Policy Brief:

Preventing the harmful effects of anthropogenic noise on biodiversity

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This **policy brief (D4.2)** is produced as part of the Horizon Europe **PLAN-B project** (Grant Agreement No. 101135308) in collaboration with its sister **project AquaPLAN** (Grant Agreement No. 101135471). This policy brief provides **strategic guidance** for the **European Union** to take steps towards **addressing noise pollution**, **recognising** its **adverse environmental impacts**, and **promoting science-based regulation**.

KEY MESSAGES

Natural soundscapes are an **integral part of nature**, **crucial** for the **environment** and **biodiversity**.

Noise pollution significantly impacts biodiversity.

Anthropogenic noise and vibrations should be **treated as potentially harmful across all media** (air, water, and soil), with attention to the differences of these media.

Noise regulation should not be solely anthropocentric, with the **European Noise Directive** (END) action plans **prioritising measures that benefit both biodiversity and human well-being**.

The **Birds and Habitats Directives** are **essential** for **protecting biodiversity from harmful noise** and must not be weakened. **Conservation** and **restoration** efforts must fully **consider noise impacts and promote wilderness areas.**

Environmental Impact Assessment (EIA) **should consider** the direct and indirect impacts of **expected noise interference** with activities **on**, at least keystone **species** and vulnerable species in the local environment.

The **human hearing range is limited** to frequencies between 20 and 20,000 Hz, while **many organisms have a completely different frequency-dependent sensitivity** within this range, and can **even perceive sounds below (infrasound) and above it (ultrasound)**. **Environmental noise assessments** and **mitigation measures** should **account for these biological differences** to accurately evaluate ecological impacts and design effective interventions.

Within a **one-health perspective**, the **noise** burden **should be addressed and mitigated for humans and animals alike.**

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INTRODUCTION

Noise pollution is unwanted sound that can impact humans and biodiversity. **Pollution** is one of the primary **drivers of biodiversity loss**. To **meet the ambitious** conservation **targets** introduced in response to widespread and rapid biodiversity decline globally, **noise pollution** in the environment **must be controlled**.

Many **organisms have sensory systems** that **detect sound and vibration**, facilitating perception of and response to opportunities and threats. **Variation** in these sensory systems and in the requirements of organisms **result in differential impacts of sound**.

For example, the notions of ultrasound and infrasound reflect sounds outside of the human auditory range, but these sounds may be detectable by the sensory systems of other species. Therefore, noise policy should transcend its traditional anthropocentric view.

Human activity (e.g. road, rail and air traffic) **introduces a variety of sounds** into the environment. The **differential impacts** of these sounds on organisms **can harm individuals**, **affect biological functions** on various other levels, and **disrupt** the **ecological balance**, **leading** to **biodiversity loss**. Natural areas exposed to high levels of anthropogenic noise also **impact a vital ecosystem service**, mental **restoration**, as **rich natural soundscapes are an integral part** of experiencing **nature**. Therefore, for **the policy agenda**, **anthropogenic noise in the environment should be considered in a one-health context**.

Noise should be recognised as an environmental pollutant, **requiring the avoidance** of new chronic sources where possible, the **reduction of noise** at source, the **safeguarding** of **quiet areas**, and long-term **monitoring** of both soundscapes and biological outcomes to verify recovery following interventions. **Addressing** anthropogenic noise in this way will **benefit** both **humans** and **biodiversity**.

ANTHROPOGENIC NOISE

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Humans produce sound to communicate information or emotions to their peers. **Some human activities**, such as open-air concerts or warning signals, **intentionally produce sound**. Occasionally, **humans use sound as a repellent**, either to **scare away animals** (e.g. mosquitoes, small mammals, martens, birds) or **to warn and avoid harm** for them (e.g. keep dolphins and whales away from fishing gear, or bats from wind farms). In this case, the **use of ultrasound** is **common** because **humans cannot hear it and** are therefore **not disturbed**. However, **such measures** involving ultrasound are **controversial**, and their use **should be carefully considered and justified**.

Most anthropogenic sound, however, is **an unwanted byproduct of human activities**, such as driving, grass mowing, recreational activities, or construction work. Due to population growth, tourism and the nighttime economy, anthropogenic sound is present throughout the day and night and **increasingly extends into less populated areas**, including protected areas. Therefore, **disturbance of wildlife by anthropogenic noise is widespread in the terrestrial environment**. Human-generated noise **also extends underwater**, affecting aquatic and marine environments, where it is both a by-product of activities such as shipping and offshore energy and intentionally generated for active sensing.

IMPACTS ON SPECIES, HABITATS AND ECOSYSTEMS

Noise impacts have traditionally focused on human health, yet the **evidence base for impacts on wildlife and ecosystems is now extensive**, spanning a wide range of taxa, habitats, and ecological outcomes. Sensitivity and **responses vary** strongly **among species**, which means **biodiversity risks can be underestimated if assessment** thresholds **are based on human-centric assumptions** or single indicator taxa. Importantly, noise can also leave legacy effects.

The **effects of noise pollution on ecosystems** often begin with **impacts** of sound on **individuals** and then **propagate across levels** of biological organisation, ultimately reshaping communities and ecosystem functioning. A practical starting point is to consider how different animals rely on sound to survive and reproduce. Across taxa, acoustic cues support environmental awareness, predator detection, prey localisation, social interactions, and habitat assessment.

Anthropogenic noise affects biodiversity through several recurrent mechanisms, such as:

Masking	Elevated background noise reduces detectability of biologically relevant cues and signals, increasing uncertainty in risk assessment and disrupting communication and foraging.
Distraction and cognitive load	Noise can reduce attention to relevant cues even when it does not overlap spectrally with those cues, impairing decision-making and performance.
Acute disturbance and chronic stