warnings delivered by city bylaw enforcement or by the police.

### 4.1.1 Regulations

Local and central governments, environmentalists, residents, schools and businesses often weigh in concerning regulatory decisions on noise management. Due to the wide range of noise issues and the localized nature of noise, there are rarely national policies around noise. The development of effective noise regulations is also often a slow process, with many iterations required to arrive at appropriate solutions.

In 2002, the European Noise Directive (END) was established as the largest and most comprehensive strategy for tackling noise in the world. The directive requires all member states to construct noise maps of all major cities and transportations routes. The END's objective is to determine the overall impact of transport-related noise sources. The noise maps are used to develop action plans to reduce noise 'hot spots' and protect quiet areas. The END helped establish a unified approach to noise assessment across Europe while also allowing for localized definitions of noisiness and quietness to prevail.[85]

One of the challenges of the END has been to develop common approaches across member states. There has been a lack of consistency in noise maps, overlaps in noise mapping where jurisdictions meet and different measurement techniques. The projects have also been subject to financial problems and lack of funding.[86]

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[85] Mike Goldsmith, *Discord: The Story of Noise*, (Oxford University Press, 2012).
[86] *Ibid.*

Japan is another notable example as it was among the first national governments to pass a noise control act. The government implemented the Noise Regulation Law in 1968 following increased urbanization and increased urban noise.[87] The law outlines regulations for factories, construction sites, road traffic, nighttime noise and the penalties associated with exceeding the maximum noise levels. However, Japan does not have a proactive noise policy to accompany the law, and the regulations are not regularly enforced except when a noise complaint is filed.[88]

Regulatory approaches to noise have been developed and implemented in jurisdictions around the world, yet data shows persistent levels of noise exposure for inhabitants. Local authorities develop regulations regarding noise from traffic, aircraft, gatherings, nightlife, construction and public streets. However, the localized nature of noise makes any type of cohesive or centralized noise plan difficult to implement.

Regulating aircraft noise is particularly challenging and has resulted in little policy movement over the years. In most countries, the regulations and noise management strategies have largely been in place for decades. In some cases, little more can be done to reduce the noise impact of aircraft, aside from implementing more restrictive policies on flight times and paths. The most promising solution is to reduce the noise of the aircraft themselves. In France, there is a scalable tax on aircraft depending on their noise footprint.[89]

Enforcing noise regulations is another issue, as noise complaints are rarely investigated, or any legal action taken. The transient nature of sound means that only a small portion of noise violations are recorded or addressed, and deterrence is difficult without a more comprehensive approach that accounts for both the objective and subjective experiences of noise in cities. This signifies that regulatory approaches alone cannot address noise. More research is needed to understand what additional measures will be effective.

### 4.1.2 Enforcement approach

Many cities around the world, including Montreal, adopt a reactive, enforcement-based approach to managing noise. Typically, this involves bylaws to control noise, enforced primarily through noise complaints. If a neighbour is making noise late into the night or a construction site is starting work early in the morning, residents can file noise complaints with the city. The noise

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[87] Noise Regulation Law of 1968, Law No. 98 of 1968 (Japan) https://www.env.go.jp/en/laws/air/noise/ap.html
[88] Daniel Dolan, "Cultural Noise: Amplified Sound, Freedom of Expression and Privacy Rights in Japan," *International Journal of Communication* 2 (2008): 662-690, https://ijoc.org/index.php/ijoc/article/view/142/200
[89] French Civil Aviation Authority. "*Environmental Report for 2008".* Ministry of Ecology, Energy, Sustainable Development and Town and Country Planning. 2008. https://www.ecologique-solidaire.gouv.fr/sites/default/files/DGAC_Environmental_Report_ENG_for_2008.pdf

emitter, whether it be a noisy neighbour or a construction site, would receive a warning or a fine from a city bylaw enforcement officer or the police.

In Auckland, New Zealand, the city addresses noise only through regulations and noise complaints. Residents can call the city to report an incident related to excessive noise, and the city will send a noise specialist with a sound meter to evaluate the noise situation. If the specialist determines the noise is excessive, they will impose fines and, in extreme cases, can pursue legal action. However, this approach does not solve the underlying issues of noise pollution. Indeed, it gives a temporary solution to an enduring problem.

### 4.1.3 Noise complaints and gentrification

Noise complaints and fines alone are a reactive approach to managing noise and using noise complaints as a single source of information about noise pollution in a city is inadequate. Not all residents interpret noise the same way, nor will they complain about the same types and levels of noise, which bias the noise complaint volumes.[90] However, research from New York City suggests that noise-related 311 and 911 calls can offer important insights about a city and its urban development.

In New York City, it was found that in the boundaries between neighbourhoods, where gentrification is happening, neighbour-related 311 calls are higher than anywhere else in the city. These types of calls were 26% higher in these newly-gentrifying boundary zones than compared to adjacent areas of ethnically homogenous populations.[91] This difference was still evident when controlling for the amount of racial diversity, rates of poverty, unemployment, education, residential turnover, tendency to call 311, immigrant populations and rates of English speakers, suggesting that the results are not simply due to the "negative consequences" of diversity or another social factor but due to the unique nature of gentrifying neighbourhoods. Further research found that between 2011 and 2016, while per capita 311 calls increased in all neighbourhoods in the city, they increased 70% faster in gentrifying neighbourhoods.[92] More specifically, compared to high-income neighbourhoods, 311 calls in gentrifying neighbourhoods rose 200% faster and compared to low-income neighbourhoods, they rose 50% faster.

This research suggests something crucial about urban neighbourhoods: a sense of community and a feeling of belonging is key. While long-term residents are more likely to know their

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[90] Emily Lang, " Now That It's The Only Sound They Hear, New Yorkers Are Complaining About Their Neighbors," April 24, 2020, in *WNYC News,* podcast, audio https://www.wnyc.org/story/new-yorkers-complain-about-their-neighbors-making-love-and-stomping-around/

[91] Joscha Legewie and Merlin Schaeffer, "Contested Boundaries: Explaining Where Ethnoracial Diversity Provokes Neighborhood Conflict," *American Journal of Sociology* 122, no. 1 (July 2016): 125-61 https://www.journals.uchicago.edu/doi/pdfplus/10.1086/686942

[92] Meryl Horn, "311 Noise Complaints," data, quoted in Wendy Zukerman, "Gentrification: What's really happening?" October 11, 2018, in *Science Vs*, (Gimlet Media), produced by Meryl Horn and Kaitlyn Sawrey, podcast, audio, https://gimletmedia.com/shows/science-vs/39hzkk

neighbours and work out noise disputes with them, newcomers, who may not know their neighbours and may not feel the same sense of community belonging, will instead make a complaint to 311. It is the *new arrivals* to a previously homogeneous neighbourhood (either racially homogenous or economically homogeneous) that affects the neighbourhood dynamics.[93] This would suggest that community-building in these changing neighbourhoods could help resolve noise disputes amongst neighbours without government intervention. By understanding the conditions that cause increased neighbourhood disputes, it is possible to begin to solve them.

Gentrification brings with it another, more insidious problem: more police surveillance.[94] An increase in noise complaints draws more police to a neighbourhood to enforce the bylaws that were not necessarily enforced previously, effectively criminalizing neighbourhood noise. Increases in misdemeanour arrests are more reflective of police presence in a neighbourhood than the total level of infractions committed by residents.[95] As well, increased police presence means an increased potential for police misconduct. There are links between gentrification, neighbourhood complaints and some of the fatal police shootings in the United States.[96]

Like New York City, Montreal is not immune to gentrification or the problems that arise from it.[97] Using data from noise-related 311 complaints, research can be done to determine if this phenomenon is also occurring in Montreal. Further analysis in a Montreal context will allow the city to shape policy to address the disputes that arise as neighbourhoods change and new residents move in. While 311 noise complaints cannot form the basis of Montreal's noise policy development, they can enrich the data that will be collected by the observatory.

## 4.2 Night mayors

Since the early 2000s, the position of Night Mayor has become an increasingly popular way to govern and promote urban nightlife and manage nightlife-related noise. The concept originated in Amsterdam in 2003, following the recognition of the need for nighttime governance.[98] Today, almost 50 cities worldwide have a similar position, including Toronto, New York City, London,

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[93] Benjamin Ryan, "What 311 Calls Can Tell Us About Gentrification," *The Cut,* August 21, 2015, https://www.thecut.com/2015/08/what-311-calls-can-tell-us-about-gentrification.html

[94] Abdallah Fayyad, "The Criminalization of Gentrifying Neighborhoods," *The Atlantic,* December 20, 2017, https://www.theatlantic.com/politics/archive/2017/12/the-criminalization-of-gentrifying-neighborhoods/548837/.

[95] Fayyaf, "The Criminalization of Gentrifying Neighborhoods."

[96] Rebecca Solnit, "Death by gentrification: the killing that shamed San Francisco," *The Guardian,* March 21, 2016, https://www.theguardian.com/us-news/2016/mar/21/death-by-gentrification-the-killing-that-shamed-san-francisco.

[97] "Montreal couple ticketed $888 for 'excessive noise,' accuses Montreal police of racial profiling," *CBC News,* April 21, 2018, https://www.cbc.ca/news/canada/montreal/montreal-couple-ticketed-888-for-excessive-noise-accuses-montreal-police-of-racial-profiling-1.4630259.

[98] Natalie Delgadillo, "The Rise of the 'Night Mayor' in America," *Governing,* August 11, 2017, https://www.governing.com/topics/urban/gov-night-mayor-economy-america.html.

Madrid, Sydney and Tokyo. These roles go by many names, including night-time economy manager, night ambassador, night czar or nightlife advocate.

Although the responsibilities of a night mayor are limited to the nighttime, this method of managing noise is relevant because of its transferable lessons, and because night mayors address nighttime noise, which emerging research suggests is the most concerning form of noise pollution for health.[99]

A recent study on the role of night mayors as a form of urban governance notes that night mayors have three key responsibilities.[100] First is improving the nighttime environment to encourage a better quality of life after dark, such as public transportation, lighting, and public toilets; second is improving and applying the laws and regulations at night, and third is mediating and promoting consensus among stakeholders.

Surveying 35 night mayors out of 46 total globally, three common characteristics of the role of night mayors emerged. First is where the position is found, either within municipal government or outside of it. The survey found that of the 35 night mayors surveyed, 40% report directly to local governments, 23% report directly to civil society organizations, 3% report directly to the nightlife industry. The other 44% is other or unclear. Further, 42% of night mayors surveyed were appointed by the mayor or city council, 26% were appointed by a civil society organization, and 13% were appointed by the nightlife industry. The other 19% is other or unclear.

A second important aspect is whether the position has advocacy or a regulatory role. This is an essential question to define and communicate to stakeholders. Despite the title of night *mayor,* the position rarely involves the authority to change laws; none of the night mayors surveyed had this authority.

A final dimension of night mayors concerns the expectations directed at the position. In 75% of the cities, the expectation of the night mayor was to promote safety, and in all cities, to provide conflict resolution. There are further questions as to who benefits from the position, whether it is the city, the businesses or the residents. The question of stakeholder engagement is essential for the success of this position.

The main activities of night mayor around the world fall into four categories: advocacy and municipal agenda setting, policy and regulation improvements, mediation and stakeholder management and municipal budgeting, and the development of private-public partnerships.[101] As well, there is hope that the role will proactively improve the urban quality of life and create a more inclusive city, especially for groups like women and the LGBTQ+ community. Further, the

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[99] Demian Halperin, "Environmental noise and sleep disturbances: A threat to health?," *Sleep Science* 7, no. 4 (December 2014): 209-212, https://doi.org/10.1016/j.slsci.2014.11.003

[100] Andreina Seijas and Mirik Milan Gelders, "Governing the night-time city: The rise of night mayors as a new form of urban governance after dark," *Urban Studies* (January 2020), https://doi.org/10.1177/0042098019895224

[101] *Ibid.*

night mayor position creates a neutral third party, and in some cases taking over the licensing of nighttime industries and the response to noise from police or bylaw.

This position has existed in its current form for less than 20 years, making it challenging to assess its impact on a larger scale. However, case studies in Amsterdam suggest that there has been a positive impact.[102] It has allowed for some impactful pilot projects, including 24-hour venue licenses and the Rembrandtplein Gastvrij (Hospitable Rembrandt Square) project. The 24-hour venue license project is a policy that permits venues to remain open and to serve alcohol around the clock, allowing patrons to come and go at any time, with the intent of eliminating the large increase in street noise as a large number of patrons leave the bars at a pre-set closing time. The Rembrandtplein pilot project implemented "Rembrandt square hosts" or employees who circulate in the area and try to de-escalate situations before they become a problem. This initiative has increased safety for partiers, and in the three years since its implementation in 2015, the area has seen a 20% decrease in alcohol-related violence and a 40% decrease in nuisance reports.

There s reason to be cautious of this position as well. The Night Czar in London ran into problems in 2018 when the local council of the borough of Hackney, the heart of London's nightlife culture, imposed a strict 11 pm closing regulation on new businesses, in order to limit nighttime noise. This was at the same time that the Night Czar and Mayor were promoting a 24-hour city vision.[103] As the Night Czar position is solely an advocacy role without any regulatory authority, it was powerless to intervene in the council's new regulation. Despite this, business owners and the local entertainment industry, who had expected the Night Czar to be their voice within government, criticized the position and questioned its effectiveness in representing their interests.[104] This tension between the night mayor's role and expectations by the industry of what the role should be has cost the London Night Czar its stakeholders' trust.[105]

Night mayors are one initiative to protect and encourage nightlife as a form of culture. As a mediator, advocate and stakeholder consultant, night mayors institutionalize the necessary space to discuss the urban night and its related noise issues. The role exists in a transversal space between many issues and government departments, including public health, economic development and law enforcement. Night mayor positions can help shape policy, raise awareness, provide mediation, improve infrastructure and create an inclusive place after dark.

For the city of Montreal, a dedicated position for nightlife, whether it be within or outside of city hall, could be useful in governing nightlife, addressing the multidisciplinary nature of the night

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[102] Jon Henley, "The stuff of night mayors: Amsterdam pioneers new way to run cities after dark," *Guardian,* March 21, 2016, https://www.theguardian.com/cities/2016/mar/21/night-mayor-amsterdam-holland-mirik-milan-night-time-commission

[103] Feargus O'Sullivan, "What's a 'Night Czar' To Do?," *City Lab,* July 27, 2018, https://www.citylab.com/life/2018/07/london-night-czar-amy-lame-hackney-curfew/566015/

[104] *Ibid.*

[105] *Ibid.*

and noise, and preserving the vibrant nightlife for which Montreal is known. While it could be a valuable addition to the city, it must be noted that the position will not be the perfect solution to all noise experienced in the city. The night mayor position focuses solely on the problems of nightlife, and as it does not address daytime noise or noise from other industries outside of the entertainment sector, it does not provide a comprehensive way to address overall noise. The position has limited powers, acting typically in an advisory role and is most often a single person with few to no support staff. While nighttime noise is a major flashpoint, and while this kind of position can be a complementary part of a data-driven noise framework, a cohesive strategy for noise management requires more than a night mayor.

### 4.3 Noise Observatories

The past five decades have been marked by the proliferation of various types of observatories. Whether they hold the designation of social, territorial, economic or environmental observatories, they tend to share similar characteristics. As their names suggest, these observatories emerge from the concept of astronomical observatories.[106] Astronomical observatories are equipped with telescopes to magnify, identify and capture phenomena that exist hundreds of millions of kilometres away and allow scientists to dive into the deepest corners of space in order to learn, understand and discover. Social, territorial, economic or environmental observatories extend the concept of astronomical observatories to other, earth-bound phenomena.[107] They seize the complexity of different realities and strive to understand their multiple angles and dimensions.

Observatories are typically initiated by state actors, academic coalitions or civil society groups to overcome gaps in knowledge or expertise on a particular topic.[108] They are a systemic approach to capture and address the complexities of real-world issues through a variety of iterative methods. Observatories allow researchers and policymakers to move from general observations to specific realities and from multifaceted problems to synthesized and nuanced

[106] Rémi Clignet, "Une invitation à observer les observatoires," in *Observatoires du développement, observatoires pour le développement*, ed. Remi Clignet (IRD Editions, 1994), 123-146, https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers4/010014362.pdf
[107] *Ibid.*
[108] Jean-Philippe Tonneau, Philippe Lemoisson, Magalie Lesueur-Jannoyer, Pierre Maurel, Marianne Le Bail and Philippe Cattan, "Les observatoires territoriaux : un outil de développement ?," in *Des territoires vivants pour transformer le monde,* ed. Patrick Caron, Élodie Valette, Tom Wassenaar, Geo Coppens d'Eeckenbrugge and Vatché Papazian, (Editions Quæ, 2017), 231-238 https://www.cairn.info/des-territoires-vivants-pour-transformer-le-monde--9782759226542-page-231.htm

recommendations.[109] Put differently, observatories offer a "zooming effect" that amplifies the understanding of every contributing factor to targeted phenomena.[110]

As they favour the formalization of methodological processes, observatories make it possible to understand the evolution of different realities over time through the comparison of stable sets of indicators. They are intrinsically designed to produce and analyze regular, coherent and organized information through a wide variety of mechanisms, which allows for the capture of complex and fluid dynamics, the measurement of needs and evaluation of the effectiveness of implemented policies. [111,112]

Observatories can also provide a multi-dimensional, collaborative approach to addressing real-life problems. They often act as a consultation table for large networks of partners, connecting different voices, points of view and perspectives.[113,114] Observatories offer opportunities for collective learning and solution building, favor deliberative democracy by inviting civil society input to contribute to the public debate and incentivizing the co-development of expertise. [115,116] In that sense, they act as a body that organizes stakeholders and experts and promotes collaborative interventions.[117]

In producing knowledge, building expertise, as well as facilitating collaboration and consultation, observatories are powerful policy tools that bridge the gap between research, decision-making and action. They often play an important role in advising policymaking by providing insights to both private and public decision-makers. [118,119,120] As such, observatories' role is not only to study a specific phenomenon to better understand it; it is also, and above all, to better evaluate options

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[109] Marie Piron, "Systèmes d'information et observatoires en sciences sociales : quel impact sur les démarches de recherche ?" *Cah. Sci. hum.* 32, no.4 (1996): 765-784, https://horizon.documentation.ird.fr/exl-doc/pleins_textes/pleins_textes_4/sci_hum/010009713.pdf

[110] Jean-Luc Dubois, "La longue marche vers les observatoires," in *Observatoires du développement, observatoires pour le développement*, ed. Remi Clignet (IRD Editions, 1994), 173-195, https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers4/010014365.pdf.

[111] Piron, "Systèmes d'information et observatoires en sciences sociales."

[112] *Ibid.*

[113] *Ibid.*

[114] Vicky Huppe and Elisabeth Masson, *Projet d'Observatoire sur la santé et l'environnement bâti,* Institut National de sante publique Quebec*,* June 2014, https://www.inspq.qc.ca/es/projet-d-observatoire-sur-la-sante-et-l-environnement-bati

[115] Jean Philippe Tonneau et al., Les observatoires territoriaux: Des outils de la société de la connaissance ?," *Rev. Int. Geomat.* 27, no. 3 (juillet-septembre 2017): 335-354, https://rig.revuesonline.com/articles/lvrig/abs/2017/03/rig00035/rig00035.html

[116] Huppe and Masson, *Projet d'Observatoire sur la santé et l'environnement bâti.*

[117] Tonneau et al., "Les observatoires territoriaux : un outil de développement ?"

[118] *Ibid.*

[119] Huppe and Masson, *Projet d'Observatoire sur la santé et l'environnement bâti.*

[120] Piron, "Systèmes d'information et observatoires en sciences sociales."

to concretely address it. Therefore, observatories' success is heavily contingent on their capacity to produce useful insights and to bring all relevant stakeholders together.[121]

It is important to note that there are as many designs for observatories as there are observatories. Observatories are designed with respect to their purpose and the context in which they are mobilized.[122] The highly contextual and localized nature of observatories indicates that there is no one-size-fits-all approach to creating them.[123] The implementation of observatories tends to be complex, as they require time, resources and continuous institutional support.[124]

There are currently a variety of observatories in Quebec. L'*Observatoire québécois des inégalités*, for example, is dedicated to the study of different sources and consequences of social inequalities.[125] L'*Observatoire québécois du loisir* and *l'Observatoire québécois de l'adaptation aux changements climatiques* respectively study leisure activities and climate change mitigation.[126,127] These are only a few examples of the wide scope of issues that observatories can study.

Since the 1990s, cities have been creating observatories to study the specific phenomenon of noise. The specific configuration of noise observatories, and the opportunities they provide for governments, convinced many jurisdictions that they represented the best vehicle for tackling emerging noise problems. Section 5 provides an overview of 11 noise observatories from different jurisdictions around the world and analyses their structure and activities. Annex B offers a deeper dive into each of these 11 noise observatories for additional details.

Compared to other strategies for tackling noise, observatories offer a range of advantages to cities. They provide comprehensive, upstream and downstream strategies to manage noise.

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[121] Marie-Hélène de Sède-Marceau and Alexandre Moine, "Les observatoires territoriaux. Une représentation collective du territoire," *Communication and Languages* 1, no.171 (2012): 55-65 https://www.cairn.info/revue-communication-et-langages1-2012-1-page-55.html

[122] Piron, "Systèmes d'information et observatoires en sciences sociales."

[123] Christian Poirier, Catherine Lavoie-Marcus, Catherine Duchesneau, Ajouna Bao-Lavoie and Guy Bellavance, *Observatoires culturels et secteur de la danse au Québec : paramètres et modalités d'un observatoire de la danse*, (Montréal: Institut national de la recherche scientifique Centre - Urbanisation Culture Société, March 2011), http://www.chairefernanddumont.ucs.inrs.ca/wp-content/uploads/2013/09/PoirieC_BellavanceG_2011_Observatoires_culturels_et_secteur_de_la_danse_au_Quebec.pdf

[124] Tonneau et al., "Les observatoires territoriaux."

[125] "Observatoire québécois des inégalités," Université de Montréal, accessed July 6, 2020, https://www.observatoiredesinegalites.com/fr/

[126] "Observatoire québécois du loisir," Université du Québec à Trois-Rivières, accessed July 6, 2020, https://oraprdnt.uqtr.uquebec.ca/pls/public/gscw031?owa_no_site=170

[127] "Mon climat, ma santé," Institut national de santé publique Québec, accessed July 6, 2020, http://www.monclimatmasante.qc.ca/oqacc.aspx

Instead of relying solely on regulations and enforcement measures to mitigate noise impacts, observatories involve stakeholders in an iterative process of finding targeted noise solutions. They also allow for data collection and scientific research to better understand the implications of noise for residents and relevant parties.

Regulations are often the first step that cities take in noise mitigation. However, the regulatory approach is rarely proactive nor innovative. Regulations often lack the data to be effective in long-term noise abatement, and they offer limited opportunities for policy innovation due to their focus on enforcement. Observatories hold the possibility of novel approaches that are informed and driven by data, collaboration and consultation.

Night mayors are an interesting approach to managing night-time noise, but they also lack the data and expertise to tackle noise from all aspects. Night mayors have proven to be effective in addressing certain nighttime noise-related issues, but they are most effective as a complementary rather than a comprehensive approach. Night mayors are responsible for nighttime-related issues, but noise is an around-the-clock issue. Night mayor positions do not benefit from the human and financial resources that are usually afforded to observatories as institutions. Finally, night mayors tend to provide downstream problem resolution on-the-ground with nighttime industry stakeholders. While they can provide expertise, night mayors do not hold the role of knowledge production and observatories' upstream solution-building.

On these grounds, the establishment of a noise observatory emerges as the best approach for Montreal in addressing its noise-related issues. An observatory is the most comprehensive, information-driven mechanism for tackling noise. An observatory can draw on the knowledge of a variety of stakeholders while generating data that informs policymakers in crafting appropriate regulations.

***Recommendation 1:*** *It is recommended that Montreal adopts a noise observatory model to address noise-related issues.*

# 5.0 Benchmark jurisdictions

Noise pollution is an issue faced by most jurisdictions globally. With growing awareness of the negative effects of noise, but also of the opportunities positive sounds can offer to improve citizens' wellbeing, more jurisdictions, including Montreal, are exploring solutions. Our team studied eleven jurisdictions that are addressing noise in a variety of ways, offering a number of best practices and some lessons of what to avoid. These jurisdictions are Auckland, Australia, Barcelona, Brussels, Delhi, Japan, London, Lyon, Madrid, New York City and Paris.

While all benchmark jurisdictions share the common goal of better addressing noise (in most cases, urban noise), their approaches differ. Not all benchmark jurisdictions refer to their noise management process as a noise observatory. However, for simplicity, when discussing the noise management approaches of all the jurisdictions collectively in this section, the term "noise observatory" will be used.

In evaluating the observatories, we identified four main questions:

- Is the noise observatory part of the government (municipal or national), or is it separate from government?
- Is the noise observatory an advisory body, or does it have regulatory authority?
- How is the noise observatory funded?
- What does the noise observatory do in terms of its key activities?

## Type of organization

Of the jurisdictions studied, six are part of the government, typically as part of a broader department. They are Auckland, Barcelona, Delhi, Japan, London and Madrid. Of those six, four are part of the government's environment or pollution department (Auckland, Delhi, Japan, Madrid).

Four observatories are independent of the government. Of these, two are academic (Australia and New York City), and two are non-profit (Lyon and Paris).

The final benchmark jurisdiction, Brussels, is a public interest organization, a specific legal entity that exists in Belgium that is quasi-independent from the regional government.

While the majority of the jurisdictions studied manage their noise strategy within government, our research determined that the non-profit models of Lyon and Paris and the academic model of New York City are most effective at addressing urban noise in a complete way.

## Advisory or regulatory

All of the six benchmark noise observatories that operate within the government have the regulatory power to craft regulations and coordinate directly with other government agencies. Brussels' observatory, despite its peculiar legal structure, also has such powers.

Three of the four non-governmental noise observatories act as advisory bodies to the government on issues related to noise (Lyon, New York City, Paris). In these cases, while the observatory itself does not have the ability to create or enforce laws or regulations, it works very closely with the government as the key advisory body on noise-related issues. This can include providing noise data for policymaking and enforcement purposes, conducting impact assessments and consultations on noise issues. Because of this, despite having only advisory power, the close working relationship these noise observatories have built with local government is key to their success. They are also afforded the independence to research and advise objectively, without the influence of elected officials or bureaucratic traditions.

The fourth non-governmental observatory, the Australian Acoustic Observatory, is primarily an academic institution studying biodiversity and climate change impacts on Australian wildlife. Therefore, it is not directly involved with the policy process in either a regulatory or an advisory way.

## Funding structure

For all six noise observatories that exist as part of the government, they are all funded through the government's operating budget, much like any other government initiative.

Two of the noise observatories, which are university-led (Australia and New York City), are funded principally through public research grants. This permits a significant level of independence and freedom to set their research agenda, prioritize their resources and innovate.

The observatories in Brussels, Lyon and Paris have the most complex funding structures of the benchmark jurisdictions. Brussels receives the majority of its funding from the regional government, with the rest of the funding from investments, revenues from activities, and the European Union. Lyon receives 50% of its funding from the municipal government, 20% from the French government and 30% from research grants. Paris, with a very similar financial structure, receives 60% of its funding from the regional government, 10% from the French government, 10% from other government sources and 20% from research grants. This diversity of funding provides these three observatories with a level of financial independence and stability not afforded to government bodies. Diversified funding also provides organizations with strategic independence while remaining useful to their key stakeholder: the local government.

Key activities

While there is diversity in the activities performed by the benchmark jurisdictions, all the activity areas are segmented into five key areas: data collection, research and innovation, stakeholder engagement, public outreach and Soundscaping and sound arts.

Ten observatories (all except Japan) collect quantitative data, including noise levels, sources of noise and the changes in noise over time through a network of noise sensors and recorders. Most use this information to produce strategic noise maps that visually demonstrate noise levels and types of noise across the jurisdiction. Many observatories make their data freely accessible online. The Australia Acoustic Observatory, due to their large number of stakeholders and partners, found that making all their sound data public is the only way they could operate the observatory.

Six observatories do research and knowledge development either with academic partners or in-house. They include Australia, Brussels, Delhi, Lyon, New York City and Paris. The benchmark jurisdictions who are completely independent of government, Lyon, Paris, New York City and Australia, are doing the most innovative research. This is due in part to their ability to independently set their key activities and access research grants for partnerships with academic institutions. Lyon's Acoucité has contributed to academic and policy discourse with many collaborative projects, including Project Hosanna, which explored the use of vegetation and natural barriers as soundproofing.

Nine observatories reach out to major stakeholders to understand their concerns, collaborate and find solutions (excluding Auckland and Japan). Benchmark jurisdictions like Lyon and Paris integrate key stakeholders into their board of directors while the London municipal government engages with nightlife industry stakeholders through the appointed Night Czar position. Noise observatories without specific stakeholder engagement mechanisms can risk alienating key stakeholders. Madrid's observatory does not have an explicit mandate to do stakeholder consultation, and as a result, some of the city council's policies have not been well received by the nightlife industries who feel specifically disadvantaged and excluded by the noise management policies.

Nine observatories consider public engagement and public awareness to be a key part of their activities (excluding Auckland and Japan). This includes using citizen scientists to help improve sound identification AI for the Australian Acoustic Observatory and the Sounds of New York City. The New York City observatory also facilitates a summer camp for kids to learn about sound arts, and Bruitparif in Paris offers an awareness program for youth called Kiwi that highlights the health risks of loud music.[128]

Four of the jurisdictions studied identify the celebration and promotion of sound arts as a part of their activities. They are Australia, Japan, London and Lyon. Sound is a critical part of the identity

[128] "Programme Kiwi," Bruitparif, accessed July 5, 2020, https://www.bruitparif.fr/programme-kiwi/.

of a jurisdiction, celebrating culture and the natural habitat. Soundscaping, which is a new field that explores how environmental sound has both positive and negative aspects, is increasingly recognized as an important approach to studying and managing noise. New York City's observatory seeks to identify sources of noise in order to differentiate between desirable and undesirable sounds. Japan's Ministry of Environment has identified One Hundred Soundscapes of Japan that highlight and protect specific aspects of Japanese culture and the natural environment. The soundscape approach recognizes that there is cultural value in preserving and celebrating the soundscape of a city.

## Lessons

There are some key lessons from studying the eleven benchmark jurisdictions. These lessons inform the recommendations found in section 6.

1. Regulatory or complaint-based approaches alone are limited in their effectiveness in abating noise. Examples from benchmark jurisdictions demonstrate that without a comprehensive strategy, a reactive regulatory approach leads to low enforcement and increased neighbourhood conflict and residents' dissatisfaction.
2. Data collection is a key part of an observatory. Without data, jurisdictions cannot quantify and locate a problem with noise pollution. Making this data freely accessible promotes transparency, helps engage residents and improves collaborative work with stakeholders.
3. Observatories are well positioned to do new research and R&D in the field of acoustics and noise management. Benchmark observatories, especially those that are independent of government, are doing unique and innovative research alone or in partnership with academic institutions and industry.
4. An observatory’s success is linked to its ability to engage with, and get buy-in from, its numerous stakeholders. Noise is a multidisciplinary issue that involves many concerned parties that are all part of the noise conversation.
5. While noise is a fact of urban life, public awareness of noise pollution and its effects is not yet ubiquitous. Residents are key stakeholders in any urban observatory activities, and most of the benchmark observatories engaged with the public in some way.
6. A narrow focus on noise abatement can overlook the types of noise that are acceptable, even desired. Studying sound as both negative noise and positive acoustic experiences is an important issue for urban jurisdictions, and many of the benchmark jurisdictions studied have unique approaches to promoting urban soundscape.

Figures 7 and 8 present a comparison of the different activities and structures of the benchmark city studied. For detailed descriptions and analyses of all the benchmark jurisdictions, see Annex B.

Figure 7 Benchmark jurisdictions summary

| Jurisdiction | Principle actor | Type of organization | Governance structure | Advisory or regulatory | Funding structure |
|---|---|---|---|---|---|
| **Auckland** | Auckland City Council | City department | Part of the municipal government, Environmental Health section | Regulatory | City operations budget |
| **Australia** | Queensland University of Technology | University | 5 lead researchers from universities across Australia and many partner organizations | n/a | Australian Research Council grant |
| **Barcelona** | Barcelona City Council | City department | Part of the municipal government | Regulatory | City operations budget |
| **Brussels** | Bruxelles Environnement | Public Interest Organization | Governed by an Executive Director, 20 employees specifically tasked with noise issues in the Noise planning service section | Regulatory | 83% from regional government, 12% from investment funds for specific projects and programs, 4% from activities revenues, 1% from the European Union |
| **Delhi** | Delhi City Council | City department | Part of the municipal government, pollution control committee | Regulatory | City operations budget |
| **Japan** | Ministry of Environment | National government | Complaints handled by the Environmental Dispute Coordination Commission | Regulatory | National operations budget |
| **London** | London metropolitan area | City department | Part of the municipal government | Regulatory | City operations budget |
| **Lyon** | Acoucité | Independent non-profit | A director, assistant director and a small group of staff | Advisory | 50% from the city, 20% from French government, 30% from research grants |
| **Madrid** | Madrid City Council | City department | Part of the municipal government | Regulatory | City operations budget |
| **New York City** | New York University and Ohio State University | University partnership | Researchers within NYU and Ohio State University | Advisory | Grants from the National Science Foundation and New York University |
| **Paris** | Bruitparif | Independent non-profit | Board of directors, 13 employees, 85 member organizations | Advisory | 60% of from the regional government, 10% from the French government, 10% from other government sources and 20% from research grants |

Figure 8 Benchmark jurisdictions key activities

| Jurisdictions | Data collection | Expertise building and research | Collaboration | Communications and public awareness | Culture, heritage and Soundscaping |
|---|---|---|---|---|---|
| **Auckland** | Uses sound level meters to determine noise regulation compliance. | n/a | n/a | n/a | n/a |
| **Australia** | Acoustic sensors in 90 locations across Australia, recording 24/7 for five years. | Significant academic research and knowledge development in ecology and climate change. | Collaborates with five universities, national parks, other government bodies, Indigenous groups, private landowners, conservation organizations. | Crowdsources sound identification to improve and supplement AI. | All sound recordings are freely available online and artists are encouraged to use them. |
| **Barcelona** | Noise Monitoring System with 86 sensors and 26 sound meters, creates strategic noise maps, identifies types of sounds. | n/a | Works with the nightlife industry and industrial sector to manage noise, educates municipal employees about noise pollution. | Educates the public including school children about noise, encourages residents to take sustainable transportation. | n/a |
| **Brussels** | 17 fixed noise sensors and 7 mobile noise sensors to measure noise throughout the city and produce noise maps. | Performs scientific research, produces reports, studies noise in the context of the whole environment including air pollution and sustainability. | Provides training programs to municipal employees, assists boroughs in the development of local noise management plans, informs policy making and urban planning. | Provides programming to teach children about noise issues, informs the population about noise-related issues through the online portal InfoBruit, responds to noise complaints. | n/a |
| **Delhi** | In early stages of systematic data collection, 5 real-time noise monitoring systems in noisy public spaces, creates traffic management plans. | Government agencies have produced some reports. | Works with other government agencies including health, police, and transport, installs sound proofing and noise limiters. | Inter-governmental campaigns around honking, traffic pollution, neighbourhood noise. | n/a |
| **Japan** | n/a | n/a | n/a | n/a | Curates “One Hundred Soundscapes of Japan: Preserving Our Heritage”, celebrating and protecting Japan’s unique cultural and natural heritage. |
| **London** | Surveys resident to understand the qualitative nature of sound, noise sensors to monitor noise, creates noise maps. | n/a | Collaborates with airports and industrial sectors to mitigate noise, Night czar position to engage with stakeholders in the nightlife industry, collaborates with boroughs and the City of London. | Encouraging residents to use sustainable transportation and public transit, incentivizes green vehicles. | Preserves iconic sounds like church bells, works to reduce noise in parks and attract insects and birds, sound art installations in parks. |

| | | | | | |
|---|---|---|---|---|---|
| **Lyon** | Collects quantitative data using a network of sensors and qualitative data from interviews and surveys, uses data to produce noise maps, publishes noise maps and data online. | Conducts research alone and in partnership with academic institutions, publishes approximately 20 reports per year. | Collaborates closely with its founding members and stakeholders including technical schools, engineers, nearby municipalities, supports 5 developing noise observatories in other jurisdictions, works with Bruitparif on specific initiatives. | Produces educational material for citizens and elementary school students, provides training to government and local industry. | Creates sound walks and "cartes postales sonores": sound clips from the region. |
| **Madrid** | An extensive noise monitoring network across the city and a fleet of cars with sound monitoring equipment to take measurements throughout the city, produces strategic noise maps, publishes data and noise maps on website. | n/a | Conducts outreach with the public, consults with neighbourhood associations about the Noise Pollution Action Plan. | Public education campaigns promoting sustainable transportation, informs residents who are exposed to high levels of noise. | n/a |
| **New York City** | 50-100 sound sensors throughout the city to collect audio, produce sound maps, help NYC with noise code enforcement and use machine learning to identify noise sources. | Developing improved noise sensor technology using AI and big data. | Works closely with New York City to support policymaking, help officials with noise level data and enforcement of the Noise Code, collaborates with city agencies, including health and environmental protection. | Engages with the public through citizen scientist initiatives, where the public can help with machine learning development, makes some data available to residents, summer camp for elementary students. | n/a |
| **Paris** | Permanent sensors throughout the city as well as mobile sensors, in person surveys to gather qualitative data, produces strategic noise maps. | Studies the impact of noise with support from their scientific council and in-house experts. | Engages with 85 member organizations, collaborates with policymakers, works with Acoucité on specific initiatives. | Educates population on the impact of noise, organizes noise awareness month. | n/a |

# 6.0 A Noise Observatory model for Montreal

Sections 2 to 5 identified multiple key considerations in proposing a specific design for a noise observatory in Montreal. Section 6 will build on these learnings and present suggested activities and a potential structure that corresponds to Montreal's specific context and needs.

## 6.1 Prerequisites for the Observatory

In evaluating the need for an observatory in Montreal, two main problems are to be considered. The first is that there is very little data available on noise because of the absence of a systematic data collection process. This scarcity of data implies that there is a lack of a shared understanding and problematization of Montreal's noise. Without a specific, defined policy problem, the noise has remained an issue characterized by diffuse, uncoordinated action by various actors in the private, public and civil society sectors.

The second problem is that there is no cohesive noise policy in Montreal and that noise management is a highly localized and decentralized issue. Noise is an interdisciplinary policy issue that requires a cohesive, city-wide approach in order to maximize noise mitigation efforts. Montreal does not currently have a dedicated noise policy department, which impedes the development of internal expertise and policy direction. All stakeholders across various sectors must be brought together under a common municipal vision to reduce noise pollution and improve the environmental sound. The lack of policy cohesion on noise explains in part why noise pollution continues to persist and even grow in some regions of the city.

An observatory for noise monitoring arises as an essential policy tool that tackles both the problem of data and of uncoordinated policy development. It facilitates the identification of noise pollution levels, the impacts, as well as priority areas. An observatory also acts as a nexus for all noise-related activities and stakeholders. It will, therefore, be a key piece in the future of Montreal's noise policy.

That being said, Montreal's Observatory must fit within a wider policy framework for noise management. Before tackling the creation of the Observatory, the City should ensure that sufficient resources are allocated within existing structures to manage noise and sound-related issues. This internal allocation of resources will be crucial to support the Observatory's work, bridge the work of the Observatory to the city's internal noise policy strategy, and allow the Observatory to act at the key institution that informs future noise policy development.

***Recommendation 2:*** *It is recommended that the City of Montreal consider the Observatory to be the main expert body on issues related to noise and environmental sound in the City.*

***Recommendation 3:*** *It is recommended that the City of Montreal dedicate sufficient resources to developing noise expertise within its existing, internal structure.*

## 6.2 Vision, mission, components and activities for the Observatory

This section proposes recommendations on the objectives, orientations and vision for Montreal's Observatory.

### 6.2.1 A vision for the Observatory

A vision statement serves as the Observatory's roadmap. The Observatory's vision statement should indicate what the organization strives to achieve and set a defined direction for growth, evolution and organizational development. It should concisely inform stakeholders about what the Observatory is, what it wishes to achieve and where it is heading.

Therefore, it is important that the Observatory adopt a vision statement to identify itself and forge its personality.

***Recommendation 4:*** *It is recommended that the Observatory adopt a vision statement.*

While the final formulation of the vision statement will be contingent on the Observatory's creation process, the objectives and the stakeholders involved, below, is a suggested vision statement for the Observatory that draws on the Observatory's purpose and objectives.

> *"The Observatory is an interdisciplinary centre that brings people and institutions together, and that strives to guarantee a healthy, pleasant and vibrant sound environment in Montreal."*

### 6.2.2 A mission for the Observatory

Mission statements result and emerge from vision statements. The Observatory's mission statement should convey the essence of the organization's activities, purpose, and identity.

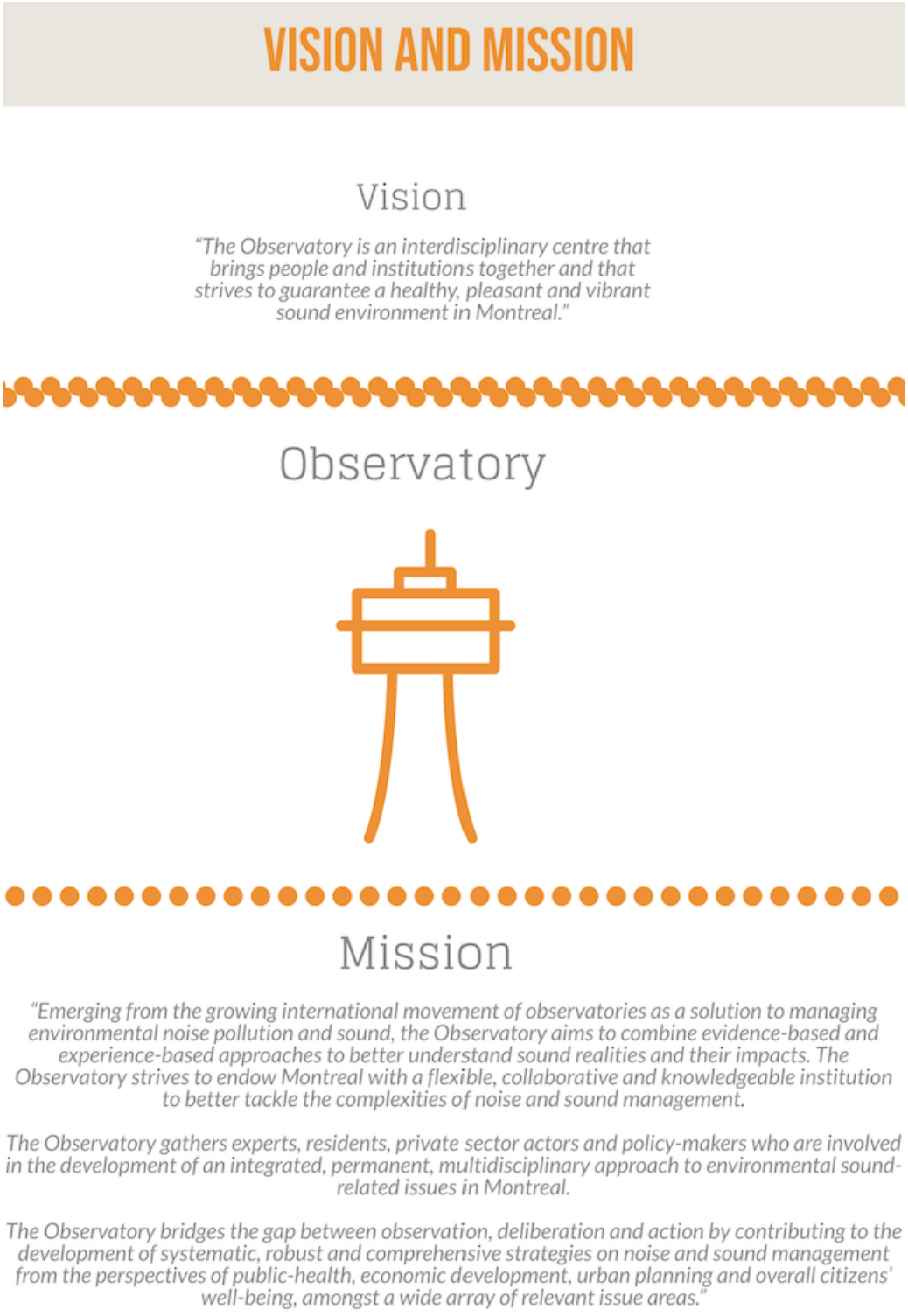
Its mission statement should provide guidance to its employees and stakeholders in their daily activities and serve as a reminder of the pillars that serve the organizational vision. The Observatory's mission statement should foster internal coherence and consistency.

***<u>Recommendation 5:</u>*** *It is recommended that the Observatory adopt a mission statement.*

As with the vision statement, below is a suggested mission statement for the Observatory.

> *"Emerging from the growing international movement of observatories as a solution to managing environmental noise pollution and sound, the Observatory aims to combine evidence-based and experience-based approaches to better understand sound realities and their impacts. The Observatory strives to endow Montreal with a flexible, collaborative and knowledgeable institution to better tackle the complexities of noise and sound management.*
>
> *The Observatory gathers experts, residents, private sector actors, and policymakers involved in developing an integrated, permanent, multidisciplinary approach to environmental sound-related issues in Montreal.*
>
> *The Observatory bridges the gap between observation, deliberation and action by contributing to the development of systematic, robust and comprehensive strategies on noise and sound management from the perspectives of public health, economic development, urban planning and overall citizens' well-being, amongst a wide array of relevant issue areas."*

Figure 9 Organizational flow chart of the vision and mission of the Observatory



### 6.2.3 Components and activities of the Observatory

The Observatory's mission must be articulated through its specific components. The components should be precise and refine the mission into concrete, materialized functions.

The components are a mix of broad, yet still narrow umbrella categories under which fall detailed and explicit activities and mandates that will be managed by the Observatory.

The following are the recommended components for the Observatory. They are inspired by the lessons extracted from the analysis of the benchmark jurisdictions.

1. Data collection;
2. Expertise building;
3. Collaboration;
4. Communications and public awareness;
5. Culture, heritage and Soundscaping.

#### Data collection component

Data and evidence inform the magnitude and details of a problem, possible strategies to address it and the measurement and evaluation of decisions.[129] They provide a coherent, more thorough understanding of the realities they describe.

In Quebec, specifically, many experts and publications highlight a significant lack of available data on noise.[130,131] Currently, most of the existing information on noise is based on estimations of noise levels and of the number of people impacted by environmental noise, as well as on noise complaints.[132] That absence of data makes it difficult to incorporate noise issues into different areas of policymaking, and impedes the differentiation between "normal noise" and "problematic noise."[133]

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[129] Justin O. Parkhurst, *The Politics of Evidence: from Evidence-Based Policy to the Good Governance of Evidence*, London: Routledge, 2017. http://eprints.lse.ac.uk/68604/1/Parkhurst_The%20Politics%20of%20Evidence.pdf
[130] Richard Martin, "Journées Du Bruit Environnemental 2019 – Conférence Introductive (Richard Martin)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=bKN2uJeLFiw.
[131] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.
[132]Richard Martin and Mathieu Gauthier, *Meilleures pratiques d'aménagement pour prévenir les effets du bruit environnemental sur la santé et la qualité de vie,* l'Institut national de santé publique du Québec, September 2018, https://www.inspq.qc.ca/sites/default/files/publications/2450_meilleures_pratiques_amenagement_effets_bruit_environnemental.pdf.
[133] *Ibid.*

For those reasons, the collection of noise data should be the cornerstone of Montreal's observatory. Montreal also has a significant data and information gap when it comes to addressing noise-related issues. Without filling this gap with reliable, relevant and high-quality data, noise problems will inevitably persist.

Almost all of the benchmark jurisdictions analyzed in this report included some form of data collection component, with the exception of Auckland and Japan. The jurisdictions without a data collection component struggle to mitigate noise in a cohesive manner and deploy a variety of noise abatement measures without the data to identify, track and evaluate changes in noise pollution.

***Recommendation 6:*** *It is recommended that the Observatory include a data collection component.*

Within that component, the Observatory should collect empirical and quantitative data, including noise levels and audio recordings. Collecting other types of information such as geographical location, demographics, and health indicators should be considered to generate more robust analyses and understand the impacts of environmental noise on the daily lives of Montrealers.

In order to collect this data, the Observatory should install a network of sound sensors in different areas of Montreal. This was seen as a common practice in the benchmark jurisdictions. Modern sensor technology is now more affordable and has the capabilities to capture noise levels in real-time and offer a year-round, 24/7 indication of the magnitude and the quality of environmental sound.[134] Newer technology can also provide information about the type (background noise or noise peak) and source (such as construction, traffic, dog barking, church bells) of recorded sound. In order to identify urgent noise issues and areas where the sound profile is acceptable, the sensors should be deployed in a variety of settings. Potential settings include calm and noisy areas, neighbourhoods with changing demographics, major roads and highways, construction sites, and schools and hospitals. In addition, the Observatory should make use of mobile sensors that can be moved from one location to another, based on needs or specific circumstances. For example, sensors could be installed in the Old Port when festivals take place at Parc Jean-Drapeau, at the Place des Festivals in June or on commercial avenues during Trade Fairs.

Australia, Barcelona, Brussels, Delhi, London, Lyon, Madrid, New York City and Paris collect quantitative data and use acoustic sensor technology.

[134] Adam Welz, "Listening to Nature: The Emerging Field of Bioacoustic," *Yale Environment 360*, November 5, 2019, https://e360.yale.edu/features/listening-to-nature-the-emerging-field-of-bioacoustics

For more detailed information regarding noise sensors, see Annex C.

***Recommendation 7:*** *It is recommended that the Observatory collect quantitative data through the installation of a permanent sound sensor network across the city and the use of mobile sensors.*

The Observatory should not limit its data collection activities to quantitative information. What differentiates pleasant sounds from unpleasant noises is our perception of what we are hearing.[135] The Observatory should, therefore, also collect qualitative information in order to understand how residents perceive the sounds they are exposed to. Efficiently tackling noise-related issues demands an acute understanding of the impacts on those affected by noise. The collection of quantitative and qualitative data best addresses the significant need for robust and policy-relevant data. Paris' Bruitparif and Barcelona's city council conduct focus groups and citizen interviews to gain an experience-based understanding of noise issues, in addition to quantitative, evidence-based considerations. Lyon's Acoucité distributes questionnaires and conducts in-person, phone and boardwalk surveys.[136]

London and New York City are other examples of jurisdictions collecting qualitative data.

***Recommendation 8:*** *It is recommended that the Observatory collect qualitative data in order to identify and evaluate residents' perceptions of sound.*

Quantitative and qualitative data enable the production and publication of noise maps that are common in many cities around the world and mandatory in the European Union for all agglomerations with a population over 250,000.[137]

Noise maps are a powerful tool that can clearly provide information on the levels, sources, changes and location of noise within the city and clearly depict "hot" and "cold" noise areas from a holistic perspective. Noise maps can serve as a fundamental contributor to urban planning and noise action plans[138] If noise maps are updated frequently, they allow for the combination of

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[135] Catherine Guastavino, "Journées Du Bruit Environnemental 2019 – Démonstration de bruit (Catherine Guastavino)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=oWApFefVPfo&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=4&t=0s.

[136] Bruno Vincent, "Journées Du Bruit Environnemental 2019 – Bloc 5 (Bruno Vincent)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=yJsD2EPRaf4&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=17&t=0s.

[137] Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise (2002). https://eur-lex.europa.eu/eli/dir/2002/49/oj

[138] *Ibid.*

different types of data to provide a comprehensive, up-to-date understanding of noise realities.[139] Barcelona's noise map aggregates decibel levels, noise sources, time periods (day, evening, night), historical data and specific geographical location.[140] It can also show the populations exposed to different noise levels, a strategic noise map (targeted decibel levels) and acoustic zoning. Noise maps can act as a data organization tool as well as a very efficient data communication device.

To maximize stakeholder engagement, noise maps need to be made completely and easily accessible online to anyone that might want to consult them.[141] It is for that reason that European cities that are required to produce noise maps, also have to make all noise maps and noise-related action plans accessible to the public.[142] Information provided to the population must be "clear, comprehensible and accessible, [and] a summary setting out the most important points shall be provided[143]

Other studied benchmark jurisdictions that produce noise maps include Australia, Brussels, London, Lyon, Madrid and Paris.

***Recommendation 9:*** *It is recommended that the Observatory produce noise maps to be made freely accessible online.*

To conclude the data collection component, the Observatory should consider making all its collected data open access. This would allow academics and other researchers to benefit from the rare and unique noise data and encourage more, and diverse, research about noise in Montreal. Open access data would also increase the transparency of the Observatory and enable the general population (residents, artists, researchers, civil society groups) to participate in the noise conversation in the city. In addition, making the Observatory's data open can significantly simplify the management of data access to the eventually numerous stakeholders of the Observatory.[144]

Qualitative data that could require confidentiality, such as audio clips of people speaking, might be exempted from being freely accessible. Yet, processes to make only aggregated or anonymized

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[139] Richard Martin, Pierre Deshaies and Maurice Poulin, *Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains*, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.
[140] Ajuntament de Barcelona. *Environmental data maps.* https://ajuntament.barcelona.cat/mapes-dades-ambientals/soroll/en/
[141] Bruno Vincent, "Journées Du Bruit Environnemental 2019 – Bloc 5 (Bruno Vincent).
[142] Directive 2002/49/EC of the European Parliament and of the Council of 25 June 2002 relating to the assessment and management of environmental noise (2002). https://eur-lex.europa.eu/eli/dir/2002/49/oj
[143] *Ibid.*
[144] Australian Acoustic Observatory, phone interview by Policy Lab Team, Montreal, June 24th 2020.

qualitative data available, or to modify personally identifiable information could help mitigate this concern.

The Australian Acoustic Observatory is the most prominent example of an observatory with an open data model, making all data they collect freely available online. Barcelona, Brussels, London, Lyon, Madrid, New York City and Paris also openly publish their data to varying degrees.

***Recommendation 10:*** *It is recommended that the Observatory make all of its noise data open access.*

## Expertise building component

Raw data is of limited use to stakeholders such as policymakers and the public. Data inputs should be processed and analyzed in order to provide any relevant contribution to understanding real-world challenges. The Observatory's data needs to be translated into valuable information that can generate expertise and improve public and private decision making.

Australia, Brussels, Lyon, Paris and New York City all include an expertise building component, through which they produce, aggregate and distribute knowledge.

***Recommendation 11:*** *It is recommended that the Observatory include an expertise building component.*

Within that component, the Observatory should engage in research activities and produce reports periodically or on an ad hoc basis. Partnering with other institutions and stakeholders, such as universities, research centers, and governmental bodies, would provide the Observatory with the opportunity to collaborate in the international network of acoustics research. The Observatory could also produce *in-house* research. Researchers from the Observatory could submit project proposals to scientific grant funds (notably the *Fonds de recherche du Québec* and the Canadian Tri-Councils) in order to finance specific research activities. The Observatory should release publications, action plans, impact assessments, and other relevant research as a member of the research community. These publications will increase access to much-needed data analysis on noise in Montreal and in Quebec.[145]

[145] Acoucité, phone interview by Policy Lab Team, Montreal, July 7, 2020.

All benchmark observatories that have an expertise building component also participate in research and publication activities. The Lyon observatory relies on its experts to showcase its credibility, which helps attract public support and diverse financing. [146]

***Recommendation 12:*** *It is recommended that the Observatory undertake research and publication activities.*

The production of data, reports and expert analysis can contribute to making evidence-based decisions about noise issues. Without them, public and private policy decision-makers will be unable to accurately identify the issues that need to be addressed and find appropriate solutions. The Observatory should be an advisor to public and private stakeholders, contributing to the improvement of noise policymaking in Montreal.[147,148] With its expertise and knowledge on the noise issues specific to Montreal, the Observatory should undertake consultation processes on noise-related issues.

The Observatory can be a key partner in the city's policy development, implementation and evaluation stages. Departments such as urban planning, health and transport could benefit from the insights of noise experts.[149] Improved knowledge of environmental sound can advise decisions on municipal directives such as zoning and construction. The Observatory can also provide valuable insights for private sector decisions such as developments, construction, site location and investments.

The Barcelona, Brussels, London, Lyon, Madrid and Paris observatories conduct policy advisory activities. Lyon's Acoucité notably contributed to the decision to build a daycare in a quieter area.[150]

***Recommendation 13:*** *It is recommended that the Observatory undertake policy advisory activities.*

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[146] Acoucité, phone interview by Policy Lab Team, Montreal, July 7, 2020.
[147] Richard Martin, Pierre Deshaies and Maurice Poulin, *Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains*, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.
[148] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.
[149] Richard Martin, Pierre Deshaies and Maurice Poulin, *Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains*, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.
[150] Bruno Vincent, "Journées Du Bruit Environnemental 2019 – Bloc 5 (Bruno Vincent)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=yJsD2EPRaf4&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=17&t=0s.

Montreal is a leader in environmental sound research and acoustics technology with its local university network of sound researchers, including the Sounds in the City soundscape project. The Observatory should consider leading, or contributing to, research and development projects in collaboration with other public, academic or private stakeholders. By undertaking fundamental and applied research mandates that could lead to concrete and needed innovations, the Observatory could contribute to technological breakthroughs and noise solutions. A research and development mandate also promotes collaboration between partners and fosters innovation.

Of the benchmark jurisdictions analyzed, London is innovating to develop quieter road materials, as a means of reducing noise emission from vehicle traffic. In addition, the city has been working to level roads as a means of reducing vehicular turbulence that generates louder sounds.[151] In Singapore, the Housing Development Board established collaborations with materials manufacturers that have led to the development of materials designed to absorb, reflect or reduce the transmission of noise between urban dwellings in close quarters. Such collaboration has proven to reduce the impact that noise has on residential units.[152]

Other cities have also included artificial intelligence and information technologies within their noise-management strategies. New York City's observatory uses big data and machine learning to develop intelligent sensor technology. Barcelona requires that every venue has a sound device linked to their speakers throughout the bar, which is able to automatically reduce the volume once sound exceeds a certain decibel level.[153]

***Recommendation 14****: It is recommended that the Observatory lead or contribute to research and development programs to contribute to technological advancements that would directly benefit noise-related solutions.*

[151] Mayor of London, "*Sounder City - The Mayor's Ambient Noise Strategy*," Greater London Authority, March 2014, https://www.london.gov.uk/sites/default/files/mayor-strategies-noise-docs-noise_strategy_all.pdf
[152] Springwise, "Noise pollution addressed by smart-city research," August 30, 2016, https://www.springwise.com/noise-pollution-addresses-smart-city-research/
[153] Barcelona City Council, *Zoom* interview by Policy Lab Team, Montreal, June 26th, 2020.

## Collaboration component

Noise issues in Quebec are overseen by 11 ministries, 10 organizations and countless municipal bodies.[154,155] This atomized structure can lead to incoherent policy development. Noise is also a source of deliberation for countless civil society groups, industries, private sector businesses and citizens that often tackle noise issues in silos. This fragmented approach impedes the development of efficient strategies to tackle noise problems, and the demand is growing for a concerted and coordinated approach towards the noise.[156]

Bringing all relevant stakeholders to the same table, under the expertise of the same institution, would help bridge responsibilities, knowledge and interests together in designing sound noise policies.[157,158] It would facilitate the adoption of a coordinated, collaborative and coherent approach to noise management between stakeholders of diversified perspectives and interests, further improving work on noise management.[159]

The Observatory should act as a noise "one-stop-shop" to bring together relevant actors around the same set of recognized data, principles, approaches and discussions. Much of the success of noise management is contingent on the ability to gather and coordinate relevant actors together. The Observatory has an opportunity to become the preeminent voice on noise and be a resource for all other stakeholders to understand how noise impacts their work.

***Recommendation 15:*** *It is recommended that the Observatory include a collaboration component.*

Within that collaboration mandate, the Observatory should proactively identify and reach out to relevant stakeholders that might have been left out of noise discussions, but whose impact would be valuable.

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[154] Richard Martin, Pierre Deshaies and Maurice Poulin, *Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains*, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.
[155] Richard Martin, "Journées Du Bruit Environnemental 2019 – Bloc 2, Présentation 1 (Richard Martin)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=SMYVIb-v2dk&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=10&t=0s
[156] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.
[157] Deborah Delaunay, "Journées Du Bruit Environnemental 2019 – Bloc 2, Présentation 2 (Déborah Delaunay)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=zIJP1xKZBog&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=11&t=0s
[158] Bruno Vincent, "Journées Du Bruit Environnemental 2019 – Bloc 5 (Bruno Vincent)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=yJsD2EPRaf4&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=17&t=0s.
[159] Richard Martin, "Journées Du Bruit Environnemental 2019 – Conférence Introductive (Richard Martin)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=bKN2uJeLFiw.

Australia, Barcelona, Lyon, London, New York City and Paris provide examples of such collaborative mechanisms embodied by their observatories.

***Recommendation 16:*** *It is recommended that the Observatory's role include identifying and bringing together stakeholders for the purpose of collaboration around noise-related issues.*

Noise impacts many sectors of municipal activity. From economic development to culture, environment and housing, noise is a low-profile issue that can have significant negative effects on urban quality of life. According to the *Ministère de la Santé et des Services Sociaux du Québec,* there is a clear need to develop the knowledge and abilities of civil servants to help them better understand the scope of noise issues and to provide them with the necessary tools to identify clever and efficient solutions to prevent them.[160]

The Observatory should collaborate with the city to design and provide training programs to municipal employees in order to increase their level of knowledge and understanding of how noise issues interact with their mandates. Such training programs currently exist in Barcelona and in Brussels.

***Recommendation 17:*** *It is recommended that the Observatory develop training programs for municipal employees to help them incorporate noise management into their mandates.*

The Observatory also has an opportunity to assist individual boroughs in their noise management efforts. In Montreal, noise regulations are largely managed by individual boroughs making noise policy and management highly localized. The Observatory can assist boroughs in their local handling of noise issues while connecting boroughs, where there are opportunities to generate a more cohesive policy.

The Observatory's support could come in the form of periodic training and consulting with boroughs on issues management and local policy development. Barcelona, Brussels and London provide such support to local governments in noise management.

***Recommendation 18:*** *It is recommended that the Observatory provide support to individual boroughs in managing noise-related issues.*

[160] Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.

Currently, noise complaints in Montreal are routed to the 311 non-emergency line or the 911 emergency services line, depending on the source of noise residents are complaining about.

The Observatory could support 311 and 911 services in handling noise complaints through training, strategic planning, sharing noise data and international best practices.[161] It is important to clarify that the Observatory should not respond to noise complaints itself; its sole responsibility would be to help services that already do it to improve. Such activity was notably noticed in Brussels and in New York City, where the SONYC observatory supports the city by identifying noise code violations via its sensor system and alerting city officials for follow up.

***Recommendation 19:*** *It is recommended that the Observatory proactively collaborates with 311 and 911 services in elaborating strategies to respond to noise complaints.*

Communication and public awareness component

Noise is often considered as an "experts only" topic, as it requires expertise in its management.[162,163] On the other hand, it is a public issue whose solutions lie in public awareness and coordinated action. Residents and local actors stand to benefit from a better understanding of noise and how it impacts their health, work, environment and quality of life. There is very little public awareness with regards to the impacts and consequences of noise. A comprehensive approach to addressing noise needs to include engaging with local actors, educating the public, developing a shared understanding of noise issues and empowering communities to play an active role in noise management to create comfortable and pleasant noise environments.

***Recommendation 20:*** *It is recommended that the Observatory include a communication and public awareness component.*

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[161] Richard Martin, Pierre Deshaies and Maurice Poulin, *Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains*, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.
[162] Richard Martin, "Journées Du Bruit Environnemental 2019 – Conférence Introductive (Richard Martin)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=bKN2uJeLFiw.
[163]. Ministère de la Santé et des Services Sociaux, *Vision Et Orientations Gouvernementales En Matière De Lutte Contre Le Bruit Environnemental Au Québec*.

There is an urgent need to improve noise literacy and communication with the greater public.[164,165] Making sure the public is informed about, and understands, noise-related issues is key if they eventually are asked to engage with policies and adapt their behaviour.[166] The Observatory should provide basic knowledge on noise, raise awareness on the problems it can create and mobilize stakeholders and residents to actively work to reduce noise-related issues.

In addition, engaging and communicating with residents can help improve their understanding of noise emissions, reduce their dissatisfaction and defuse noise-related conflicts before they occur. A German study suggests that informing citizens on construction noise helps avoid complaints and creates a more positive context regarding construction projects.[167] Given the construction-heavy reality of Montreal, this could significantly improve overall city perceptions and quality of life.

By including communication activities in its design, the Observatory can become an important upstream actor that informs stakeholders and residents on noise, while partnering with Montreal on its downstream noise management strategies.[168,169]

Barcelona, Brussels, Lyon, Madrid, New York City and Paris conduct communications and public awareness activities.

***Recommendation 21:*** *It is recommended that the Observatory undertake public awareness campaigns and activities with the goal of sensitizing residents and stakeholders to noise issues.*

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[164] Coralie Deny et Déborah Delaunay, "Journées Du Bruit Environnemental 2019 – Bloc 6, Présentation 2 (Coralie Deny et Déborah Delaunay)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=eMtaGQv-QKA&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=18

[165] Richard Martin, Pierre Deshaies and Maurice Poulin, *Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains*, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.

[166] *Ibid.*

[167] Margrit Bonacker, "Avoiding Neighbors Complaints Because of Construction Site Noise." InterNoise 18 (December 18, 2018). https://www.ingentaconnect.com/content/ince/incecp/2018/00000258/00000001/art00001

[168] Catherine Guastavino, "Journées Du Bruit Environnemental 2019 – Démonstration de bruit (Catherine Guastavino)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=oWApFefVPfo&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=4&t=0s.

[169] Deborah Delaunay, "Journées Du Bruit Environnemental 2019 – Bloc 2, Présentation 2 (Déborah Delaunay)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=zlJP1xKZBog&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=11&t=0s

Noise impacts different segments of the population, and the Observatory can play a primary role in designing and delivering adapted educational material and programs.[170,171]
In New York City, the SONYC observatory holds a summer program to educate school-age children about noise and the science of sound.[172] Brussels has developed a school program to help children understand and engage with noise issues in their schoolwork. Lyon's Acoucité has created educational material such as videos and handouts for elementary school students.[173]

In the private sector, the Observatory could assist workplaces and industry groups in understanding noise issues and developing responses. Such responses can include incorporating noise management at the design stage of projects, developing private sector noise policies, adapting their practices to limit their noise emissions and contributing to mitigation measures. The Observatory's noise mapping could also provide valuable insights to private sector actor decisions.

***Recommendation 22:*** *It is recommended that the Observatory target schools, workplaces and industries to develop programs adapted to their noise management needs.*

## Culture, heritage and Soundscaping component

Environmental sound is an important aspect of Montreal's culture and heritage. The Observatory's data collection activities provide the opportunity to explore the multiple facets of noise and sound, including their cultural importance and their contributions to Montreal's heritage.[174]

***Recommendation 23:*** *It is recommended that the Observatory include a culture, heritage and Soundscaping component to capture the sensory dimensions of sounds and to celebrate positive sounds.*

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[170] Bruno Vincent, Journées Du Bruit Environnemental 2019 – Bloc 5 (Bruno Vincent), Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=yJsD2EPRaf4&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=17&t=0s.
[171] Richard Martin, Pierre Deshaies and Maurice Poulin, Avis sur une politique québécoise de lutte au bruit environnemental : pour des environnements sonores sains, l'Institut national de santé publique du Québec, September 2015, https://www.inspq.qc.ca/pdf/publications/2048_politique_lutte_bruit_environnemental.pdf.
[172] Graham Grove, *"SONYC ieSoSC summer program"* SONYC Sounds of New York City September 24th, 2018, https://wp.nyu.edu/sonyc/2018/09/24/sonyc-iesosc-summer-program/
[173] "Pedagogie," *Acoucite,* accessed July 7, 2020, https://www.acoucite.org/pedagogie/.
[174] Bruno Vincent, "Journées Du Bruit Environnemental 2019 – Bloc 5 (Bruno Vincent)," Presented November 13, 2019 in Montreal, Youtube video, https://www.youtube.com/watch?v=yJsD2EPRaf4&list=PLHCIr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=17&t=0s.

The visual features of urban environments tend to be highly accessible and are accorded the most attention and resources. On the other hand, the auditory features of cities are often taken for granted, although they play such an important role in a city's identity.

The Observatory has the opportunity to contribute to the growing local and international movement to capture urban sounds and the noise personalities of cities. Aside from measuring and capturing noise, the Observatory's sensor network can capture a range of Montreal sounds that could be useful for a growing list of purposes, including promoting tourism, memorializing culture, and remembering historical sounds. The Montreal Sound Map project is an online repository for sounds.[175] Similar sound projects exist around the world but often rely on crowdsourcing, limited technology and have low visibility. The Observatory can leverage its sensor network and pre-existing infrastructure to contribute to the capturing of Montreal sounds and bring more visibility to this new field. Other interesting applications of environmental sound recordings include music and sound art installations.

Montreal is rich in history and cultural heritage. Environmental sound recordings should be a part of this heritage. The Observatory should explore opportunities to partner with historical and cultural institutions such as the *Centre d'Histoire de Montréal*, *Musée McCord*, and *Musée Pointe-à-Callière*.

Japan's *One Hundred Soundscapes of Japan: Preserving Our Heritage* is an initiative from the Japanese Ministry of Environment to curate and preserve 100 unique sounds throughout the country that represent its unique heritage and culture. Among the many soundscapes is the Bell of Peace in Hiroshima.[176]

Similar activities are led by the Australian Acoustic Observatory as well as by noise observatories in Barcelona, London, and Lyon.

***Recommendation 24:*** *It is recommended that the Observatory build an archive of Montreal sound recording for the purpose of celebrating, analyzing and memorializing Montreal's sound personality, heritage and culture.*

As a leading voice on environmental sound, the Observatory should help promote sound arts and environmental Soundscaping. Activities could include collaborating with sound artists, holding sound arts exhibits and connecting the acoustics and arts communities.

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[175] Montreal Sound Map, 2020, https://www.montrealsoundmap.com
[176] Mike Goldsmith, "Discord: the story of noise" (Oxford UP, 2012).

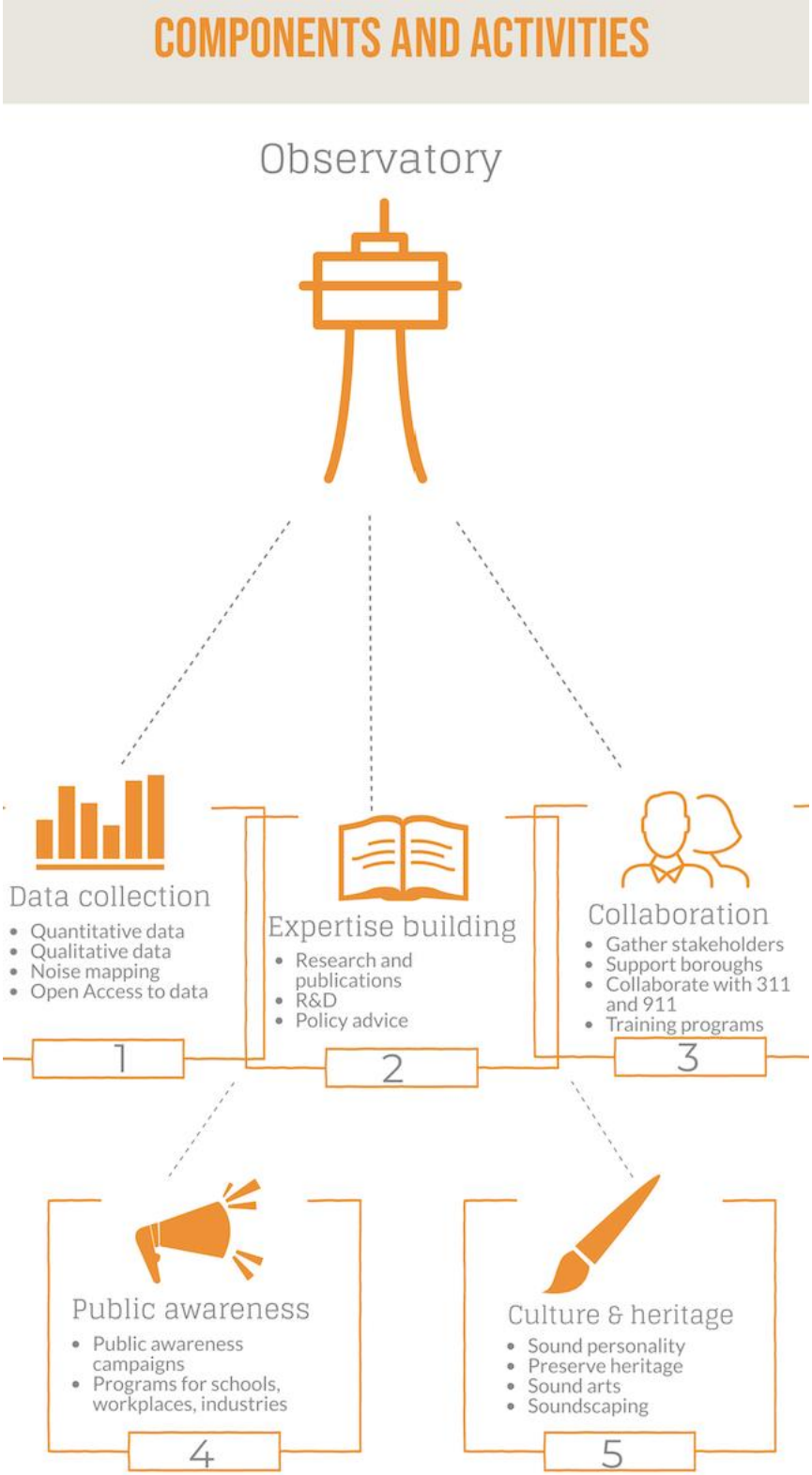
Other potential projects the Observatory could explore include soundwalks, or vibe maps and urban sound trails. The Montreal-based project Sounds in the City already offers soundwalk tours in Montreal, as well as in other cities like Amsterdam and Boston, to initiate people to Soundscaping and environmental sounds.[177] Partnerships with organizations already in this space should be explored.

The Australian Acoustic Observatory, while primarily an ecoacoustic research observatory, is collaborating with artists and musicians to use sound recordings in creative ways.[178]

***Recommendation 25:*** *It is recommended that the Observatory promote environmental Soundscaping and sound arts.*

[177] "Interested in a sound walk?" Sounds in the City, accessed July 7, 2020, https://www.sounds-in-the-city.org/en/soundwalks/
[178] "Leah Barclay," Soundcloud, accessed July 7, 2020 https://soundcloud.com/leah_barclay

Figure 10 Organizational flow chart of the components and activities of the Observatory.



## 6.3 Governance structure for observatories

Observatories vary in their structure. While some observatories are incorporated as a standalone organization, others are simply included as branches, working groups or dedicated missions within existing organizations.[179,180] Depending on their intended purpose, observatories enjoy different levels of decisional autonomy and independence. The following section will cover existing governance methods and models for observatories, along with an assessment of the advantages and disadvantages of those models.

### Governance according to the type of observation

The type of phenomenon being observed can influence the structure of an observatory. Observatories that are designed to study a territory rather than a specific topic tend to be geographically decentralized and included in existing structures. On the other hand, observatories that tackle a specific subject without territorial limits tend to exist as standalone entities, or at least to be affiliated with larger-scale organizations.[181]

Given its purpose and the type of observations it is intended to perform, Montreal's Observatory should be a hybrid of these two models. Its objective would be to study issues in the context of noise and environmental sound within the defined jurisdictional framework of the city.

It is important to note that if the Observatory was eventually intended to study a larger area than the island of Montreal, a standalone structure that still allows for some decentralization could prove to be particularly effective. This idea is further addressed at the end of this section.

[179] Jean Rouchet, Les Observatoires Economiques et Sociaux, Conseil National de l'Information Statistique, September 1999, http://www.epsilon.insee.fr/jspui/bitstream/1/56657/1/CNIS_rapports_1999_53.pdf
[180] Emilie Zapalski, Développement des territoires - Les observatoires territoriaux : des coquilles vides?, Banque des Territoires, October 19, 2011 https://www.banquedesterritoires.fr/les-observatoires-territoriaux-des-coquilles-vides
[181] Jean Rouchet, Les Observatoires Economiques et Sociaux, Conseil National de l'Information Statistique, September 1999, http://www.epsilon.insee.fr/jspui/bitstream/1/56657/1/CNIS_rapports_1999_53.pdf

## Governance according to the structural configuration

A research report published by the *Institut National de Recherche Scientifique du Québec* (INRS) suggests that observatories' governance schemes can be divided into three different models: the Classical model, the Structural Partnerships model and the "Part of a Mission" model.[182,183]

The Classical model of governance involves an independent organization, with a mostly vertical, hierarchical structure. Observatories corresponding to that model are often managed by a board of governors, an executive team, an executive director and a team of employees assigned specifically to the observatory. These observatories tend to establish partnerships on an *ad hoc* basis, according to their needs, either to collaborate on specific projects or to share services and visibility.

This model offers the advantage of a clear, traditional governance structure that facilitates accountability. It also favours the establishment of important organizations with important resources and therefore increases working capacity. However, this structure can be perceived as rigid, and it does not structurally include partners and stakeholders in the daily governance and activities of the observatory.

The Structural Partnership model of governance is intrinsically designed to encourage collaboration between multidisciplinary actors with common objectives or interests. Similarly to those following the classical model of governance, observatories based on structural partnerships tend to be standalone organizations, but they include external stakeholders in the core of their governance structure. As such, instead of collaborating through ad hoc partnerships, they formalize their collaborations and consider them as pillars of their governance scheme.

This model offers similar advantages to those of the classical model of governance. It also ensures that a wider variety of voices are structurally included in the daily governance and activities of the observatory. It is to be noted, however, that this diversity of interests and priorities can become harder to manage, and the efficiency of the observatory can be impacted by the need to negotiate different actors' views before any work can be initiated.

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[182] Christian Poirier, Catherine Lavoie-Marcus, Catherine Duchesneau, Ajouna Bao-Lavoie et Guy Bellavance, Observatoires culturels et secteur de la danse au Québec : paramètres et modalités d'un observatoire de la danse,Institut national de la recherche scientifique Centre - Urbanisation Culture Société, (Montreal, March 2011), http://www.chairefernanddumont.ucs.inrs.ca/wp-content/uploads/2013/09/PoirieC_BellavanceG_2011_Observatoires_culturels_et_secteur_de_la_danse_au_Quebec.pdf

[183] Note that the INRS report also defines a fourth model, the Financial Partnership model. This model has not been included in our report, as funding schemes are presented and treated independently from the governance structure.

The last model is referred to as the "Part of a Mission" model of governance. It often characterizes observatories that are not established as a standalone organization, but mostly as branches, working groups or dedicated objectives within already existing organizations. Their purpose is often very specific and demarcated and is usually accomplished by smaller teams.

This governance model has the advantage of being easier to implement, as it only requires slight modifications of existing structures and to reassign some roles, tasks and employees. However, this model usually comes with fewer resources and less independence.

The three models presented above share similarities and differences, as well as respective advantages and disadvantages. In choosing a model for the Observatory, and based on benchmark jurisdictions' example, Montreal should prioritize ensuring collaboration between stakeholders and a multidisciplinary and transversal approach to noise and environmental sound. In order to accomplish its mission, the Observatory should benefit from sufficient resourcing, flexibility and a wide scope of activities.

Per the INRS report:

> "[...] observatories that combine a horizontal, flexible and light structure, in phase with the needs of their environment, and that connect partners producing and asking for information are, most often, structural partnerships or 'parts of a mission' within a strong organization with important financial means".[184]

We believe that the best governance structure for Montreal's observatory is a standalone institution, based on the model of structural partnership. It is this model that would best combine efficiency, structure, constant collaboration, independence and proactivity. A standalone institution is also ideal for expanding coverage to include multiple jurisdictions. Given the inter-jurisdictional nature of noise, particularly noise related to road traffic, there are opportunities for expanding the observatory activities to multiple jurisdictions or at the provincial level. An independent observatory is also the most appropriate structure to coordinate various jurisdictions in joint noise management projects.

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[184] Christian Poirier, Catherine Lavoie-Marcus, Catherine Duchesneau, Ajouna Bao-Lavoie et Guy Bellavance, Observatoires culturels et secteur de la danse au Québec : paramètres et modalités d'un observatoire de la danse,Institut national de la recherche scientifique Centre - Urbanisation Culture Société, (Montreal, March 2011), http://www.chairefernanddumont.ucs.inrs.ca/wp-content/uploads/2013/09/PoirieC_BellavanceG_2011_Observatoires_culturels_et_secteur_de_la_danse_au_Quebec.pdf

Lyon's Acoucité and Paris' Bruitparif are established under a model similar to the structural partnership model and have been effective in carrying out their mandates.

***Recommendation 26:*** *It is recommended that the Observatory be a public, not-for-profit organization at arms-length from the City, with its own independent governance, operations and activities, and operating under a collaborative governance model.*

Governance

As an independent organization, the Observatory will need its own governing Board of Directors. The Board of Directors would be responsible for the strategic direction of the organization, overseeing functions including administration (such as internal policies and by-laws, and human resources obligations), finance (such as budget planning, fiscal obligations and funding approval) and structural activities (such as long-term development and strategic planning) of the Observatory.

Given the importance of collaboration in the Observatory, the Board will need to be inclusive and accessible to various key stakeholders:

- **Municipal, Provincial and Federal elected officials and civil servants**
  Their presence fosters intergovernmental coordination, both on the political and administrative side. Consideration should be taken of the differences between permanent civil servants and elected officials, and their respective roles. In order to protect the independence of the Observatory, there must be a limit on the number of elected and non-elected government officials on the Board (they should notably not represent a majority of Board members).

- **Civil society members**
  A significant amount of advocacy and action on noise pollution has been led by civil society. In order to leverage their expertise and understanding of noise issues on the ground, the Observatory's Board should include civil society members. Including the public integrates transparency and collaboration at the heart of the Observatory. Civil society members could include interest groups, citizens' coalitions, residents and noise or sound-related collectives.

- **Experts, scientists and the academic community**
  The inclusion of experts and researchers encourages knowledge development and sharing. It is important that the Observatory is a legitimate, nonpartisan, and evidence-based organization. This requires that the organization is guided, in part, by representatives from universities, think tanks or other research bodies and organizations.

- **Private sector members**
  Private sector actors are an important part of the noise and environmental sound management. From industry to local businesses and workplaces, the private sector is often regarded as a problematic noise emitter, and not as a key partner in noise strategies. Including representatives from this sector would foster more collaboration and innovation. Potential members include *Aéroports de Montréal, Evenko, Quartiers des Spectacles* and *Port of Montreal,* amongst other big noise emitters already active in the noise debate. Smaller noise emitters from the private sector should also be included.

Such a structure resembles Lyon's Acoucité observatory's Board of Directors, which includes various stakeholders to guarantee diversity in the governance of the organization. However, it is important for the Board of Directors to be nonpartisan on specific issues. Partisanship can affect the Observatory's credibility and public opinion. The Board of Directors should continue to provide clear directives for the Observatory without interfering with its daily operations.[185]

The specific decision to include political actors on the Board deserves further discussion. By not including political officials, the Observatory would assure its independence from internal governmental influence. However, including political actors is the best way to ensure cohesion between the Observatory's work and the city's noise policy development. Based on our analysis of the benchmark jurisdictions and the Observatory's role as a convener of various stakeholders, it is our opinion that the inclusion of political actors best serves the Observatory's mandate and objectives. Therefore, in order to leverage the important role of government in noise issues, the Observatory's Board should have political actors with clear definitions of their role within the Board, with a balance of municipal, provincial and federal levels.

***Recommendation 27:*** *It is recommended that the Observatory's Board of Directors includes a diversity of stakeholders from the public sector, private sector, academic and research community, and civil society organizations that will have the opportunity to participate fully in the governance of the Observatory.*

Employees

In order to achieve its mandate and objectives, the Observatory should have permanent staff that will manage its daily activities and operations.

[185] Acoucité, phone interview by Policy Lab Team, Montreal, July 7th 2020.

The Observatory should have an Executive Director, in charge of overseeing the general activities of the observatory and leading a team of permanent employees. The Executive Director should also have a seat on the Board of Directors.

Under the Executive Director should be a team of permanent employees, including but not limited to noise technicians and researchers, to help with the data collection and report production activities. Employees with expertise in communications could also be a strong asset to help with the communication and public awareness component. A community liaison and a partnership role could also assist the organization in its stakeholder and collaboration objectives. Note that all employees should be employees of the Observatory, and not of the City of Montreal since it is an independent organization.

Lyon's Acoucité has a similar structure with a director and staff, which has been effective in the execution of its mandate.

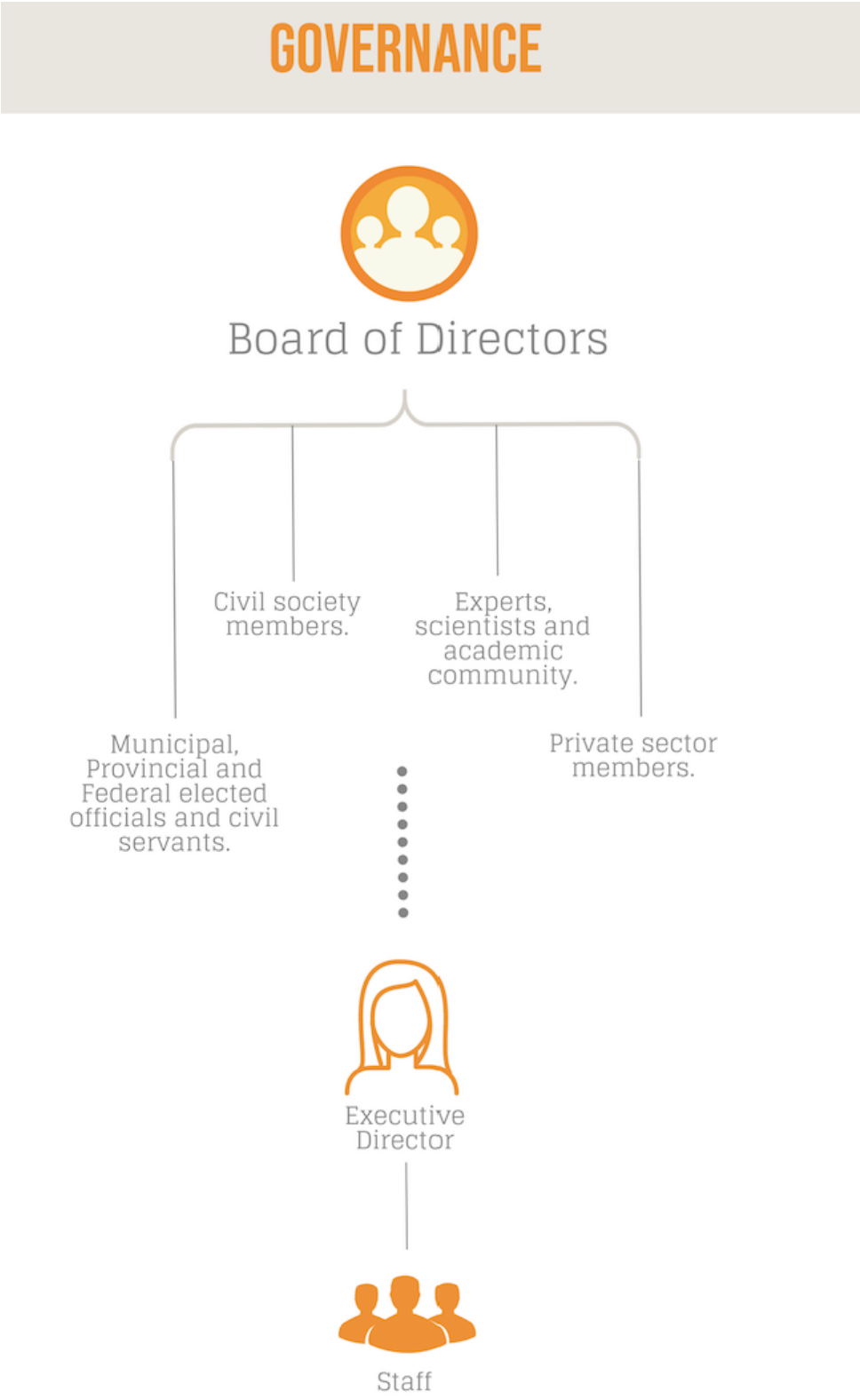
***Recommendation 28:*** *It is recommended that the Observatory establish a full-time Executive Director role, whose responsibilities will include the operationalization of the Observatory's mandate and serving as an ex-officio member of the Board of Directors.*

***Recommendation 29:*** *It is recommended that the Executive Director of the Observatory be appointed by the Board of Directors.*

***Recommendation 30:*** *It is recommended that the Observatory have full-time dedicated staff.*

***Recommendation 31:*** *It is recommended that the Observatory have, amongst its staff, researchers, noise-experts, technicians, community liaisons, and communication specialists.*

Figure 11 Governance structure



## Financial governance

Observatories can receive funding for their operations through a variety of sources, including but not limited to public institutions, private stakeholders, research and innovation departments and philanthropic foundations. The fore mentioned INRS report and our analysis of the benchmark jurisdictions highlight that the most effective financing option for observatories is a combination of different financial contributions to ensure organizational continuity, independence and flexibility.

In the case of Montreal, the Observatory should be financed by a combination of mostly public, academic and philanthropic sources and explore other financing sources that align with its mandate.

In the long term, the public portion of the funding should include municipal, provincial and federal funding from relevant departments (such as public health, infrastructure, transportation, and economic development). Funding from the different levels of government is appropriate, given the Observatory's activities in research and collaboration in partnership with government actors. The Observatory's work feeds directly into many government departments' mandates and will inform their policy work.

In order to guarantee sufficient funding for the first years of operation for the Observatory, the City of Montreal should commit to fully funding the operations of the Observatory for a period of five years following implementation. The time period of five years was identified in order to ensure continuity of the Observatory beyond the typical four-year mandate of a government and insulate the organization from the budget punctuations of the electoral cycle. As the Observatory matures and secures external funding, the publicly funded portion of the Observatory's budget could then be scaled back over the years. Yet, it is recommended that the Observatory's municipal government funding always remains at a minimum of 50% of total funding. This ensures that the Observatory remains a majority public organization, maintains its strong connection to the municipal government and continues to serve Montreal's population and the public interest. Lyon's Acoucité is currently receiving such diversified sources of funding. That diversity helps the Observatory to remain independent and not bound to specific interests. Acoucité's more than 20 years of existence contribute to its current funding scheme.[186] For Montreal, guaranteed funding would be preferable for the first years of the Observatory's operations; this would guarantee its ability to run its operations, helping build the Observatory's credibility. After its reputation is well established, the Observatory will have more options to easily seek funding from different stakeholders.

[186] Acoucité, phone interview by Policy Lab Team, Montreal, July 7, 2020.

For additional sources of funding, the Observatory could leverage partnerships with academic researchers who receive grants from major scientific grant funds such as the *Fonds de Recherche du Québec* or the *Canadian Tri-Councils*. It could also pursue philanthropic funding given its primarily public-oriented mandate.

New York City's observatory is an example of a diversified funding model. It is jointly funded by New York City, Ohio State University and New York University. Lyon and Brussels are other similar examples.

Note that a systematic evaluation of any source of funding should be conducted, in order to ensure that funders align with the mission of the Observatory. Further considerations should be taken regarding private sources of funding and evaluating how they may impact the Observatory.

***Recommendation 32:*** *It is recommended that the funding structure of the Observatory include multiple sources (municipal, provincial, federal, academic, philanthropic and other). Further consideration should be taken into what types of funding will be accepted to ensure that funders align with the Observatory's vision, mission, components and activities.*

***Recommendation 33:*** *It is recommended that the City of Montreal commit to funding the Observatory at 100% of its budget for the first 5 years, and no less than 50% of its annual budget in subsequent years, as additional funding sources become available.*

Independence and decision making

Autonomy and independence are paramount for observatories.[187] If they are to fully accomplish their objectives, observatories need to benefit from an unchallenged liberty to conduct their operations as per their stated mandate. Any undue pressure or lack of autonomy, real or only in appearance, will undermine the work of the Observatory.[188]

The need for independence might appear as a tension point for a publicly supported and funded observatory. Yet, some of Montreal's institutions already operate in a way that maintains both independence and ties with the city's administration. The *Office de Consultations Publiques de*

[187] Vicky Huppe and Elisabeth Masson, Projet d'Observatoire sur la santé et l'environnement bâti, Institut national de sante publique de Quebec, June 9, 2014, https://www.inspq.qc.ca/es/projet-d-observatoire-sur-la-sante-et-l-environnement-bati

[188] Vincent Piveteau, "Observatoire des territoires et gouvernance locale : un lien structurel à réinterroger," Pour no. 2-3 (2011): 165-168, https://www.cairn.info/revue-pour-2011-2-page-165.htm

*Montréal* (OCPM) is an institution that is financially supported by the city but maintains its independence.[189]

Observatories also vary in their level of decision-making power. While some observatories have the recognized power to sanction binding decisions, some only have the ability to submit public recommendations. Other observatories limit themselves to internal recommendations to different departments of their home organization.

In the case of Montreal, the Observatory should be allowed to provide public recommendations through the publication of reports and research papers. It should also have the autonomy to publish recommendations to governmental and non-governmental bodies. However, the Observatory should not have regulatory or policymaking powers. Policymaking for noise is and should remain the job of government and elected, accountable decision-makers, with opportunities explored for how the Observatory can support that work.

The Observatory's role as an advisory body on noise policy will have an important part to play in the future of noise policy. Just as organizations such as the *Office de Consultations Publiques de Montréal* have leveraged their powerful platform and legitimacy to influence policy, the Observatory can advise the government and meaningfully shape noise policy.

***Recommendation 34:*** *It is recommended that the Observatory, in an advisory role, be granted the freedom to disseminate its independent commentary and views with respect to noise issues in Montreal, without undue interference or censorship, by any external parties.*

Proactivity

Some observatories contribute to the public debate only when they are required or requested to do so, while others proactively identify areas where their expertise would be impactful.

Drawing on its expertise, Montreal's observatory should proactively identify situations where its input can be relevant and convene stakeholders when it could positively contribute to public dialogue. If the Observatory had to wait to be called upon, many opportunities to benefit from its knowledge could be missed.

***Recommendation 35:*** *It is recommended that the Observatory have the autonomy to proactively identify and engage with any relevant noise-related issues.*

[189] "Accès Universel," Office de Consultation Publique de Montréal, accessed July 7, 2020 https://ocpm.qc.ca/fr/acces-universel

## Territory

Observatories sometimes study specific issues or study any issues that impact specific territories. Montreal's observatory will fall at the junction of those two approaches, as it will orient its actions towards the specific issue of noise and environmental sound within the Montreal territory.

That being said, the Observatory's knowledge and expertise on noise would still be useful and relevant for other jurisdictions. Based on the experience of Lyon's Acoucité, Montreal's observatory could be headquartered in Montreal and propose regional collaborations to other municipalities around Quebec. The majority of Acoucité's activities are concentrated in Lyon, but it also holds partnerships with 5 other jurisdictions, including Saint-Étienne, Monaco, Grenoble and Aix.[190] As such, Acoucité's expertise benefits more than just Lyon and allows for better, wider, more comprehensive noise action in the region.

As Montreal is a metropole of Quebec, surrounded by hundreds of other small and large cities, with which the Observatory could easily propose partnerships while keeping its headquarters and main activities in Montreal. The Observatory could even collaborate with cities that are further away, on an ad hoc or regular basis. For example, Québec City could benefit from the Observatory during festivals and major tourist seasons, and Trois-Rivières could benefit from the Observatory during its Grand-Prix weekend.

Financial support from other jurisdictions could also assist in the Observatory's budget and Facilitate the sharing of resources.

In the case of Acoucité in Lyon, the Observatory provides its expertise to surrounding municipalities. However, it requires that the cities to have internal staff that are dedicated to the noise issues. This requirement includes the necessary human resources and physical resources. This stipulation allows Acoucité's researchers to partner with the city employees. It is important to note that the majority of the research is conducted by the experts in Acoucité's Headquarters. This partnership model allows the Observatory to minimize costs while supporting municipalities.[191]

***Recommendation 36:*** *It is recommended that the Observatory have its headquarters in Montreal, but consider collaborations with other cities, depending on their needs and issues related to noise management.*

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[190] "Observatoires de nos Partenaires," Acoucité, accessed July 7, 2020, http://www.acoucite.org/observatoires-de-nos-partenaires/.
[191] Acoucité, phone interview by Policy Lab Team, Montreal, July 7, 2020.

## 6.4 Limits and challenges of observatories

The limits and challenges of observatories must be accounted for in the creation of Montreal's Observatory. Understanding these challenges provides the opportunity to mitigate them at the design stage of the Observatory and anticipate potential setbacks.

### Challenge 1 - Narrow scope

Observatories are designed to address complex issues and study their impacts on various aspects of society. They develop different methodologies that are fundamental to the accomplishment of their objectives. However, the necessary methodological choices, such as defining categories and identifying priorities, can impose blinders to the observatory and narrow its scope. Noise and environmental sound are interdisciplinary issues, overlapping with countless other issues that must be simultaneously considered. By narrowly focussing on the problematization of noise, particularly its quantitative aspects, observatories can risk becoming single-issue institutions with little relevance for policymakers or other disciplines with which they could collaborate.[192] Some observatories focus almost exclusively on mitigating situations where noise levels are considered too high. While this may fit their objective, this approach ignores the environmental sound and Soundscaping approaches that look at situations where noise and sound are desirable and should be preserved and promoted.

To mitigate the problem of self-imposed blinders on such an interdisciplinary issue, the Observatory should remain flexible and forward-looking. This means implementing internal processes to ensure it remains connected to the rapidly changing field of acoustics research and open to new and emerging approaches to noise and sound studies.

### Challenge 2 - Mitigating the tension between observing the known and unknown phenomenon

Observatories are often created to study a known phenomenon that either raises questions and problems, or that calls for further research. Observatories serve as a tool to answer a comprehensive set of predetermined questions. In that sense, they are expected to provide insightful information and effective solutions to decision-makers and other stakeholders.

However, observatories are also often requested to shed light on new realities and to uncover phenomena that were not anticipated or known. This is why observatories should have an exploratory and experimental aspect of their agenda.

[192] Piveteau, Vincent. "Observatoire Des Territoires Et Gouvernance Locale : Un Lien Structurel à Réinterroger." *Pour* 209-210, no. 2 (2011): 165. https://doi.org/10.3917/pour.209.0165.

Observatories need to have the ability to investigate questions they may not have immediate policy-relevance.[193] In the creation of the Observatory, Montreal must ensure that this experimental aspect of the observatory is preserved despite the inherent tensions that will exist with the city's immediate policy priorities.

### Challenge 3 - Government supported observatories

Observatories created and supported by government administrations tend to be less dynamic than their privately funded equivalents. This is in part because of the cumbersome administrative processes that are intrinsic to some public institutions. Yet, government-supported observatories are often more institutionalized and better organized than their private counterparts. This is because they can leverage the organizational expertise and resources of government departments.

In Montreal's case, the independent mandate of the Observatory, combined with a sufficient allocation of resources from the government, would allow it to benefit from the support of a strong government organization with maintaining the nimbleness and flexibility of an independent institution.

### Challenge 4 - Methodology

Observatories around the world employ a wide range of methodologies in studying noise. The rapid development of noise sensor technology, data collection methods, and new approaches involving AI and big data, leave many possibilities for the Observatory's methodological approach. Methodology permanently shapes the development of an observatory and must be considered carefully.[194] The Observatory should develop a methodology that is rigorous and consistent with the highest scientific standards for noise and sound studies.[195,196] The methodology should also be appropriate for the Observatory's jurisdiction and its objectives. For example, the decisions on how to conduct public surveys and install sensors will have to consider privacy and data protection implications, costs and analytic approaches.

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[193] *Ibid.*

[194] Piveteau, Vincent. "Observatoire Des Territoires Et Gouvernance Locale : Un Lien Structurel à Réinterroger." Pour 209-210, no. 2 (2011): 165. https://doi.org/10.3917/pour.209.0165.

[195] Jean-Luc Dubois, "La longue marche vers les observatoires," in *Observatoires du développement, observatoires pour le développement*, ed. Remi Clignet (IRD Editions, 1994), 173-195, https://horizon.documentation.ird.fr/exl-doc/pleins_textes/divers4/010014365.pdf.

[196] Jean-Bernard Chebroux, *"Les Observatoires Locaux : Quelle Méthodologie Pour Les Conduire ?", Socio-logos*, January 16, 2012, https://journals.openedition.org/socio-logos/2620#quotation.

## Challenge 5 - The Observatory's image

Being an organization that will be funded in part by the government, the Observatory will have to manage its public perception and negotiate its position as an institution working in the public interest while pursuing an independent research agenda. It is most important that the Observatory is perceived as an impartial institution that brings diverse voices together, under a collaborative approach.[197]

Managing its close relationship to the city and other stakeholders should remain a priority for the Observatory. Good stakeholder management will improve the Observatory's capacity for collaboration and carrying out its mandate.

## Challenge 6 - Provincial expansion

Being the first observatory of its kind in Quebec, there is an opportunity for expanding the Observatory model to other municipalities in Quebec. The potential expansion of the Observatory comes with additional challenges that must be considered at the design stage to ensure its structure can accommodate growth.

Whether multiple Quebec observatories will be organized under one main structure, or if they intend to collaborate with each other, it is necessary that they adopt similar processes and methodologies. One of the key learnings from European observatory networks is that differing processes and methodologies led to different and incompatible observations and conclusions.[198] This was particularly challenging for observatories with overlapping jurisdictions. Different observatory approaches led to disagreements over their shared noise mitigation strategies, impeding policy development. Statistical and methodological coordination is key to producing comparable data that can be aggregated and be useful for further research and policy action.[199]

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[197] Piveteau, Vincent. "Observatoire Des Territoires Et Gouvernance Locale : Un Lien Structurel à Réinterroger." *Pour* 209-210, no. 2 (2011): 165. https://doi.org/10.3917/pour.209.0165.

[198] Jean Rouchet, *Les Observatoires Economiques et Sociaux*, Conseil National de l'Information Statistique, September 1999, http://www.epsilon.insee.fr/jspui/bitstream/1/56657/1/CNIS_rapports_1999_53.pdf

[199] Jean Rouchet, *Les Observatoires Economiques et Sociaux*, Conseil National de l'Information Statistique, September 1999, http://www.epsilon.insee.fr/jspui/bitstream/1/56657/1/CNIS_rapports_1999_53.pdf.

## 6.5 Other considerations

### Holistic environmental approach

Establishing an Observatory specifically dedicated to noise is the best option for tackling noise issues and developing more comprehensive noise strategies. Given the multifaceted aspects of noise and environmental sound, the Observatory could eventually consider including other environmental determinants in its activities or collaborate with departments and institutions that currently address them.

Inspired mainly by the mandate of *Environnement Bruxelles*, the Observatory could consider a holistic approach that connects noise with other determinants of environmental well-being like air pollution and green spaces protection. These types of environmental externalities that affect urban life are similarly complex, transversal and multidisciplinary, and call for coordinated strategies that address multiple problems simultaneously. These solutions might prove to be more complex to establish, but they are often more comprehensive and complete than single-issue strategies.

In the long term, the Observatory should consider the adoption of structural procedures and mechanisms to connect its action on noise with other projects on environmental determinants. In the short-term, it should utilize a holistic approach on an ad hoc, non-structural basis when appropriate. Having a holistic approach as part of its toolkit allows the Observatory to seize opportunities to design better, more global and far-reaching strategies.

### The Observatory's name

The Observatory should be referred to as "l'*Observatoire Montréalais de l'environnement sonore"* (The Montreal Environmental Sound Observatory) rather than "l'*Observatoire Montréalais du bruit"* (The Montreal Noise Observatory).

Sound must be understood as a broad concept of which noise is an aspect. The Observatory's focus on noise comes out of a recognition of the ways in which noise negatively impacts residents and urban life. However, the broader focus on environmental sound is important to envision the future of urban sound. Focusing on environmental sound centres the idea that humans perceive sound in various ways.[200] Some sounds may be unpleasant and will be categorized as noise. Other sounds are pleasant, like music, church bells and children playing on a playground.

[200] Catherine Guastavino, "Journées du bruit environnemental 2019 – Démonstration de bruit (Catherine Guastavino)."

If the Observatory was to be referred to as *The Montreal Noise Observatory*, this suggests a narrow purpose to analyze the disruptive and unpleasant noise environments of the city. It is imperative that the Observatory's activities consider all types of sounds, both desirable and undesirable ones, and include upstream approaches to preserve calm and quiet areas where noise levels are adequate.

*The Montreal Environmental Sound Observatory* accurately identifies the broader purpose of the Observatory.

***Recommendation 37:*** *It is recommended that the Observatory be referred to as "The Montreal Environmental Sound Observatory" (MESO), or "L'Observatoire Montréalais de l'Environnement Sonore (OMES)."*

On a lighter note: The Observatory's logo

The Observatory's logo should encompass its vision and be immediately identifiable.

The suggested logo below communicates:

- A multi-level approach and lens for the Observatory
- Sound waves and sounds of the city
- An independent organization that focuses on Montreal but does not explicitly and solely identify with the City of Montreal or the Province of Quebec.

Figure 12 Observatory logo

## 7.0 Conclusion

As cities grow and develop, sound management is an increasingly important issue of public policy. In Montreal, there are several noise-related tension points. There are various stakeholders from different activity sectors ranging from road and railway noise, aviation noise, neighbourhood noise, festival noise, construction noise, tourism noise and manufacturing noise.

Noise pollution has a wide range of negative consequences on public health, the economy and the environment. Its costs are also not proportionately borne by all residents. Montrealers of lower incomes and those who live closer to major roadways and flight paths experience a declining quality of life due to excessive noise beyond internationally recognized levels. Yet, some pleasant sounds can also have positive consequences on the development of cities and residents' wellbeing. Accounting for both realities calls for comprehensive, intersecting and multidisciplinary strategies for noise and sound management. If it is not addressed accordingly, noise pollution is expected to be an increasing cost to society.

Cities have moved to address noise and sound management through a variety of approaches. The regulatory approach and the use of night mayors are often-utilized strategies to address noise-related issues, but these models are limited in terms of long-term efficiency and do not offer comprehensive solutions. These models are most effective in complement with other approaches. Montreal's current noise management strategy is predominantly a regulatory approach, and it has had limited effectiveness.

In order to address the shortcomings of these approaches, Montreal should draw from the international movement of noise observatories, which have emerged as an efficient and comprehensive noise and sound management strategy. By establishing an independent observatory at arms-length from the city, Montreal has the opportunity to be the first city in Canada to establish a sound observatory. With financial support from the city, the Observatory will provide data on noise and sound-related issues and allow Montreal to leverage its pre-existing network of universities already doing research on sound. The Observatory will also serve as a hub for sound, acoustics and noise pollution expertise in Quebec. It will bring together stakeholders from various industries and sectors who have historically been a part of the noise debate but have never been convened in such a manner. It will also favour citizens' engagement through public awareness campaigns and celebrate Montreal's Soundscaping, sound personality and sound heritage.

Learnings from observatories around the world indicate that the future of managing urban sound will depend on creative solutions, including sensitizing and educating residents about noise and

its impacts on society. The *Observatoire Montréalais de l'Environnement Sonore* will be the future of sound in Montreal and position Montreal to be a North American leader in noise pollution management. It will bring forward more cost-effective, proactive approaches to noise management, be integral to developing Montreal's noise policy, and cultivate new approaches to Soundscaping to further Montrealers' quality of life.

## 8.0 List of recommendations

***Recommendation 1:*** *It is recommended that Montreal adopts a noise observatory model to address noise-related issues.*

***Recommendation 2:*** *It is recommended that the City of Montreal consider the Observatory to be the main expert body on issues related to noise and environmental sound in the City.*

***Recommendation 3:*** *It is recommended that the City of Montreal dedicate sufficient resources to developing noise expertise within its existing, internal structure.*

***Recommendation 4:*** *It is recommended that the Observatory adopt a vision statement.*

***Recommendation 5:*** *It is recommended that the Observatory adopt a mission statement.*

***Recommendation 6:*** *It is recommended that the Observatory include a data collection component.*

***Recommendation 7:*** *It is recommended that the Observatory collect quantitative data through the installation of a permanent sound sensor network across the city and the use of mobile sensors.*

***Recommendation 8:*** *It is recommended that the Observatory collect qualitative data in order to identify and evaluate residents' perceptions of sound.*

***Recommendation 9:*** *It is recommended that the Observatory produce noise maps to be made freely accessible online.*

***Recommendation 10:*** *It is recommended that the Observatory make all of its noise data open access.*

***Recommendation 11:*** *It is recommended that the Observatory include an expertise building component.*

***Recommendation 12:*** *It is recommended that the Observatory undertake research and publication activities.*

***Recommendation 13:*** *It is recommended that the Observatory undertake policy advisory activities.*

***Recommendation 14****: It is recommended that the Observatory lead or contribute to research and development programs to contribute to technological advancements that would directly benefit noise-related solutions.*

***Recommendation 15:*** *It is recommended that the Observatory include a collaboration component.*

***Recommendation 16:*** *It is recommended that the Observatory's role include identifying and bringing together stakeholders for the purpose of collaboration around noise-related issues.*

***Recommendation 17:*** *It is recommended that the Observatory develop training programs for municipal employees to help them incorporate noise management into their mandates.*

***Recommendation 18:*** *It is recommended that the Observatory provide support to individual boroughs in managing noise-related issues.*

***Recommendation 19:*** *It is recommended that the Observatory proactively collaborates with 311 and 911 services in elaborating strategies to respond to noise complaints.*

***Recommendation 20:*** *It is recommended that the Observatory include a communication and public awareness component.*

***Recommendation 21:*** *It is recommended that the Observatory undertake public awareness campaigns and activities with the goal of sensitizing residents and stakeholders to noise issues.*

***Recommendation 22:*** *It is recommended that the Observatory target schools, workplaces and industries to develop programs adapted to their noise management needs.*

***Recommendation 23:*** *It is recommended that the Observatory include a culture, heritage and Soundscaping component to capture the sensory dimensions of sounds and to celebrate positive sounds.*

***Recommendation 24:*** *It is recommended that the Observatory build an archive of Montreal sound recording for the purpose of celebrating, analyzing and memorializing Montreal's sound personality, heritage and culture.*

***Recommendation 25:*** *It is recommended that the Observatory promote environmental Soundscaping and sound arts.*

***Recommendation 26:*** *It is recommended that the Observatory be a public, not-for-profit organization at arms-length from the City, with its own independent governance, operations and activities, and operating under a collaborative governance model.*

***Recommendation 27:*** *It is recommended that the Observatory's Board of Directors includes a diversity of stakeholders from the public sector, private sector, academic and research community, and civil society organizations that will have the opportunity to participate fully in the governance of the Observatory.*

***Recommendation 28:*** *It is recommended that the Observatory establish a full-time Executive Director role, whose responsibilities will include the operationalization of the Observatory's mandate and serving as an ex-officio member of the Board of Directors.*

***Recommendation 29:*** *It is recommended that the Executive Director of the Observatory be appointed by the Board of Directors.*

***Recommendation 30:*** *It is recommended that the Observatory have full-time dedicated staff.*

***Recommendation 31:*** *It is recommended that the Observatory have, amongst its staff, researchers, noise-experts, technicians, community liaisons, and communication specialists.*

***Recommendation 32:*** *It is recommended that the funding structure of the Observatory include multiple sources (municipal, provincial, federal, academic, philanthropic and other). Further consideration should be taken into what types of funding will be accepted to ensure that funders align with the Observatory's vision, mission, components and activities.*

***Recommendation 33:*** *It is recommended that the City of Montreal commit to funding the Observatory at 100% of its budget for the first 5 years, and no less than 50% of its annual budget in subsequent years, as additional funding sources become available.*

***Recommendation 34:*** *It is recommended that the Observatory, in an advisory role, be granted the freedom to disseminate its independent commentary and views with respect to noise issues in Montreal, without undue interference or censorship, by any external parties.*

***Recommendation 35:*** *It is recommended that the Observatory have the autonomy to proactively identify and engage with any relevant noise-related issues.*

***Recommendation 36:*** *It is recommended that the Observatory have its headquarters in Montreal, but consider collaborations with other cities, depending on their needs and issues related to noise management.*

***Recommendation 37:*** *It is recommended that the Observatory be referred to as " The Montreal Environmental Sound Observatory" (MESO), or "L'Observatoire Montréalais de l'Environnement Sonore (OMES)."*

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# Annex A: Policy challenge


## Ville de Montréal Policy Lab 2020

**Policy Question:** How the creation of a Noise Observatory in Montreal can shape public policies developed by the City of Montreal in terms of noise pollution management?

**Context:**

The night is not simply a time for sleep, rest and retreat to privacy. It is a public policy matter. However, in public policy terms, nightlife has been largely ignored or treated primarily through a safety or health prevention lens. Given the economic potential of nighttime activities, the principles of "night management" and "environmental equity" are increasingly becoming public health and economic development issues in most large cities.

According to OECD, Montreal represents a fascinating case that illustrates the paradoxes cities face today. Montreal is a city that enjoys a vibrant nightlife. According to *Tourisme Montréal*, 18% of the population report engaging in nightlife-related activities. However, businesses and citizens remain concerned about the impacts of nightlife on the quality of life. Montreal has therefore decided to embark on a reflection journey to identify the needs and develop guidelines for better noise and nighttime economy management.

Noise is everywhere and is an expression of active life, economic development, tourism and culture. When noise gets disruptive, it generates tensions between the public and the private sectors. Indeed, the health consequences of noise are now well understood, proven and studied. According to the World Health Organization, the environmental noise has detrimental physical and psychological effects on the well-being and health of individuals. These effects include: sleep disturbance, and cardiovascular diseases such as hypertension, stroke, and heart attack.

Although Montreal recognizes that environmental noise is a "pollutant" which has negative effects on the health of the population, noise management currently is the responsibility of the police and noise management is not therefore a priority in terms of public safety. Citizen are a key stakeholder. They mobilize, seek solutions and are critical towards environmental risk assessments that officials rely on.

The city aims to develop a policy framework for managing the quality of nightlife and night economy that would balance citizen needs and the interests of economic actors for the overall benefit of Montreal. This process includes the creation of a Noise Observatory in Montreal which would enable the City of Montreal to assess noise levels with certainty and finally put in place solutions to reduce noise nuisances.

**Objective:**

The City of Montreal and its various boroughs have adopted several noise regulations over the past years. Nevertheless, noise issues persist. Mitigating noise and the night economy now appears to be a societal, health, quality of life and economic development issue in Montreal. Montreal wants to remain attractive to investors, visitors, but also livable and overall sustainable.

The city needs to act so that interests of all stakeholders are accounted for: night workers, residents, enterprises, visitors and others. At the same time, Montreal must maintain its position as a cultural and festive city. The City of Montreal, though its Living Montreal Action Plan aims to "begin the implementation of a nightlife policy, ensuring that noise and nuisances are prevented areas where residents live". This implies that Montreal must define the conditions for quality nightlife in order to achieve a healthy balance between economic and cultural development, and the provision of quality and safe living environments.

In addition, the fight against noise requires a detailed assessment of citizen exposure to noise pollution generated by various sources. That's why the City of Montreal would like to establish a Noise Observatory for the Montreal area that would document noise levels in the city based in reliable data in order to implement policies (or adjust policies) for noise regulation at the source as well as produce reliable data for public dissemination.

Through the Policy Lab, the City would like to answer the following overarching question: How the creation of a Noise Observatory in Montreal can shape public policies developed by the City of Montreal in terms of noise pollution management? Students are invited to analyze similar practices in the following markets: Barcelona, London, Paris, Berlin, Sydney and New York.

**Opportunities and Challenges:**

The City of Montreal must demonstrate that noise management is not a struggle for silence, but an advance for the right to have a healthy environment that is also favourable to economic development of neighbourhoods. Montreal's objective must be clear: combating unnecessary, aggressive, harmful noises, moderating those who are unpleasant to others, while accepting those who are part of everyday life and who are expression of a controlled sound environment. The aim is therefore to remove the negative effects of noise, i.e. nuisances.

In order to ensure greater coherence between the actions of the boroughs, Montreal must also evaluate the possibility of establishing noise and nightlife standards that would apply throughout its territory and which would cover all sources of noise, all while respecting the autonomy of the boroughs. The challenge for Montreal is to harmonize its actions and ensure that the bylaws and measures of the boroughs are not open to interpretation or are not an obstacle to the night economy. It is also important to note the importance of taking a concerted and integrated approach between all levels of the City of Montreal and other stakeholders.

It should be noted that the City of Montreal's approach in the creation of a Noise Observatory for the Montreal area is consistent with current international approaches in night-time nuisance management and night economy development.

**Excluded from Scope:**

This project focuses solely on the creation of a Noise Observatory for the Montreal area. Therefore, the analysis will not include the elements that relate to the nightlife quality management framework and the night economy.

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VIVRE EN VILLE – REPERTOIRE ET ANALYSE DES OUTILS D'ACCOMPAGNEMENT EN MATIERE DE BRUIT – MARS 2019, p.13

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Article 61.1 : La Ville de Montréal peut, à l'égard de tout permis visé au premier alinéa de l'article 59 et exploité sur son territoire, fixer par règlement des heures d'exploitation différentes de celles prévues à cet alinéa. Ces heures d'exploitation peuvent différer selon la période de l'année, par catégorie de permis ou par partie du territoire de la ville. La ville peut également, par résolution, exercer sur son territoire le pouvoir prévu à l'article 61 à l'égard des heures d'exploitation visées au premier alinéa de l'article 59 ou qu'elle fixe en vertu du premier alinéa.

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# Annex B: Benchmark jurisdictions

## B.1 Auckland Council, New Zealand

| Quick Facts | |
|---|---|
| Principle actor: | Auckland Council |
| Funding structure, costs, resources, employee profile: | Noise specialists respond to noise complaints to evaluate the noise |
| Governance structure: | Part of the municipal government Environmental Health section |
| Partners: | municipal police, Environment Court, Ministry for the Environment |
| Stakeholders: | Residents, Industry |
| Legal authority/ regulations: | Resource Management Act 1991, the Auckland Council District Plan |
| Implementation: | The enforcement of noise comes from the Resources Management Act 1991 and is adapted to the local context through the Auckland Council District Plan |
| Scope of action and key activities: | Enforcement of noise bylaws through sound meter measurements and the imposition of fines |
| Research, output, reports: | n/a |
| Public consultations or public engagement: | n/a |
| Advantages: | Bylaw enforcement officers use sound meters to verify sound levels and objectively impose the bylaw regulations. Residents are able to appeal to the Environment Court for ongoing noise issues or for abatement orders against them. |
| Disadvantages: | It is a regulatory approach only and is therefore reactive and does not address the root causes of noise. |

The Auckland City Council has a developed noise regulation and enforcement strategy.[201] Under the New Zealand Resource Management Act 1991, excessive noise is defined as "any noise that is under human control and unreasonably interferes with the peace, comfort and convenience of any person."[202] Excessive noise does not include aircraft, vehicles and trains, and rather it focuses on neighbourhood noises like loud parties and car alarms. These complaints are addressed on a case-by-case basis and do not have set maximum decibel levels. The Act also establishes "unreasonable noise," which addresses industrial and nightlife noise. This noise does have maximum decibel levels and quiet hours as established by the Auckland Council District Plan. Vehicle-related noise, including ships, trains and cars, is not handled by the city.

The population of Auckland can call the city to complain about excessive or unreasonable noise. A city employee will investigate to judge if the noise is excessive or unreasonable based on volume, time of day and type of noise. Unreasonable noise, or industrial noise, is measured with a sound meter to determine if it exceeds maximum levels. If the noise is deemed too loud, the employee will issue an Excessive Noise Direction (END) to the individual who requires the noise emitter to halt any excessive noise for 72 hours. If there is excessive noise resulting in a noise complaint again during the three days, the city will revisit the site and seize the noise-emitting equipment or issue a $500 fine. For ongoing problems with noise, the city will send a Compliance Noise Specialist to evaluate the situation and take noise measurements. The specialist can issue an abatement notice, a formal letter requiring the offender to reduce noise. Non-compliance with an END or an abatement notice can result in further fines.

For unreasonable noise that is ongoing, typically industrial noises, and an abatement notice is in place with no improvement, a resident can apply to the Environment Court for an enforcement order.[203] Residents or businesses can also appeal abatement orders filed against them. The Environment Court has jurisdiction over issues arising from the Resource Management Act, including noise pollution.[204]

The city also monitors noise produced during motorsport events and concerts at the Western Springs Stadium and Speedway, taking readings every 5 minutes to note breaches of maximum noise levels and correct it in real-time.

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[201] "Noise," *Auckland Council,* accessed July 2, 2020, https://www.aucklandcouncil.govt.nz/licences-regulations/noise/Pages/default.aspx

[202] Resources Management Act 1991 no 69, s 326, New Zealand http://www.legislation.govt.nz/act/public/1991/0069/latest/DLM238589.html

[203] "An everyday guide: Your guide to the Environment Court," *Ministry for the Environment,* Accessed July 2, 2020, https://www.mfe.govt.nz/publications/fresh-water/everyday-guide-your-guide-environment-court/everyday-guide-your-guide

[204] "About the Environment Court," *Environment Court of New Zealand,* September 7, 2016, https://environmentcourt.govt.nz/about/history/

While the adoption of a bylaw to control excessive noise is a quick solution to a complex problem, Auckland's integration of sound meters into its noise complaint response makes its system much more objective than Montreal's. While Montreal also has noise ordinances that are enforced through noise complaints and fines, police or bylaw enforcement do not use sound meters to measure the problem, which makes enforcement very subjective. However, the lack of a complete noise management plan means that Auckland does not address the root cause of the noise. A broader noise strategy is needed. It is also important to note that in 2018-2019, only 52% of the population who brought forward a complaint was satisfied with the Auckland City Council's services.[205] Residents were satisfied with the initial contact with the council related to noise issues but were dissatisfied with the time it took to get the noise issue addressed and with a lack of follow up done regarding the action taken by the council.

[205] "Te Pūrongo ā-Tau 2018/2019: A Te Kaunihera O Tamaki Makaurau Auckland Council Annual Report 2018/2019," Accessed July 2, 2020, https://www.aucklandcouncil.govt.nz/plans-projects-policies-reports-bylaws/our-annual-reports/documentsfullannualreport20182019/volume-1%E2%80%93overview-service-performance.pdf

## B.2 Australia: Australian Acoustic Observatory

| Quick Facts | |
|---|---|
| Principle actor: | Lead: Queensland University of Technology Ecoacoustics Research Group<br>Partner organizations: James Cook University, University of Queensland, University of New England and Charles Sturt University |
| Funding structure, costs, resources, employee profile: | The Observatory is run by five "Chief Investigator Managers" from 5 Australian universities. The Observatory received a funding grant from the Australian Research Council, Linkage Infrastructure, Equipment and Facilities grant of $1.8 million. |
| Governance structure: | 5 lead researchers, partner organizations and a number of essential key stakeholders. Exists within the Queensland University of Technology. |
| Partners: | Queensland Cyber Infrastructure Foundation, Birdlife Australia, Frontier Labs supplied the acoustic sensors. |
| Stakeholders: | Universities across Australia, National Parks, other government bodies, the Terrestrial Ecosystem Research Network (TERN), Traditional Owners (Indigenous groups), the Australian Wildlife Conservancy (AWC), Bush Heritage Australia (BHA), the Tasmanian Land Conservancy and other private conservation organizations, and several private landholders on whose land the observatory has installed acoustic monitoring equipment. |
| Legal authority/ regulations: | The observatory exists within the Queensland University of Technology. |
| Implementation: | The project began in 2018, installing the acoustic sensors in 90 locations. Installation continued throughout 2019, with the first acoustic data becoming available in November 2019. |
| Scope of action and key activities: | The observatory collects and provides data. The data will be used by the principal researchers and partners for biodiversity and climate change research. |
| Research, output, reports: | In development, preliminary data is available now. Data is freely available to everyone online. |
| Public consultations and public engagement: | The data will be completely available to the public. There is also some crowdsourcing projects to help identify bird song in recordings. This will likely be expanded in the future as the observatory receives more data. |

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|---|---|
| Advantages: | Rigorous data collection made freely available online. Cultural dimensions as the sound data are being used in music and sound arts. |
| Disadvantages: | Limited transferability to Montreal as it is primarily an academic research institution. |

The Australian Acoustic Observatory is the world's first national acoustic observatory.[206] It is a country-wide data-collection and research project led by the Queensland University of Technology and funded by a $1.8 million AUD (1.7 million CAD) grant from the Australian Research Council, the government research funding agency. The project, which started in 2018, is a partnership between five Australian universities and several stakeholders, including conservation organizations, the National Parks, and Indigenous people. The Observatory consists of 400 solar-powered sound sensors across 90 remote ecological sites in Australia, throughout 7 distinct ecological zones. These sensors will record sound continuously for five years, although researchers plan to make it a permanent fixture in Australia. The sound recordings are uploaded online to create a public sound map with data accessible to everyone, including researchers, citizen scientists, students and artists. The precursor to the observatory was a small-scale acoustic sensor project to monitor koala populations in 2014. Today, it aims to record the heartbeat of the environment of Australia.

The project is a multidisciplinary endeavour that advances the emerging field of ecoacoustics, the study of sound and its relationship to the environment.[207] With a team of ecologists, computer scientists and environmental scientists, the researchers are collecting data that has been previously impossible to collect. Prior to the observatory, researchers would go into the field a few days a year to do a visual point-in-time count of animals, or to make audio and visual recordings. The Australian Acoustic Observatory significantly expands the data available by producing large amounts of high-quality data (at least five complete years of sound), which allows researchers to track an ecosystem over time in great detail and watch how it is coping. The observatory also allows for the collection of rich data from very remote locations that cannot be easily visited or are inaccessible at certain points of the year. The sensors will collect data during extreme weather events and natural disasters and the recovery that follows. This improved data collection will allow researchers to advance in areas of seasonality, migratory dynamics, and the impact of invasive species.

[206] "Australian Acoustic Observatory," accessed June 10, 2020, https://acousticobservatory.org/home_1/
[207] Adam Welz, "Listening to Nature: The Emerging Field of Bioacoustics," *Yale Environment 360*, November 5, 2019, https://e360.yale.edu/features/listening-to-nature-the-emerging-field-of-bioacoustics

The Acoustic Observatory's focus on freely accessible data is due to a number of factors. The research grant by which the project is funded strongly suggests that the infrastructure be used in a collaborative way and be accessible to all researchers.[208] As well, the project involves dozens of stakeholders and partners, including private landowners who volunteered their land for sensor installation. With so many people involved, data sharing agreements would have been nearly impossible to coordinate. Instead, the Chief Investigators made the decision to make the data not only available to other researchers but to everyone.[209] While there are significantly fewer privacy issues with nature sounds than with sounds in a city, the Chief Investigators did have to consider the protection of rare species from poachers and egg collectors. By publicly providing the location of the sensors and the animal sounds in that area, poachers could more easily determine the location of desirable animals. Ultimately, open data was prioritized, and sensors were not installed in areas that contained protected or endangered species.

Open data also facilitates crowdsourced citizen science and art. In 2019, the Observatory asked citizen scientists for help with identifying the vocalizations of nighttime birds and owls in sound clips as it is something AI cannot yet do well. [210] As well, the publicly available data allows people to listen to and appreciate the rich sounds of Australian nature. A Chief Investigator at the Observatory noted that there had been a lot of interest in using the recordings in soundscapes and music. Leah Barclay, an artist and researcher at the University of the Sunshine Coast, has used the recordings in soundscapes and art installations.[211]

The observatory is possible due to two major changes in technology in recent years. First is the rise in more accurate and affordable equipment to capture sound. The solar-powered acoustic sensors used for this project are built by Frontier Labs. The data is stored on an SD card that is manually collected and replaced every year. They are durable devices, able to withstand years of weather. Second, the emergence of AI has allowed the creation of sophisticated computer algorithms that can sort through the acoustic data to identify species and using novel visualization techniques, create a picture of the sound. In the past, according to Chief Investigator David Watson, simply doing data collection would use 75% of the budget and 50% of the time of research.[212] However, with higher quality, universally available data, researchers now have more time and resources to dedicate to their research.

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[208] "Linkage Infrastructure, Equipment and Facilities," Australian Research Council, last modified February 25, 2020, https://www.arc.gov.au/grants/linkage-program/linkage-infrastructure-equipment-and-facilities

[209] Interview with Australian Acoustic Observatory, June 24, 2020.

[210] "Searching for powerful owls and other night birds," *Australian Acoustic Observatory,* accessed June 10, 2020, https://data.acousticobservatory.org/citsci/night-birds

[211] "Leah Barclay," *Soundcloud,* accessed July 2, 2020, https://soundcloud.com/leah_barclay; Interview with the Australian Acoustic Observatory, June 24, 2020

[212] Sarah Whyte, "Scientists reveal Australia's first acoustic observatory", AM, ABC, November 30, 2017, https://www.abc.net.au/radio/programs/am/scientists-reveal-australias-first-acoustic-observatory/9209660

The Australian Acoustic Observatory provides some interesting insights into the development of a Montreal observatory. Providing freely available data is something Montreal could explore, in order to involve both the academic and general community and encourage more, and diverse, research about noise and sound in the city. As investigated earlier in the report, noise isn't always bad; there is good noise as well that shapes a city and defines its culture. A city has a sound profile that should be explored and celebrated. Through making sound data publicly available, researchers, interested citizens, and artists could participate in the Montreal sound conversation in new and innovative ways. The Chief Investigators in the Australian Acoustic Observatory note that they hope that Australians will use sound data to celebrate the cultural and the diverse ecosystems of the country.

However, the Australian Acoustic Observatory has some limitations in its comparison to the envisioned Montreal Observatory. The only key activities of the Australian Acoustic Observatory are data collection and academic research. It is an apolitical organism focused on scientific research with a fairly simple governance structure. Further, the observatory is not involved with policy development or decisions. While the data collection and research aspects of the Australian Acoustic Observatory provide some interesting insights for Montreal, the Montreal observatory would be involved in many more activities and will require a more complex structure and governance model. Due to the nature of the work the Montreal Observatory will be tasked with, it could not and would not be able to avoid the policy development process. By its nature, the Montreal Observatory will be political and will have to structure itself accordingly.

## B.3 Barcelona City Council, Spain

| Quick Facts | |
|---|---|
| Principle actor: | Barcelona City Council |
| Funding structure, costs, resources, employee profile: | Part of the municipal government |
| Governance structure: | Part of the municipal government |
| Partners: | n/a |
| Stakeholders: | local nightclubs, outdoor venues, industrial/commercial sectors, the general public |
| Legal authority/ regulations: | European Noise Directive 2002 |
| Implementation: | Barcelona's noise strategy was implemented in 2010 and is up for renewal in 2020. |
| Scope of action and key activities | sound monitoring, strategic noise maps, stakeholder engagement, public education, strategic noise plan, urban design solutions to noise |
| Research, output, reports: | n/a |
| Public consultations and public engagement | Media campaigns, educational material, print and digital resources |
| Advantages | Sound devices are a key part of the strategic plan; the city works closely with stakeholders to have a collaborative approach, media campaigns and print resources to educate about noise, training for city employees to familiarize them with noise pollution and noise management. |
| Disadvantages | There are no clear signs of noise reduction since 2010; there is pushback from nightlife venues over the city's policies. |

Barcelona is a compact, densely populated city, with 15,000 inhabitants per square kilometre. As a city that is densely populated, with residents not sleeping until well after 11 pm, environmental noise is difficult to manage. The city is additionally economically diverse, with a wide variety of services, commerce and culture and a major tourist destination, receiving almost 9 million tourists in 2017 alone.[213]

As the second noisiest city in Europe,[214] Barcelona is seeking to decrease noise pollution in the city through a comprehensive noise strategy. The mission of Barcelona's noise reduction strategy that was created in 2010 and will end this year is to "improve the acoustic quality of the city by promoting and leading priority programs and actions as well as collaboration, coordination and information frameworks."

The noise strategy was created by the city council to analyze the impacts of noise and determine how to better incorporate noise policy into city decision making. To reduce urban noise pollution, Barcelona City Council has adopted three main pillars of municipal noise policy: Diagnosis, the creation of Strategic Noise Maps; Prevention and Control, updating the current noise ordinances in place (which was completed in 2010); and Action, the implementation of ten-year action plans.

To create noise maps, Barcelona has a network of sensors across the city. The Barcelona Noise Monitoring System (NMS) consists of 112 devices, 86 sound sensors, and 26 sound level meters as of 2018. The sound sensors are used in fixed points of the city for a long-term analysis of sound levels. The sound level meters are similar to the sound sensors, but they are able to measure more information and make audio recordings of the surroundings. Due to privacy concerns, the sound meters are only used in temporary locations to carry out specific studies that require a detailed data analysis. They prove more useful in identifying the sources of sound and determining how they can be mitigated using a targeted approach. [215]

These instruments allow the city to create three types of noise maps: a standard noise map that represents the sound levels of the city graphically, an acoustic capacity map that marks the acoustic quality objectives to be achieved and an overcoming map that identifies points in the city where noise levels exceed the limits set by noise quality targets. To effectively reduce noise

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[213] Javier Casado Novas, Neus Muntané Gregori, Laura Zapata González, and Aránzazu Millás Nicuesa, "2017 Barcelona Strategic Noise Map : Current, Real, and Sensitive to the Noise Management Needs of the City," (paper presented at inter.noise 2019, Madrid, June 2019), http://www.sea-acustica.es/fileadmin//INTERNOISE_2019/Fchrs/Proceedings/1570.pdf

[214] Grey, Alex, "These are the cities with the worst noise pollution," *World Economic Forum*, March 27, 2017, https://www.weforum.org/agenda/2017/03/these-are-the-cities-with-the-worst-noise-pollution/

[215] Júlia Camps Farrés and Javier Casado Novas, "Issues and challenges to improve the Barcelona Noise Monitoring Network," (Conference proceedings, Euronoise 2018, Crete), http://www.euronoise2018.eu/docs/papers/119_Euronoise2018.pdf.

in priority overridden areas, the city has created a map of desired noise levels for each district of the city. The city also uses these noise maps to track the evolution of the city's acoustic quality.

The city also identifies noise types and sources by conducting sound observation tests at different times over a 24-hour period. This provides more in-depth data on areas that may produce more noise at night rather than the day. As Barcelona is a popular night hub for Europeans, similar to Montreal for North Americans, it is necessary to segregate such data to produce an accurate picture of noise levels and its source.

The city segregates the different types of noise to be able to determine the sources of such noise. Currently, most noise comes from roads, followed by recreational noise, private activities, waste collection, and construction. With the number of noise complaints increasing, a long-term strategy has been implemented to reduce noise levels during the night. This required sound devices to be installed at fixed points in order to target noise reduction policies. These devices are concentrated in areas with more recreational activities and that are more densely populated.[216]

Barcelona's noise reduction plan establishes key focus areas. First is to improve the acoustic quality of urban life, including encouraging the use of public transit and biking, improving cycling and pedestrian infrastructure, reducing vehicle noise and protecting the quiet areas of the city. They also aim to promote the inclusion of acoustic design into urban development. Finally, they focus on educating municipal employees, industries and citizens, including primary school students, about noise pollution and how to mitigate it. Barcelona aims to make the City Council a benchmark in good practice. The City Council is improving the internal and external channels of coordination, training and management in the field of noise pollution.

The superblocks programme is not highlighted in their 10-year strategy; however, it is another useful way to reduce the primary source of noise in the city – traffic. Introduced in 2016, the programme is a new way of organizing the city in a way that prioritizes more sustainable travel, whilst securing public spaces for residents. This is done through the reclamation of roadways as pedestrian zones, and the widening of main boulevards to accompany more rapid transit options.[217] Although this strategy serves the city in means of urban development, it has had

[216] Javier Casado Novas, Neus Muntané Gregori, Laura Zapata González, and Aránzazu Millás Nicuesa, "2017 Barcelona Strategic Noise Map : Current, Real, and Sensitive to the Noise Management Needs of the City," (paper presented at inter.noise 2019, Madrid, June 2019), http://www.sea-acustica.es/fileadmin//INTERNOISE_2019/Fchrs/Proceedings/1570.pdf

[217] "The implementation of the Superblocks programme in Barcelona: Filling our streets with life," *C40 Cities,* March 19, 2018, https://www.c40.org/case_studies/barcelona-superblocks

positive implications in terms of noise reduction through its projected reduction in traffic levels by 21%.

Barcelona still maintains some of the highest noise levels in the world. Although the city has such a comprehensive strategy, there has been limited evaluation to determine whether the city has effectively implemented all its recommendations. This makes it difficult to evaluate Barcelona's approach to noise and precisely determine the effectiveness of each recommendation. As a result, not all of the benefits below can be substantiated with evidence in the local context.

The benefits of Barcelona's noise management strategy are sound devices, stakeholders engagement and educational initiatives. Sound devices are strategically placed to gain an accurate understanding of where the city should prioritize their noise strategy. This has proven effective in identifying the 'priority overriding zones,' which are in the most urgent need of policy implementation for noise reduction. The city works with different government bodies to manage sound. Through working with local nightclubs, outdoor venues, and industrial/commercial sectors, the city council is able to generate a more collaborative approach to monitoring and reducing noise levels throughout the city. Further through media campaigns encouraging the use of alternative transportation means, digital and print resources distributed to institutions, providing insight on what the city is doing surrounding noise, and how individuals can contribute to the collective strategy. In addition, the noise department within the city council works on training different department staff on noise policy and how to incorporate noise reduction in their line of work.

Putting in place a comprehensive variety of sound devices throughout Montreal will allow the city to better analyze where the sound is coming from, and at what time the different sounds are occurring. Sound recording devices should be moved around to mitigate privacy concerns, as well as the change of sound environments throughout the starkly different seasons of the city.

The department within the city council that deals with reducing city-wide noise levels is autonomous of decision making, and provides an important voice on the panel of decision-makers for city projects, an aspect necessary for Montreal's observatory. The addition of such allows the Montreal observatory to provide valuable feedback to different organizations and developers on how they should improve their event and development plans to meet city noise standards.

The drawbacks to Barcelona's plan are the lack of midterm review and no clear sign of noise reductions as well as pushback from nightlife venues. The city has now followed through with its midpoint obligation to review the progress made on the city's proposed strategies. The success

of certain components, such as collaborative efforts with different stakeholders, have not been confirmed. Despite their main strategy report being created in 2010, there have been no clear signs of sustained noise reduction throughout the city. Further, the city council has significant control over the noise levels at bars, but this has received pushback from the nightlife industry. In the context of Montreal, the nightlife industry would not support this either as it would be bad for their business.

## B.4 Brussels: Bruxelles Environnement

| Quick Facts | |
|---|---|
| Principle actor: | *Bruxelles Environnement* |
| Funding structure, costs, resources, employee profile: | There are 1000 employees total, approximately 20 employees specifically tasked with noise issues.<br>The annual budget is approximately 200 million euros. In 2017, 83% of the budget came from public endowments from the *Région de Bruxelles-Capitale*, 12% from investment funds for specific projects and programs, 4% from revenues from activities and 1% from the European Union. |
| Governance structure: | *Bruxelles Environnement* is a "Public Interest Organisation," a legal status specific to Belgium.It is governed by an Executive Director, chosen by a selection committee accountable to the regional government, eight divisions, nineteen subdivisions, sixty departments and specific services like the Environment Police. |
| Partners: | Civil society organizations, interest groups, private businesses, other public administrations, unions and many others on specific projects. They also have specific partners for events planning. |
| Stakeholders: | Brussels population |
| Legal authority/ regulations: | European Noise Directive<br>*Bruxelles Environnement* has regulatory power; it delivers permits and authorizations, and oversees evaluation processes and ensures regulations are respected. |
| Implementation: | Bruxelles Environnement, originally the Institut Bruxellois pour la Gestion de l'Environnement, was created in 1989. |
| Scope of action and key activities: | Regarding noise specifically, *Bruxelles Environnement:*<br>● Measures noise levels (17 fixed noise sensors and 7 mobile noise sensors);<br>● Produces noise maps (with various types of maps);<br>● Performs scientific research and produces reports;<br>● Informs the population about noise-related issues (including the creation of the online portal InfoBruit);<br>● Receives noise complaints;<br>● Offers training programs to municipal employees;<br>● Designs specific strategies to inform children about noise issues;<br>● Informs policy making, urban planning and residential developments;<br>● Help boroughs develop local noise management plans. |

| | |
|---|---|
| Research, output, reports: | Publishes reports, most recently published the quiet. Brussels report. |
| Public consultations and public involvement: | Provides specific training to city employees and children on noise, informs policymakers, helps communes (boroughs) develop local noise management strategies, provides public education about noise-related issues on the online portal InfoBruit. Citizens can file complaints regarding noise. |
| Advantages: | Bruxelles Environnement tackles noise holistically with other environmental components, comprehensive strategy. |
| Disadvantages: | Having noise managed by a public administration results in a lack of independence; noise is handled by a large environmental institution rather than a specific noise institution that could limit the resources and focus on noise management. |

Brussels' noise strategy is managed by *Bruxelles Environnement*, a Public Interest Organization with administrative and binding regulatory power that is responsible for all environmental issues in the *Région de Bruxelles-Capitale,* one of Belgium's three regions. A Public Interest Organisation is a unique legal entity-specific in Belgium, tasked with the operation of public service. *Bruxelles Environnement* is, therefore, a public department of the *Région de Bruxelles-Capitale*, created by a royal decree.

*Bruxelles Environnement* works on air quality, food accessibility, energy and housing, animal wellbeing, noise, sustainable development, waste management, water quality, green spaces and biodiversity, geology and hydrology, health and safety, ground quality, economic transition, zero waste policies and sustainable city. *Bruxelles Environnement* operates countless activities for each policy subject it covers. Noise and vibration issues are one of many other environmental issues *Bruxelles Environnement* is tasked with addressing.

*Bruxelles Environnement* has a significant budget of nearly 200 million euros and more than 1000 employees.[218] In 2017, 83% of *Bruxelles Environnement*'s budget came from public endowments from the *Région de Bruxelles-Capitale*, 12% came from investment funds for specific projects and programs, 4% came from revenues by *Bruxelles Environnement*'s activities and 1% came from funding from the European Union. The proportion of the budget that is being used on noise-

[218] Vera Mombeek, Francis Radermaker, Isabelle Degraeve, *Rapport d'activites 2017,* Bruxelles Environnement, 2017, https://document.environnement.brussels/opac_css/elecfile/RAP_BE_Rapportdactivites_2017

related operations is not clear.[219,220] The organization is governed by an Executive Director, chosen by a selection committee accountable to the regional government.[221] There are eight divisions, nineteen subdivisions, sixty departments and specific services like the Environment Police[222,223.] There are 1000 employees total, and approximately 20 employees are specifically tasked with noise issues, in the Noise planning service of the Authorisation and Partnership division, itself within the Noise and vibration pollution department.

*Bruxelles Environnement* leads various operations and activities regarding noise. To begin with, it measures noise levels with a combination of fixed and mobile noise sensors. They capture decibel levels and can differentiate the sources of noise. *Bruxelles Environnement* uses that data to produce noise maps that display noise levels, noise targets, sources of noise, and other characteristics. It also produces a number of reports and scientific research to increase knowledge development. Recently, the report quiet.brussels was made public.[224] It includes three different major objectives to tackle noise in Brussels, as well as 45 precise activities to achieve those objectives.

In most of its projects, *Bruxelles Environnement* collaborates with civil society organizations and interest groups, private businesses, other public administrations, unions and the public.[225] They also have specific partners for events planning. It offers specific training to city employees and children on noise, informs policymakers and helps communes (boroughs) develop local noise management strategies. They also provide public education about noise-related issues on InfoBruit, an online portal. As well, the organization is responsible for noise regulation

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[219] Bruxelles Environnement, *Bruxelles Environnement Organigram*, July 1, 2020, https://environnement.brussels/sites/default/files/map_organigram_fr.pdf; Marie-Noëlle Adnet, Marie Poupé, Fabienne Saelmackers and Thomas Styns, *Quiet.Brussels: Plan de Prévention et de Lutte contre le Bruit et les Vibrations en Milieu Urbain*, Bruxelles Environnement, February 28, 2019, https://document.environnement.brussels/opac_css/elecfile/PROG_20190228_QuietBrussels_FR.pdf

[220] Vera Mombeek and Isabelle Degraeve, *Rapport d'activites 2018,* Bruxelles Environnement, 2018, https://document.environnement.brussels/opac_css/elecfile/BE_RA_2018_FR_web

[221] Arrêté du Gouvernement de la Région de Bruxelles-Capitale portant attribution du mandat de directeur général de l'Institut bruxellois pour la Gestion de l'Environnement, July 18, 2013, https://www.etaamb.be/fr/arrete-du-gouvernement-de-la-region-de-bruxellescapit_n2013031645.html

[222] Bruxelles Environnement, *Bruxelles Environnement Organigram*, July 1, 2020, https://environnement.brussels/sites/default/files/map_organigram_fr.pdf

[223] "Qui nouse sommes," *Bruxelles Environnement,* last modified March 13, 2019, https://environnement.brussels/bruxelles-environnement/qui-sommes-nous

[224] Marie-Noëlle Adnet, Marie Poupé, Fabienne Saelmackers and Thomas Styns, *Quiet.Brussels: Plan de Prévention et de Lutte contre le Bruit et les Vibrations en Milieu Urbain*, Bruxelles Environnement, February 28, 2019, https://document.environnement.brussels/opac_css/elecfile/PROG_20190228_QuietBrussels_FR.pdf

[225] "Nos principes de fonctionnement," *Bruxelles Environnement,* June 12, 2017, https://environnement.brussels/bruxelles-environnement/qui-sommes-nous/nos-principes-de-fonctionnement

enforcement. *Bruxelles Environnement* receives noise complaints from citizens and has an Environmental Police division that responds to them.

Brussels' strategy regarding noise has many advantages. It is a comprehensive plan, including different and complementary strategies that address both upstream and downstream problems with noise. It collects its own data and uses many tools and devices to benefit from them as much as possible. The most important and specific advantage of Brussel's model, and what differentiates it from most other models studied, is the fact that it tackles noise holistically with other environmental policy areas. This allows *Bruxelles Environnement* to place noise into context with other connected and complementary issues, which provides the opportunity to explore comprehensive solutions. It allows them to design sound environmental strategies that can have multiple benefits all at once, simultaneously addressing noise pollution, air quality, sustainable development, ground quality and green spaces protection. By working from a multidisciplinary approach to solving environmental problems, *Bruxelles Environnement* understands and manages noise as one component of overall population wellbeing and ensures that its programs take into account the complexity of environmental policy.

That being said, the fact that noise is handled by a large environmental institution rather than a specific noise institution can be a double-edged sword. As noise is not the sole focus, but rather a small part of a greater portfolio, it may not be the main priority. This suggests that Brussels' model might lead to more limited actions in terms of noise. Indeed, even if the holistic approach is a definitive value-added to Brussels' approach, not having a specific noise observatory could limit the resources awarded to noise management. Similarly, it implies that the spotlight will be shared between different subjects rather than being concentrated solely on noise. As well, having noise management handled by a fully public administration can have some downsides, specifically regarding independence. However, when *Bruxelles Environnement* makes strategic plans, they are more likely to be comprehensive, polished and well-designed.

## B.5 Delhi City Council, India

| Quick Facts | |
|---|---|
| Principle actor: | Delhi City Council, Pollution Control Committee |
| Funding structure, costs, resources, employee profile: | Part of the municipal government |
| Governance structure: | An initiative of the municipal government. |
| Partners: | n/a |
| Stakeholders: | Delhi Police, civic agencies, Delhi State Industrial and Infrastructure Development Corporation Ltd.(DSIIDC) and the Delhi Pollution Control Committee (DPCC) |
| Legal authority/ regulations: | Noise Pollution (Regulation and Control) Rules |
| Implementation: | In 2017, the Ministry of Environment, Forest and Climate Change released a report recommended that Delhi adopt more noise abatement strategies to manage road, industrial and commercial business-related noise. In 2019, Delhi City Council created its noise action plan and began using noise sensors. |
| Scope of action and key activities: | Installed five noise monitoring systems, the creation of a noise action plan, traffic management plan, designation of an area of 100 metres around schools, hospitals, courts and government offices a silent zone, soundproofing material installation |
| Research, output, reports: | Noise Action Plan |
| Public consultations or public engagement: | The police have a noise complaints hotline for residents to call into |
| Advantages: | A city-wide regulatory approach across departments. A focus on establishing noise sensors and collecting some data. |
| Disadvantages: | Still in its preliminary phases of implementation. |

Noise is a well-documented issue in Delhi with industrial, aircraft, transportation and diesel generators being the leading sources of noise in the city.[226] Noise mapping studies show noise ranging from 53 dB(A) to 83 dB(A) in locations across Delhi,[227,228] which is well above the WHO recommended 55 dB(A).

In 2017, the national Ministry of Environment, Forest and Climate Change released a report on Delhi's traffic noise pollution and recommended that Delhi adopt more noise abatement strategies to manage road, industrial and commercial business-related noise. That year, the Worldwide Hearing Index ranked Delhi and Mumbai in the top five noisiest cities in the world, highlighting transport, construction and loud radios and televisions in shops and restaurants as leading sources of noise pollution.[229] One analysis found that there was virtually no non-peak time on Delhi's main roads, with heavy congestion leading to prolonged noise[230]. Despite designated silence zones where honking is banned and subject to fines, honking remains an issue in Delhi.[231] Aircraft noise is also a significant issue, and detailed noise studies have been conducted with the Delhi International Airport in order to develop strategies to reduce noise pollution.[232]

In 2019, the Delhi government came up with its first noise action plan, with measures to identify noise pollution hotspots, equip police and city agencies with noise meters, install soundproofing at designated sites and require corporations to use sound limiter devices to ensure that audio systems did not exceed acceptable noise levels. The Noise Pollution (Regulation and Control)

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[226] "Noise Pollution," *Department of Environment,* accessed July 7, 2020, http://www.mediation.delhigovt.nic.in/wps/wcm/connect/environment/Environment/Home/Environmental+Issues/Noise+Pollution

[227] Nasim Akhtar, Kafeel Ahmad and S. Gangopadhyay, "Road Traffic Noise Mapping and a Case Study for Delhi Region," *International Journal of Applied Engineering and Technology* 2, no. 4 (2012): 39-45, https://www.cibtech.org/J-ENGINEERING-TECHNOLOGY/PUBLICATIONS/2012/Vol_2_No_4/06-015...Nasim...Road...Region...39-45.pdf

[228] Nasim Akhtar, Kafeel Ahmad and Pervez Alam, "Noise Monitoring and Mapping for Some Pre-selected Locations of New Delhi, India," *Fluctuation and Noise Letters* 15, no. 2 (June 2016), DOI: 10.1142/S021947751650019X

[229] Central Pollution Control Board, *Delhi's ambient noise levels influenced by traffic flow - Case studies,* Control of Urban Pollution Series (CUPS/86/2017-18, September 2017), http://www.indiaenvironmentportal.org.in/files/file/Delhi%E2%80%99s%20ambient%20noise%20levels%20influenced%20by%20traffic%20flow.pdf

[230] Centre for Science and Environment. "Congestion on Delhi Roads Has Worsened – Says New Analysis by CSE of Latest Google Map Data." Centre for Science and Environment, 2017. https://www.cseindia.org/congestion-on-delhi-roads-has-worsened--6994.

[231] "No honking drive - A menace city needs to take by the horns," *Times of India,* August 18, 2016, https://timesofindia.indiatimes.com/city/delhi/No-honking-drive-A-menace-city-needs-to-take-by-the-horns/articleshow/53732305.cms

[232] "Noise Management in India and Road Map for International Aviation," (working paper, International Civil Aviation Organization),A38-WP/222, August 20, 2013, https://www.icao.int/Meetings/a38/Documents/WP/wp222_en.pdf

Rules, 2000 Action Plan seeks to designate quiet zones, particularly around schools, hospitals and government offices. It also introduces measures to reduce the noise levels from leading causes such as traffic and construction. The Delhi Pollution Control Committee installed five real-time noise monitoring systems in noisy public spaces, with plans to expand the noise monitoring network across residential, commercial and industrial areas.[233]

The plan also calls on construction sites and industrial areas to have sound barriers were required by city agencies and integrates Delhi's pre-existing traffic management plan to help reduce vehicular noise by reducing speeding

[233] Joydeep Thakur, "Delhi govt readies first action plan to curb noise pollution," *Hindustan Times,* August 3, 2019, https://www.hindustantimes.com/delhi-news/delhi-govt-readies-first-action-plan-to-curb-noise-pollution/story-QZa2ZP9JrMg1UUEdRXtViI.html

## B.6 Japan: Ministry of Environment

| Quick Facts | |
|---|---|
| Principle actor: | Japanese Ministry of Environment |
| Funding structure, costs, resources, employee profile: | Part of the national government. |
| Governance structure: | Noise complaints are handled by the Environment Dispute Coordination Commission, a quasi-judicial government body. |
| Partners: | n/a |
| Stakeholders: | Residents and noise producing industries |
| Legal authority/ regulations: | Noise Regulation Law 1968 |
| Implementation: | The Noise Regulation Law was implemented following a period of increased urbanization, leading to increased noise pollution. To counteract the noise in urban areas and appreciate Japanese culture, in 1996, the Minister of Environment created One Hundred Soundscapes of Japan: Preserving Our Heritage. |
| Scope of action and key activities | Noise regulation law that is enforced through noise complaints, preservation of soundscapes |
| Research, output, reports: | n/a |
| Public consultations or public engagement | Noise management is mainly through noise complaints by citizens to the government who determines fault and imposes penalties. |
| Advantages | Celebrating culture and the natural environment is an innovative way to promote “good” noise. |
| Disadvantages | The noise management plan relies solely on regulatory and enforcement mechanisms. |

Japan is among the world's noisiest countries. Loudspeakers announce the arrival of trains; escalators remind you to hold the handrails, salespeople call out deals. For many Japanese, noise is accepted as a fact of life. Research comparing the tolerance level to the noise of people living in Japan to people living in the US found that while they experienced similar sounds daily, US respondents judged three times as many audible sounds annoying as Japanese respondents.[234] Following increased urbanization in Japan, the government implemented the Noise Regulation Law in 1968.[235] The law outlines regulations for factories, construction sights, road traffic, nighttime noise and the penalties associated with exceeding the maximum noise levels. Noise is the most reported source of neighbourhood conflict for the last 5 years. The government body that receives environmental complaints, the Environment Dispute Coordination Commission, received 15,665 complaints about noise in 2018, accounting for a third of all complaints received by the commission. [236] Other than filing complaints, the noise regulations aren't proactively enforced.[237] Additionally, there is a lack of large-scale noise data available.

Today, the majority of noise pollution occurs in residential areas due to factors such as overcrowding, low sound insulation in apartment buildings and an increased number of recreational facilities.[238] In fact, neighbourhood noise causes a significant amount of conflict between neighbours. Rising urbanization and a lack of positive neighbour relationships leading to less communication between neighbours, negatively affects how people perceive neighbourhood noise. There are some concerning examples of noise exploding into major conflicts, including a May 2020 murder of a man by a neighbour who, when questioned by authorities, said he did it because he "could not stand the loud footsteps and voices."[239]

While Japan is a loud country, it is also a country with a rich heritage and environmental beauty. The country has a long tradition of making sound-producing water features in Japanese gardens and creating quiet, peaceful teahouses. Coming out of this tradition and in an effort to protect the environment and manage noise pollution, in 1996, the Minister of Environment in Japan

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[234] Namba, S., Kuwano, S., Schick, A., Aclar, A., Florentine, M., & Zheng, D. R., "A cross-cultural study on noise problems: Comparison of the results obtained in Japan, West Germany, the U.S.A., China and Turkey," *Journal of Sound and Vibration*, 151 no. 3, (1991): 471-477.
[235] Noise Regulation Law 1968, Law No. 98 of 1968 (Japan), https://www.env.go.jp/en/laws/air/noise/ap.html
[236] "Gripes about noisy neighbours boil over in Tokyo as stay-home drive drags on," *The Japan Times,* May 20, 2020, https://www.japantimes.co.jp/news/2020/05/20/national/noisy-neighbors-tokyo-coronavirus/
[237] Daniel Dolan, "Cultural Noise: Amplified Sound, Freedom of Expression and Privacy Rights in Japan," *International Journal of Communication*, 2 (2008): 662-690.
[238] Kyoko Yoshioka-Maeda , " A preliminary review of literatures focusing on the neighbourhood noise issue in Japan," *Asian Pacific Journal of Disease Management* 8, no. 1 (2017): 01-08, https://www.jstage.jst.go.jp/article/apjdm/8/1-2/8_1/_pdf
[239] "Gripes about noisy neighbours boil over in Tokyo as stay-home drive drags on," *The Japan Times,* May 20, 2020, https://www.japantimes.co.jp/news/2020/05/20/national/noisy-neighbors-tokyo-coronavirus/

curated One Hundred Soundscapes of Japan: Preserving Our Heritage.[240] This project selected sounds from across the country, from all four seasons, representing Japanese nature and cultural traditions. These soundscapes that are unique to a particular place and time. Include the Tateyama Shomyo waterfall in Toyama prefecture and the Bell of Peace in Hiroshima.[241] While the 100 soundscapes of Japan are used to promote tourism and celebrate Japanese culture, these soundscapes are also carefully protected from outside noise, creating small pockets of the country free from noise pollution.

Japan's approach to noise provides Montreal with two main lessons. First, they offer a warning about relying only on regulations to address noise issues. While the Noise Regulation Law has been in place for over fifty years, due to its rare enforcement, and the lack of quantitative data, it is impossible to determine if noise pollution has improved as a result of the regulation. The fact that noise remains the most complained about the issue to the Environment Dispute Coordination Commission and continues to cause major neighbour disputes suggests that the noise pollution problems in Japan continue to persist. At the same time, Japan's One Hundred Soundscapes celebrate sound as something to be protected and enjoyed. Montreal's cultural and natural soundscape is a defining feature of the city and should be celebrated and protected.

[240] Mike Goldsmith, "Discord: the story of noise" (Oxford UP, 2012).;
[241] Krista Rogers, "The 100 Soundscapes of Japan: A list of Japan's greatest natural, cultural, and industrial sounds," *Sora News 24,* May 14, 2016, https://soranews24.com/2016/05/14/the-100-soundscapes-of-japan-a-list-of-japans-greatest-natural-cultural-and-industrial-sounds/

## B.7 London, United Kingdom

| Quick Facts | |
|---|---|
| Principle actor: | London and City of London |
| Funding structure, costs, resources, employee profile: | Part of the municipal governments |
| Governance structure: | Part of the municipal government, with a Night Czar, appointed by the mayor |
| Partners: | Night Czar |
| Stakeholders: | Borough governments, local airports, residents, commercial and industrial businesses |
| Legal authority/ regulations: | European Noise Directive 2002/49/EC |
| Implementation: | London's noise strategy was created in 2004. |
| Scope of action and key activities: | Incentivising greener vehicle use, road repavement, home building insulation, preserving iconic sounds, Night Czar position to improve and support nightlife, and collaboration with the airports and industrial sectors |
| Research, output, reports: | n/a |
| Public consultations or public engagement: | Building awareness of noise issues in residents and businesses, encouraging residents to use sustainable transportation and public transit. |
| Advantages: | The city is collaborating with different government bodies and stakeholders to ensure that road, commercial, and industrial noise is minimized. The city is also seeking ways to better reduce noise coming from roads, as well as offering resource solutions for individuals facing higher levels of noise (such as free sound insulation). |
| Disadvantages: | The strategy is traffic centric; there is a disjunction between the boroughs, the City of London and London, which makes it challenging to achieve consensus on noise-related issues; the night czar is not effective. |

The City of London (CoL) and London are two distinct jurisdictions and governments that makeup London, England. The City of London and London each have sound management strategies in place with many overlapping practices. This section will mainly focus on projects undertaken by London, with mentions of activities undertaken by CoL.

London is a mega-city with a fragmented noise strategy. Currently, local noise from pubs and clubs, roadworks and construction sites are managed by local boroughs. Industrial noise is managed by the boroughs and the Environment Agency of the city.

London's concrete strategy on noise was created in 2004. Since then, the city has incorporated noise policies through many departmental initiatives and strategies that contain noise reduction components. The purpose of London's Ambient Noise Strategy is "to minimize the adverse impacts of noise on people living and working, and visiting London using the best available practices and technology within a sustainable development framework."[242] The strategy primarily consists of noise reduction through means of incentivizing greener vehicle use, road repavement, and home building insulation.

A survey conducted in 2002 found that 13% of residents rated noise from road traffic where they lived as a 'serious problem,' compared with aircraft at 6%, roadworks at 4%, neighbours at 4%, trains/public transport at 2% and night entertainment at 2%. The theme of London's strategy is to target noise by order of importance.

Three issues have been identified, securing good, noise-reducing surfaces for London's roads, securing a night aircraft ban across London and reducing noise through better planning and design of new housing. In addition, other initial priorities have been highlighted. These include road regulations and pavement to allow for quieter zones, with materials used to minimize environmental noise, establishing a London Ambient Noise Fund for exemplar noise reduction projects, and a London Domestic Noise Fund to improve internal and external noise, especially in poorly covered flats and ensuring that 'polluter pays' levies compensate those affected by aircraft noise and other effects, such as through Aviation Environment Funds for each airport.

London Environment Strategy identifies how the city will further reduce noise from its congested city streets in a manner that is more feasible to residents. The city has created three categories of noise to target locations with the highest noise pollution from transport: the road transport network, non-road transport and non-transport sources.

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[242] Mayor of London, *Sounder City; The Mayor's Ambient Noise Strategy,* March 2004 https://www.london.gov.uk/sites/default/files/mayor-strategies-noise-docs-noise_strategy_all.pdf

London is one of the most congested cities in the world. The city wants to encourage different types of transport to reduce road traffic with the aim of increasing the number of trips made by walking, cycling, or public transport from 64% in 2018 to 80% in 2041. This is through their plan to make the entire transport network zero emissions by 2050, to be achieved through an infrastructure overhaul that will see the streets able to support zero-emission vehicles. These vehicles will significantly reduce urban noise. This will also include increased investment in public transport, to both improve existing service, while adding new service in the coming decades. In addition, the city will work with key stakeholders to reduce noise from freight activity through the consolidation and distribution of freight traffic. Lastly, the city will analyze and implement new, quieter materials for road development.[243]

Non-road traffic includes nighttime activities and street-level noise. The city will implement new rail infrastructure while also opposing the runway expansion of London-Heathrow Airport, a significant source of air-traffic noise for the city.

The city is working with non-transport sources of noise, including commercial and industrial premises, to formulate and apply appropriate noise mitigation measures. This sets out the layout, design and management practices that developers should follow to reduce noise from these sites. This guidance will be kept under review to ensure that it is mitigating noise from these premises in the long-term. On top of this, the city will encourage better planning and integration of roadworks by incentivizing minimal interruption in roadworks. This is through a quick completion scheme which charges a daily lane rental for road workers in sensitive traffic areas.

Currently, there are no legal limits to road noise; however, noise levels may be taken into account when new roads or houses and offices near roads are planned. When planning new roadways, local authorities assess how the noise in the surrounding areas will be affected. Affected households may be able to apply for funding to be used for sound insulation.[244]

Aviation noise affects more people in the UK than any other country in Europe. As such, the country has had major difficulties in expanding runways in airports, due to citizen dissent. The aviation industry in the UK recognizes the need to work with communities to plan for additional runway capacity.

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[243] Mayor of London, *Mayor's Transport Strategy,* March 2018 https://www.london.gov.uk/sites/default/files/mayors-transport-strategy-2018.pdf

[244] "Noise from roads, trains or planes," UK Government, accessed July 2, 2020, https://www.gov.uk/noise-pollution-road-train-plane/noise-from-roads

The city has established key recommendations as a means of supporting airline growth. It is recommended that airports and airlines ensure that operational approaches to mitigate noise are incentivized and adopted wherever feasible and should significantly increase spending on noise mitigation schemes in line with international competitors. Airlines and airports should encourage local buy-in through funding community schemes, direct payments, or tax breaks. Noise performance should be prioritized when purchasing new aircraft, and airports should incentivize cleaner quieter flights through landing charges.

A 2018 report from London identified that 29% of the city's parks are severely impacted by traffic noise, defined as meaning that 50% to 100% of the park is impacted by traffic noise of 55+ decibels. Conversely, 44% of the city's parks are completely free from traffic noise. As part of its 2018 strategies, the city outlines ways to which it will reduce traffic noise in parks. These are by means of diverting traffic, closing streets around parks, and implementing natural or man-made sound barriers throughout the park to decrease decibel levels.[245] The first two strategies pose a solution to decrease park sound levels; however, it comes at the expense of increasing sound levels in other parts of the city. London is also looking to protect and improve the acoustic sound of the city through the creation and maintenance of quiet and tranquil spaces across London, as well as the reduction of noise through good design and construction. In addition, CoL's strategy highlights the implementation of other innovative measures, such as using water features to mask unwanted sounds, encouraging planting to attract insects and birds, and promoting sound art installations.

Newer components of regulation of noise disruptions focus on researching materials and methods to reduce traffic noise, the main source of sounds in the London area. Additionally, the city is seeking ways to reduce such noise, whilst maintaining what it calls "iconic sounds," or sounds such as church bells that are liked by the majority of residents. It further seeks to integrate ways in which the city can integrate art and urban planning as a means of reducing overall noise throughout London.

The Department for Environment, Food & Rural Affairs (Defra) is responsible for implementing the European Noise Directive. These include mapping the main areas and sources of noise in order to identify areas that are in urgent need of attention, working to establish adverse effects, techniques to improve or preserve conditions, economic analysis and prioritizing actions. As part of its implementation, Defra completes noise mapping throughout the country every five years, with the last one being completed in 2017. Defra does not publish the methodology used to

[245] CPRE London, Traffic noise in London's Parks, May 2018, https://www.london.gov.uk/sites/default/files/ad_82_traffic_noise_in_londons_parks_final.pdf

create its sound maps. Defra's sound mapping, as well as noise complaints, are the primary ways that London approaches its noise strategy.

Noise complaints are also used as a means to graph out areas of increased noise and irritability in different areas of London. This is used to provide more qualitative data that can, in turn, be quantified by the number of complaints received and the pertinence of the noise complaint. CoL additionally utilizes interviews to gain an understanding of how residents feel about the different noises throughout the city, and whether they think it is best for the city to push for greater noise reduction in certain parts of the city.

Lastly, a Night Czar was appointed in 2016 as a representative to work with the night economy and the different boroughs to address noise issues and noise complaints. London's Night Czar works to share good practices on the development and management of the night economy. The goal of the position is to develop London into a sustainable and safe 24-hour city. The Night Czar works in partnership with the Night-Time Borough Champions network in order to coordinate with each of the city's boroughs in supporting the development of new nighttime initiatives, whilst minimizing the impact of noise on the city. The network will also help with the sharing of best practices between the boroughs. As the city has a decentralized way of handling noise, which can cause problems for regulators, and collaborators (such as the Night Czar) to work with the different bodies to create a symbiotic relationship that preserves the night economy. As boroughs are the ones who set local noise regulation, there are often clashes between neighbouring boroughs due to the spillover of noise. Critics are stating that the Night Czar of London has not been doing much for the city, as the position has not reduced the number of bar closures related to noise complaints.

London's policies are effective in collaboration and resource analysis. The city, in its numerous strategies, is collaborating with different government bodies and stakeholders to ensure that road, commercial, and industrial noise is minimized. The city is also seeking ways to better reduce noise coming from roads, as well as offering resource solutions for individuals facing higher levels of noise (such as free sound insulation).

However, there are several drawbacks, the policy is traffic centric, the Night Czar is ineffective, and there's a disjunction between the boroughs within the city and between the City of London and London. Although traffic noise is deemed to be the primary source of complaints, it seems that the strategy could look at other sources of noise as well, and to integrate it into its reduction of traffic noise. Critics of the Night Czar have been arguing that there still remains friction between pubs, and boroughs as noise regulation are varying between areas.

Further, the Night Czar has struggled to have a positive impact due to a number of high profile setbacks, such as the borough of Hackney Council's new venue curfew laws.[246] The dependence of the Night Czar on the governing party means the position lacks significant autonomy to take decisive and bold action. Montreal should, therefore, have an autonomous observatory to avoid conflicts of interest between the city officials and the observatory. Further, the role, as an appointment of the mayor, is quite vulnerable; if the leadership changes, then the role may change or disappear. This highlights the importance of having an independent role with the city and industry buy-in. This will ensure that a position of Night Czar is working in the interest of all stakeholders. [247]

The decentralization of noise policy between London's 33 boroughs and CoL makes it difficult to collaborate for a collective noise policy that sees results for all stakeholders. This makes it very difficult to appoint task forces or for positions like the Night Czar, who seek to improve the working relationship between night entertainment venues and local governments—as such, getting consensus on strategies to implement to make the city quieter while meeting demands of the night economy is all but impossible. It is, therefore, necessary to have a legislative power pertaining to noise restriction centralized by London, in order to allow for effective policymaking. London and the City of London are two different municipalities that make up the greater London area. CoL is small and surrounded by London, and therefore should have a joint strategy pertaining to noise. Despite this, both cities have different strategies with different resolutions. Therefore, London must work with neighbouring municipalities to incorporate a strategy that works for all residents.

[246] Derek Robertson, "What London's Night Czar Could Learn From Amsterdam's Success," *Vice,* September 20, 2018, https://www.vice.com/en_uk/article/kz5w3v/what-londons-night-czar-could-learn-from-amsterdams-success
[247] *Ibid.*

## B.8 Lyon: Acoucité: Soundscapes and noise observatory of Greater Lyon

| Quick Facts | |
|---|---|
| Principle actor: | Acoucité, non-profit organization |
| Funding structure, costs, resources, employee profile: | 50% municipality, 20% national government, 30% research grants. The diversification of the financial structure ensures its independence. |
| Governance structure: | A director, assistant director and a small staff, including engineers and research experts. The majority of work is through partnerships and with stakeholders. Five associated observatories set up between 2011 and 2013. |
| Partners: | Founding members: CSTB, IFSTTAR, ENTPE, Cerema |
| Stakeholders: | Numerous stakeholders including municipality of Lyon, technical schools, engineers, nearby municipalities |
| Legal authority/ regulations: | European Noise Directive 2002/49/EC |
| Implementation | It was created in 1995 by the municipality and in partnership with a group of key stakeholders. In 2010, it began supporting the development of noise management in four other jurisdictions in France and in Monaco. |
| Scope of action and key activities: | They have a strong partnership with the Greater Lyon municipality and support the city in noise management. Quantitative and qualitative data collection, public education campaigns and public awareness, promotion of sound heritage, research, publications, stakeholder engagement. The Observatory also works with surrounding municipalities, the main research is done in Lyon, but the analysis of the situation is made on the field with local employees. |
| Research, output, reports: | 20 reports per year, many research projects in partnership with other organizations |
| Public consultations and public involvement: | A lot of public education campaigns and awareness about noise, data collection interviews and surveys with residents. |
| Advantages: | Independent nonprofit is involved in innovative research, good working relationships with the municipality, and strong data collection. The governance is mainly based on experts, which helps with its credibility in public opinion. This also gives the opportunity to gather more funding because they proved their expertise and their added value in their domain. |

| | |
|---|---|
| Disadvantages: | The current governance structure heavily relies on its scientific experts. However, they might not be the best fit to advertise the relevance and purpose of the observatory with different stakeholders. It would be important to gather different employees with different expertise to fully showcase the work that is being done at Acoucité. (Public relations, stakeholder relations, etc.). |

Acoucité is a non-profit organization that studies noise and works closely with the Greater Lyon municipal government to address noise.[248] It was founded in 1996 by the Greater Lyon municipality and four technical research centres, Institut Français des Sciences et Technologies des Transports, de l'Aménagement et des Réseaux (IFSTTAR), École Nationale des Travaux Publics de l'État (ENTPE), Cerema and Centre Scientifique et Technique du Bâtiment (CSTB) with the goal of promoting links between research and local authorities and embracing the multidisciplinary, multifaceted approach to noise.[249]

The observatory is funded by 50% by the Lyon municipality, 20% by the French government and 30% by research grants.[250] It is led by a director and has a small team of staff including engineers, researchers and sound technicians. There is an eight-person Board of Directors that includes members from the founding organizations.

The observatory operates in partnership with the city, a permanent noise measurement network established in 2002, that measures noise levels and records sound. It also has mobile sound devices that, together with the permanent network, are used to create strategic noise maps, which are freely available on the Lyon website. As per the European Noise Directive, Acoucité supports Lyon's development of noise maps every five years, with maps from 2007 and 2012. These maps identify three types of noise areas based on the level of noise, critical zones, which are the priority areas, challenging zones that require monitoring and calm zones where noise levels are low. In addition to quantitative data collection, the observatory collects qualitative data

[248] "Observatoire de l'environnement sonore," *Acoucité Observatoire de l'environnement sonore de la Métropole de Lyon,* accessed June 29, 2020, http://www.acoucite.org/.
[249] Bruno Vincent, "Acoucité, 20 ans d'observatoire de l'environnement sonore orienté vers l'action, au service des agglomérations," (Powerpoint presentation, ECUM 49e École urbaine de l'ARAU Le bruit de la ville, Bruxelles, March 20, 2018), https://www.reseau-vivre-la-ville.fr/wp-content/uploads/2018/05/Presentation-Acoucite-Bruno-Vincent.pdf
[250] Bruno Vincent, "Journées du bruit environnemental 2019 – Bloc 5 (Bruno Vincent)," Presented on November 12, 2019 in Montreal, Youtube video https://www.youtube.com/watch?v=yJsD2EPRaf4&list=PLHClr1T5nD1-deOOTZ8ihZJPEuPWNA2V6&index=17&t=0s

through interviews and surveys with residents to understand how they perceive noise. The observatory also collects sound recordings and creates sound clips of neighbourhoods in Lyon to document the soundscapes. Acoucité uses all the data collected to build a historical data set that demonstrates the changes in noise over time. All the data is made publicly accessible.

Because of their unique position as an independent non-profit, Acoucité works closely with the local government but also has the freedom to conduct innovative research and participate in unique projects. The observatory publishes approximately 20 articles a year on many noise-related topics. They also participate in many unique projects related to sound. In collaboration with the University of Stockholm and Centre Scientifique et Technique du Bâtiment, the Hosanna project researched and tested natural acoustic solutions to reduce urban noise pollution such as plant walls and structures using recycled materials. The HARMONICA project, in collaboration with Bruitparif Sound Observatory in Paris, worked to create a standardized sound index for European countries in order to improve the efficacy of noise management policies in the European Union. Acoucité is also involved with the development of the urban design to promote sound heritage.

Another major part of Acoucité's activities is the education of civil servants, professionals and the public, including schoolchildren. Because Acoucité has experts on staff, including acoustic engineers and technicians, they have the expertise available to provide technical training to local technicians and professionals on noise issues and help government officials understand and apply noise management policies. Acoucité's work feeds into the policy development process and helps inform Lyon's urban planning, noise management strategy, and environmental health policies. They also have educational material for elementary school children and the public. Their data is available online for residents to engage with and better understand the noise environment in the city. Public and community education form an important part of the noise observatory.

A unique and important aspect of Acoucité is its association with other noise observatories in four French municipalities, the Agglomeration community of Grenoble-Alpes Métropole, Agglomeration community of pays d'Aix, the Agglomeration community of Saint-Etienne Métropole, Métropole Nice Côte d'Azur, and in Monaco. These observatories were established in partnership with Acoucité between 2011 and 2013, following a request from the French government for the creation of sound observatories in municipalities. Acoucité acts as a hub for the development of noise management throughout France, producing in 2008 a methodology guide for permanent noise measuring networks in other jurisdictions. Acoucité supported these partner municipalities through the creation of their noise maps and preliminary noise policy development.

Acoucité is an excellent example for Montreal for many reasons. Their position as an independent non-profit, with a strong relationship with the local government, allows them to support the government in monitoring sound and to create noise maps, while also conducting innovative research in collaboration with universities and technical institutions. Without this independence, the observatory would not have the same freedom and ability to contribute to and conduct interesting research. In addition, Acoucité is able to engage with stakeholders and create training material for residents, professionals and government more effectively as an independent body. Acoucité's lack of affiliation gives the observatory the neutrality necessary to engage with such a diverse set of partners and stakeholders. Due to the complex and multidisciplinary nature of both noise and Montreal's noise stakeholder landscape, this independent, non-profit model may be a good fit to effectively address Montreal's noise. Montreal is also a city with many universities and research institutions and a rich research culture. A noise observatory in Montreal must take advantage of this opportunity by being able to do rigorous and innovative research and R&D.

Acoucité's partnership and role as an advisor in the creation of five other noise observatories are similar to a role Montreal's noise observatory could play in the creation of a network of observatories across the province of Quebec. The lessons and best practices of the Montreal observatory, similar to the Acoucité noise management methodology, would be a great tool to support a standardized and effective implementation of future noise observatories in Quebec.

## B.9 Madrid City Council, Spain

| Quick Facts | |
|---|---|
| Principle actor: | Madrid City Council |
| Funding structure, costs, resources, employee profile: | Noise is managed by the Environmental Administration, a city department, which is funded through the city's budget. |
| Governance structure: | A department of the city. |
| Partners: | Noise pollution is addressed by the same department as air pollution and environmental protection. |
| Stakeholders: | Citizen advocacy groups including SOS Malasana; Bruel and Kjaer: the company that produces their noise monitoring equipment; nightlife industry group Plataforma por el Ocio, nightlife industry. |
| Legal authority/ regulations: | The city regulation is *Ordinance for Protection against Acoustic and Thermal Pollution*, based on the national *Law 37/2003*, *European Noise Directive 2002/49/EC* |
| Implementation: | Noise management has been in place in Madrid since 1969, and they began to monitor noise levels in 1994. Since 2002, the city has adhered to the European Noise Directive. |
| Scope of action and key activities: | As the noise management strategy is part of the Madrid city council, they are able to both collect data, make action plans and implement policy. The city council also does some public education. |
| Research, output, reports: | Madrid city council produces strategic noise maps and a strategic noise action plan. Daily noise measurements are also published on their website. |
| Public consultations and public engagement: | Public education campaigns promoting sustainable transportation, public consultation on the Noise Pollution Action Plan, including neighbourhood associations. The city commits to informing residents who are exposed to high levels of noise. |
| Advantages: | Extensive noise monitoring that is used to build strategic maps and make a Noise Action Plan. |
| Disadvantages: | Madrid has adopted a strict regulatory approach to nightlife noise, which has not been well received by the nightlife industry. |

Madrid is a noisy city. A study published in 2015 connected 1048 cardiovascular-related deaths and 1060 respiratory illness-related deaths annually to exposure to high daytime levels of noise in the city.[251] The majority of this noise (80%) comes from traffic.[252] Noise management by the Madrid City Council has been a policy area for over fifty years. In 1969, they were an early adopter of noise policy, approving an ordinance dedicated exclusively to noise management.[253] In 2011, they approved the *Ordinance for Protection against Acoustic and Thermal Pollution*, an ordinance encouraged by *Law 37/2003*, the national Spanish legal framework on noise pollution.[254]

The Madrid City Council Environmental Administration operates one of the oldest and most extensive urban noise monitoring networks, established in 1994 with 6 fixed monitoring stations and expanded to 31 by 1998.[255] The permanent network is focused predominantly on road traffic noise. The network also includes a mobile noise pollution control network of 16 stations that can be moved throughout the city to do local studies, and monitor leisure activities and special events. These sensors are used to produce strategic noise maps based on the *European Union Noise Directive 2002/49/EC*, which stipulates that the noise maps must be updated at least once every 5 years. The first strategic map in Madrid was developed in 2009, and since updated in 2013 and 2018. These maps are quite expensive and labour intensive to produce, and due to this, in 2003, the city introduced the SADMAM system for dynamic noise mapping.[256] This updated data collection method consists of a fleet of cars with noise monitoring terminals that measure noise throughout the city over shorter periods. These mobile noise monitoring terminals allow the city to produce and update dynamic noise maps without needing to install thousands of noise monitoring terminals throughout the city. As well, it makes it possible to make detailed noise maps of a small area during a special event or traffic modification. The strategic noise maps, as well as the daily noise measurements collected by the network, are available to the public online.

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[251] Aurelio Tobias, Alberto Recio, Julio Diaz, Cristina Linares, "Health impact assessment of traffic noise in Madrid (Spain)," *Environmental Research* 137 (February 2015): 136-140, https://doi.org/10.1016/j.envres.2014.12.011

[252] J. Díaz, C. López, A. Tobías and C. Linares, "Los riesgos de vivir ruidosamente. Resultados de un estudio europeo," Rev. Interdiscip. Gest. Ambient., 58 (2003) : 23-32.

[253] "Gestion del ruido," *El Ayuntamiento de Madrid,* accessed June 26, 2020, https://www.madrid.es/portales/munimadrid/es/Inicio/Medio-ambiente/Gestion-del-ruido/?vgnextfmt=default&vgnextoid=806d49a97eb17610VgnVCM2000001f4a900aRCRD&vgnextchannel=3edd31d3b28fe410VgnVCM1000000b205a0aRCRD&idCapitulo=10827408

[254] Juan Carlos 1 King of Spain, "Law 37/2003 del Ruido," November 17, 2003, translated text https://www.global-regulation.com/translation/spain/1449769/law-37-2003-of-17-november%252c-the-noise.html

[255] Jose Carlos Garrido Salcedo, Julen Echarte Puy, Blanca Maria Mosquera Lareo and Roberto Sanz Pozo, "Management Noise Network of Madrid City Council," *Internoise,* Madrid 2019, http://www.sea-acustica.es/fileadmin/INTERNOISE_2019/Fchrs/Proceedings/1402.pdf

[256] D Manvell, L Ballarin Marcos, H Stapelfeldt and R Sanz, "SADMAM – Combining Measurements and Calculations to Map Noise in Madrid," *International Congress and Exposition on Noise Control Engineering,* Prague, 2004, https://d3pcsg2wjq9izr.cloudfront.net/files/1442/articles/6139/bn0150.pdf

In addition to the noise monitoring network, the Madrid City Council has four major parts of their noise management policy: the creation of strategic noise maps, delimitation of acoustic areas, a noise pollution action plan and the installation of special acoustic protection zones.[257] The strategic noise maps generated based on the noise monitoring network, allow Madrid to identify levels of noise throughout the city and use that information for policy development and city planning. The city also uses them to determine compliance with noise level limits established throughout the city, quantify the number of people affected by elevated noise levels and determine how to reduce noise. Using this data, the city has divided the territory into areas with similar types of noise levels and noise-producing activities. These delimited acoustic areas are each assigned maximum ambient noise levels that are allowed to occur in each period of the day. The strategic mapping feeds into Madrid's comprehensive strategic noise policy, the Noise Pollution Action Plan. It involves public awareness and education campaigns, actions targeting nightlife noise, promotion of sustainable transportation like biking, urban planning and actions targeting urban neighbourhoods.

The final pillar of the Madrid noise management plan is the creation of four special acoustic protection zones (ZPAE). These areas, established between 2010 and 2017, are identified to be loud nightlife areas. Nightlife in Madrid, like in many cities, is a key flashpoint for noise confrontations. As a result of the indoor smoking bans decades ago causing people to stand out on the street to smoke and the illegal alcohol street vendors popular in nightlife districts, outside noise at night can be very disruptive for residents in these neighbourhoods. In order to control noise and address complaints from resident groups in these neighbourhoods, the ZPAE impose restrictions: restaurants must close their outdoor seating earlier than in other neighbourhoods, and there are restrictions on permits for new nightlife businesses.[258]These policies have not been well received by the nightlife industry who has financial hit in these special acoustic protection zones. Due in part to this conflict, during the last municipal election campaign in 2019, the mayor at the time proposed the creation of a night mayor position.[259] She was not re-elected, however, and no further action has been committed.

Although Madrid remains a loud city, the city believes that these policies have had a positive impact. In a Quality of life and satisfaction survey of Madrid residents, noise as a problem moved

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[257] "Gestion del Ruido Ambiental en la Ciudad de Madrid, " *El Ayuntamiento de Madrid,* accessed June 26, 2020, https://www.madrid.es/portales/munimadrid/es/Inicio/Medio-ambiente/Gestion-del-ruido/?vgnextfmt=default&vgnextoid=806d49a97eb17610VgnVCM2000001f4a900aRCRD&vgnextchannel=3edd31d3b28fe410VgnVCM1000000b205a0aRCRD&idCapitulo=10827163

[258] Fernando Peinado, " For residents of Madrid's city center, trendiness is offset by industrial levels of noise," *El Pais,* April 8, 2019, https://english.elpais.com/elpais/2019/04/02/inenglish/1554197254_999353.html

[259] Manuel Tapia Zamorano, "Carmena wants a "Mayor of the night" for Madrid that improves coexistence and nightlife," *Publico,* May 24, 2019, https://www.publico.es/politica/elecciones-municipales-carmena-quiere-madrid-alcaldesa-noche-mejore-convivencia-ocio-nocturno.html

from 8th biggest issue for residents in 2017 to 13th in 2019.[260] Due to a 2011 policy strictly enforcing permitted decibel limits on vehicles, noise from roads has decreased in the city.[261] In an effort to reduce air pollution, and inadvertently noise pollution, the city in 2018 also banned older vehicles from driving in the city centre.[262]

Madrid's noise management strategy can provide some key insight into the city of Montreal. Due to the high-quality data they are able to collect with their noise monitoring network, Madrid can target the areas of the city and the times of day with the most noise. Like Madrid, Montreal is a large and diverse city with nightlife districts as well as areas with loud vehicle and rail traffic. Being able to build detailed, neighbourhood level noise maps and delimited similar acoustic areas in Montreal will be essential to addressing noise in the city.

While the example of gathering detailed noise level data is a key takeaway from Madrid, some of the strict policies the city has imposed have been unpopular and detrimental to the nightlife industry. The strict limitations on businesses in the special acoustic protection zones have imposed major costs on many businesses. While Montreal should explore ways to manage nightlife noise, following Madrid's example, the strict regulation is not recommended.

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[260] Subdireccion General de Calidad y Evaluacion, "Encuesta de Calidad de Vida y Satisfacción con los Servicios Públicos de la Ciudad de Madrid 2019, " *Madrid City Council,* June 8, 2019, https://www.madrid.es/UnidadesDescentralizadas/ObservatorioCiudad/Documentos_Apoyo/Presentaciones_2019-06-08/Encuesta_Calidad_Vida/Encuesta_Calidad_Vida_Satisfaccion_Servicios.pdf

[261] Fernando Peinado, " For residents of Madrid's city center, trendiness is offset by industrial levels of noise," *El Pais,* April 8, 2019, https://english.elpais.com/elpais/2019/04/02/inenglish/1554197254_999353.html

[262] Miguel Angel Medina, "Madrid announces new rules of the road in a bid to banish traffic from center," *El Pais,* October 5, 2018, https://english.elpais.com/elpais/2018/10/05/inenglish/1538733317_890210.html?rel=mas

## B.10 New York City: Sounds of New York City

| Quick Facts | |
|---|---|
| Principle actor: | Researchers from NYU Center for Urban Science + Progress; NYU Steinhardt School of Culture, Education, and Human Development; NYU Tandon School of Engineering; Ohio State University's School of Engineering |
| Funding structure, costs, resources, employee profile: | Seed grant by NYU's Center for Urban Sound and Progress, $4.6 million grant from the National Science Foundation |
| Governance structure: | The core team of researchers from partner universities |
| Partners: | New York City Environmental Protection, New York City Health, New York University, New York City Parks, business improvement districts |
| Stakeholders: | New York City municipal government |
| Legal authority/ regulations: | University-led research project |
| Implementation | The project began in 2016. Between 50-100 sensors have been installed around New York City |
| Scope of action and key activities | Data collection, coding, machine learning, sensor development. The observatory collects data, uses it to train an algorithm to identify the sources of the sounds and measure the noise levels. The data will be used by the principal researchers and used to inform city agencies. |
| Research, output, reports: | Publications |
| Public consultations and public involvement: | Public engagement, including educational materials and a summer camp for elementary school kids. |
| Advantages: | Noise sensor network installed collecting real-time data that helps NYC agencies in noise mitigation. A good partnership between an independent organization and the City in terms of monitoring noise code violations. |
| Disadvantages: | The sensor network requires regular maintenance. Machine learning and sensor development are resource-intensive and still experimental. |

In 2016, New York University (NYU) and Ohio State University began a unique multi-year study, Sounds of New York City (SONYC), to help the city understand and control noise more effectively. The long-term vision of the project is to improve the understanding of the adverse impacts of noise on public health, educational outcomes of school children and property prices. The project is funded by a seed grant from NYU and a $4.6 million grant from the National Science Foundation. It is being developed in collaboration with New York City agencies, though the city does not provide any funding for the project.

The project uses a remote acoustic sensor network to gather data on noise and sound. The data is used to create sound maps and datasets with accurate descriptions of environmental sound, including the sources of the sounds (i.e. dog barking, footsteps), to help city agencies and policymakers. Researchers mounted 50 to 100 sensors on buildings around the city and are collecting snippets of audio, which are then labelled and categorized using a machine-learning engine. This trains the sensors to identify the hundreds of noises and sounds in New York City and pinpoint their sources. Future applications for this technology could include tracking the effectiveness of noise regulations or interventions.

SONYC has developed a partnership with the Department of Environmental Protection (DEP), which primarily handles noise code violations. With its real-time sensors, SONYC is able to monitor noise level spikes, identify their source (such as heavy machinery at a construction site) and record how long the noise code violation was. This allows DEP technicians to arrive at the site with evidence of the violation, saving the city time and resources.

SONYC is developing a low-cost, real-time, source-specific noise monitoring technology. The project has now progressed onto analytics and mitigation in collaboration with city agencies, developing newer sensor technologies, data-driven modelling, and a collaborative mobile platform to enable citizens to contribute annotated noise data in real-time. The citizen engagement component empowers residents to engage with noise as an issue in the city and contribute to better research and policy. The project has a focus on product development as well, using its research learnings to help improve noise technologies. It is currently working on developing a domestic noise sensor for residents.

In terms of policy development, New York City council revised its noise code in 2007 for the first time since 1972 to tighten up existing restrictions. It has been estimated that 9 out of 10 adults in New York City (NYC) are exposed to excessive noise levels beyond the limits recommended by the Environmental Protection Agency (EPA).

New York City primarily manages noise through its New York City Noise Code, with guidelines for residential noise, commercial noise, construction noise and heating and air conditioning equipment. The Noise Code was created to reduce excessive noises that affect factors such as public health, safety and welfare for residents.[263]

New York City does not systematically measure ambient noise or noise disturbance.[264] The 311 system is the primary way that the City tracks noise complaints. A survey found that 75% of New Yorkers experienced noise disruption seven or more times per week.[265]

[263] NYC Environmental Protection, *A Guide to New York City's Noise Code*, March 2018, https://www1.nyc.gov/assets/dep/downloads/pdf/air/noise/noise-code-guide-summary.pdf
[264] New York City Department of Health and Mental Hygiene, "Ambient Noise Disruption in New York City," *Epi Data Brief,* no. 45 (April 2014), https://www1.nyc.gov/assets/doh/downloads/pdf/epi/databrief45.pdf
[265] *Ibid.*

## B.11 Paris: Bruitparif

| Quick Facts | |
|---|---|
| Principle actor: | Bruitparif |
| Funding structure, costs, resources, employee profile: | 13 full-time employees, Board of Directors with key stakeholders. The funding is divided among different stakeholders, from governmental agencies to academics, to private donations. It has a similar structure to Acoucité in Lyon. |
| Governance structure: | Independent nonprofit association with a board of directors and a scientific council |
| Partners: | Bruitparif has 85 active members, which includes various institutions. The members' current composition is 45% from community groups, 25% state agencies, 15% associations, and 15% activities. |
| Stakeholders: | Paris municipal government, residents |
| Legal authority/ regulations: | European Noise Directive 2002/49/EC |
| Implementation | Established in 2004 |
| Scope of action and key activities | Uses a network of noise sensors and in-person interviews to produce strategic noise maps, public education, policy advice |
| Research, output, reports: | In-house experts and a lab to study noise |
| Public consultations or public engagement | Conducts in-person interviews with residents |
| Advantages | Bruitparif is independent and apolitical. It has its own Board of Directors and an operational body. It does not obey any political influence, but it shares its findings with policymakers to tackle the issue of noise pollution. It also adopts a very comprehensive approach to noise and sound management. Bruitparif is one of the few observatories that undertake qualitative data collection to better understand residents' perceptions of noises and sounds. It also produces quality research that informs policymaking. |
| Disadvantages | Bruitparif is a large organization with many members, which makes it hard to reach consensus. In addition, the organization’s bylaws are quite strict and bureaucratic. |

Established in 2004, Bruitparif, one of the leading noise observatories in Europe, is a nonprofit association in Paris, France (Ile de France) that brings together all the stakeholders in the field of noise.[266] The organization has three main objectives: observe and evaluate noise, help the local government implement noise policies and inform the population on the impacts of noise and the importance of preserving the local soundscape.

Bruitparif has 13 full-time employees and many partners and experts.[267] There are 85 active members, which includes representatives of state departments, the regional and local authorities, organizations managing infrastructures, transport and industrial operators, acoustics professionals, and environmental and consumer defence associations. The members' current composition is 45% from community organizations, 25% state agencies, 15% associations, and 15% activities. The nine-person board of directors is a collection of various stakeholders from different backgrounds. This ensures that they gather different points of view and interests in their research. The organization also has a nine-person Scientific Council made of independent experts that validate the observatory's research. The same principle of diversity applies to the council to ensure diversity of opinion and expertise. Bruitparif itself is also a member of associations and working groups, including the Eurocities noise working group.

Bruitparif uses three data collection methods to measure the impact of the noise in a specific area. The organization has installed 45 permanent noise sensors in the Ile-de-France area to study to gather important data regarding noise in different locations and assess the noise levels and variations throughout the day. It also has 350 mobile meters that can be used to do smaller scale or more targeted data collection allowing the organization to quickly adapt to a situation and provide expertise to ad-hoc requests. The mobile meters are specifically focused on aircraft noise. The sound meters are also able to take photos of the area to help identify the source of the noise.[268] Using this data, Bruitparif creates noise models using algorithms to estimate the impact of the noise. Thirdly, the organization conducts in-person surveys with the public to gather qualitative data to complement the quantitative data. This is an important step in the methodology because as noise has subjective aspects, the qualitative data is essential to understanding the human impact of the noise. Bruitparif focuses its research specifically in locations near critical infrastructure like highways, airports, and railways, urban noise including nightlife activities and large public gatherings, construction zones and calm zones. All these sources of data are used to build strategic noise maps of the region in collaboration with the

[266] "Les Membres, La Gouvernance Et Le Conseil Scientifique," Bruitparif, Accessed July 07, 2020, https://www.bruitparif.fr/les-membres-la-gouvernance-et-le-conseil-scientifique/.
[267] "Le rôle de Bruitparif," Bruitparif, accessed July 07, 2020. https://www.bruitparif.fr/le-role-de-bruitparif1/.
[268] David Owen, Amanda Petrusich, and Ben Wellington, "Is Noise Pollution the Next Big Public-Health Crisis?" *The New Yorker*, May 6, 2019, https://www.newyorker.com/magazine/2019/05/13/is-noise-pollution-the-next-big-public-health-crisis .

regional government, supporting Paris' obligations under the European Noise Directive. The sound level data and the noise maps are freely available online.

Bruitparif collaborates with policymakers, sharing its expertise and knowledge to support evidence-based public policies that help in the reduction of noise and improved quality life in France. Its independence makes Bruitparif a trusted expert in noise management.

Throughout the years, Bruitparif has established a laboratory with experts to study the impact of noise. In-house expertise contributes to the credibility of the organization and has made the organization a leader in its domain. The observatory has participated in many projects alone and in collaboration with partners. The HARMONICA project, in collaboration with Bruitparif Sound Observatory in Paris, worked to create a standardized sound index for European countries in order to improve the efficacy of noise management policies in the European Union.

Bruitparif recognizes that the majority of the population is not aware of the impacts of noise on health. A key objective of the organization is to raise awareness and educate the public about the noise. They produce publicly available educational material about noise and noise pollution. The observatory supports the organization of Sound week and National hearing day to share their knowledge of noise with the public. Bruitparif also focused on educating youth about the auditory dangers of loud music, including an online program called Kiwi.

Bruitparif is a good example for Montreal of how a noise observatory can operate. It is versatile, with high-quality research and expertise. Its independence and neutrality allow the organization to participate in and add to the noise debate with innovative research, engage with its numerous stakeholders and members and support policymakers to create noise management plans.

The one downside is that with so many members, stakeholders and partners and quite strict bylaws, the organization can be bureaucratic. It can be a challenge to reach a consensus with so many stakeholders, which can delay the publication of research.

## Annex C: Additional information on noise measurement

Sound level meters are the traditional instruments of measurement and allow for cities to track noise and enforce noise bylaws. Sound level meter technology varies widely and has its limitations, including the types of sounds it can measure, the location, the time of day, weather, cost, and the focus on quantitative decibel measurement. A-weighted decibels (dBA) are the common measurement units, which approximates how sound is heard and experienced by the human ear and accounts for the human hearing thresholds. Decibels (dB) is the unit for unweighted sound pressure levels, which takes into account the entire range of sound frequency, including the very low and high frequencies that human ears may not hear equally.

Most sound is measured through a method that aggregates all sound energy without being able to isolate the impact of particular sounds. With this method, thunderstorms can register on a sound sensor as being louder than the noise that measurers want to capture and while a sensor can register the sound spikes, it cannot tell the researcher what the sound source or context is. One of the major limitations of current sound measurement technology is that it does not capture the qualitative aspect of noise, which is so central to how residents experience noise and sound.

New technological approaches to sound management are ongoing, with smartphone sensing increasingly being investigated as an alternative tool which can address many of the limitations of traditional sound measurement techniques.[269,270]

Publishing noise data is controversial, due to the complexity of the data, which is usually most useful for acousticians and noise experts. Noise mapping itself is complex, with varying degrees of uncertainty depending on factors such as the methodology used, the type of noise action plan in place and the quality of input data.[271]

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[269] Romain Dumoulin and Jeremie Voix, "Calibration of smartphone-based devices for noise exposure monitoring: Method, implementation, and uncertainties of measurement," *The Journal of the Acoustical Society of America* 133 no. 3317 (2013) https://doi.org/10.1121/1.4805531

[270] Charlie Mydlarz, Justin Salamon and Juan Pablo Bello, "The implementation of low-cost urban acoustic monitoring devices," *Applied Acoustics* 117 (February 2017): 207-218, https://doi.org/10.1016/j.apacoust.2016.06.010

[271] M. Ausejo, Manuel Recuero López, C. Asensio, R. Pagan Munoz, I. Pavón, "Study of Uncertainty in Noise Mapping," *In Proceedings of the 39th International Congress on Noise Control engineering. Inter-noise 2010* (2010): 616-625 https://research.tue.nl/en/publications/study-of-uncertainty-in-noise-mapping

A study found that qualitative evaluations of noise sources are particularly important in analyzing sound. Human sounds such as conversation and open markets should be delineated in terms of pleasantness from more mechanical sounds such as traffic.[272]

[272] Daniele Dubois, Catherine Guastavino, and Valerie Maffiolo, "The meaning of city noises: Investigating sound quality in Paris (France)," *The Journal of the Acoustical Society of America* 115, no. 5 (2004), doi: /10.1121/1.4809275.

## Annex D: List of stakeholders for the Observatory to consider

| **Government** | |
|---|---|
| *Municipal* | The Observatory should work with the city and its different departments and employees, as well as with surrounding municipalities to manage services and policies afforded by their respective jurisdictions. This shall include the mitigation of road traffic, roadworks, urban planning and construction, amongst others. |
| *Provincial* | The Observatory should work with the provincial government to identify ways in which it can contribute to provincial portfolios and agendas. Collaboration with the provincial government should also cover the eventual expansion of the Observatory's model to other jurisdictions throughout Quebec. |
| *Federal* | The Observatory should work with the federal government to identify ways in which it can contribute to provincial portfolios and agendas. It should also provide input on how noise policy can play a greater role in policymaking decisions. |
| **Industry** | |
| *Airports* | The Observatory should work with *Aéroports de Montréal* to analyse the impacts of aviation noise, and to formulate solutions for noise reduction[273,274]. |
| *Maritime Transportation* | The Observatory should work with the Port of Montreal and Transport Canada to seek ways to reduce the noise produced by transport ships and ferries.[275] |

[273]Aéroports de Montréal, "Climat Sonore," Accessed July 7, 2020, https://www.admtl.com/fr/adm/collectivites/climat-sonore

[274] David Kaiser, et al, *Le bruit et la sante: État de situation — île de Montréal,* Centre intégré universitaire de santé et de services sociaux du Centre-Sud-de-l'Île-de-Montréal.

[275] *Ibid.*

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| *Railways* | The Observatory should engage with Via Rail, Amtrak, CN Rail, and CP-Rail to seek and introduce methods of reducing noise caused by rail traffic.[276] This may include track replacement, sound barriers, and limiting hours of operation. |
| *Commercial Business* | The Observatory should work with commercial businesses in ensuring that noises and sounds do not disturb the surrounding environment and neighbourhoods. |
| *Cultural Business and Tourism* | The Observatory should work with cultural and tourist-oriented businesses to reduce the sound impacts of tourism, transport busses, tourism groups, nighttime events, and cultural events. |
| *Night Clubs and Bars* | The Observatory should work with the nightlife sector and event coordinators to introduce means of sound reduction, whilst preserving the dynamism of nighttime economic activity, especially in quarters which are experiencing densification of the residence adjacent to bars.[277] |
| *Manufacturers and Other Heavy Industry* | The Observatory should work with manufacturers and other heavy industry to identify ways in which sound can be better insulated or reduced, to impact communities to a lesser extent. |
| *Local and Provincial firms* | The Observatory should work with firms, both in Quebec and in Montreal, who offer diverse services in the areas of environment, architecture, industry, events, manufacturing, and transportation. This will be with the aim of improving the sound environment. Such organizations, as Atelier 7Hz, have started consultations on the observation of urban |

[276] *Ibid.*
[277] Partenariat du Quartier des Spectacles Montréal. *Mémoire du partenariat du Quartier des Spectacles*. September 2019. https://medias.quartierdesspectacles.com/pdf/2019/memoire-mssq-sept2019-pqds.pdf

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| | environmental noise and the bodies that produce the different types of noise |
| **<u>Community Stakeholders</u>** | |
| *Residents* | The Observatory should work with residents of the City of Montreal to gain an understanding of the noise nuisances most disruptive to their livelihood, and which impact their health. Residents associations, interest groups and community organizations could be effective collaborators in noise policy development. |
| *Canadian Acoustical Organisation* | The Observatory should work with The Canadian Acoustical Organisation.[278] The Canadian Acoustical Organisation is a professional interdisciplinary organization that encourages communication between different stakeholders pertaining to noise. In addition, they work in the development and application of acoustic knowledge, education from research, environmental protection. |
| *Engineers, artists, and creators* | The Observatory should engage with different working bodies to formulate feasible, creative, and artistic solutions to reduce noise where necessary. |
| Audiotopie | The Observatory should work with the Montreal work cooperative that works in the domain of sound design and media.[279] Audiotopie offers various services surrounding sound language and digital art, which can be used in collaboration for sound mitigation strategies created by the observatory. |

[278] Canadian Acoustical Association, "Ce qui est l'association canadienne d'acoustique?," Accessed July 7, 2020, https://caa-aca.ca/?lang=fr
[279] Audiotopie, "Mandat, Vision," Accessed July 7, 2020, https://www.audiotopie.com/la-coop/

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| *Le Regroupement Québécois contre le Bruit* | The Observatory should consult this body to further environmental protection from sound, and to ensure a better quality of life for residents.[280] |
| *Le comité de citoyens "Les Pollués de Montréal-Trudeau »* | The Observatory should work with this body to identify the impacts of sound on the environment from the Montreal YUL Airport.[281] |
| *La Société du Vieux-Port de Montréal* | The Observatory should work collaboratively with the society on sound management of its activities and events. |
| *Quartier des spectacles* | The Observatory should work collaboratively with the *Quartier des spectacles* to favour the mitigation of the noise impacts of the various festivals hosted by the city while maintaining the dynamism that these festivals bring to Montreal.[282] |
| *La Société de parc Jean-Drapeau and La Ronde* | The Observatory should work with the park to ensure that events and common activities do not disturb nearby residents on the island of Montreal or on the South shore. |
| *Le Groupe d'Experts Interministériel sur le Bruit Environnemental* | The Observatory should work with this body on the establishment of a national concertation table on noise, a noise research network, a noise observatory and the definition of a holistic environmental action plan.[283] |

[280] Le Regroupement Québécois contre le Bruit, "Accueil," Accessed July 7, 2020. http://www.rqcb.ca/fr/accueil.php
[281] Les Pollués de Montréal-Trudeau, "Home page," Accessed July 7, 2020. https://www.lpdmt.org/?lang=en.
[282] Partenariat du Quartier des Spectacles Montréal, *Mémoire du partenariat du Quartier des Spectacles,* September 2019, https://medias.quartierdesspectacles.com/pdf/2019/memoire-mssq-sept2019-pqds.pdf.
[283] Ministère de la Santé et des Services Sociaux: Visions et Orientations Gouvernementales en matière de lutte contre le bruit environnemental au Québec. https://msss.gouv.qc.ca/professionnels/documents/bruit-environnemental/19-214-02w_vision_orientation_bruit_complet.pdf

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| *Academic Institutions* | The observatory should work in collaboration with various academic institutions, including public health organizations (INSPQ), universities (Laval University, McGill University, ÉTS, Montreal University, Concordia University and Université de Sherbrooke) and research dedicated non-for-profit organizations to increase knowledge in the field and support municipalities with regard to noise. |
| *La Direction de Santé publique de Montréal* | The Observatory should work with the Montreal *Direction régionale de Santé Publique to identify* the health impacts of certain noises on residents.[284] |
| *Sounds in the City* | The Observatory should work with the multi-party and multi-sectoral project Sounds in the City, to further collaborations on Soundscaping research.[285] |
| *Vivre en Ville* | The Observatory should work with *Vivre en Ville,* whose mandate is to develop tools to support Quebec municipalities in the management of environmental determinants.[286] |

This is a non-exhaustive list of relevant stakeholders to consult. The Observatory should actively seek out bodies throughout the city working on innovative technologies to reduce environmental noise pollution, as well as bodies performing research on the effects that such pollution has on local populations, to develop additional meaningful collaborations.

[284] *Ibid.*
[285] Sounds in the City, "Project Overview," Accessed July 7, 2020. https://www.sounds-in-the-city.org/en/overview/.
[286] Vivre en Ville, "A Propos," Accessed July 7, 2020. https://vivreenville.org/.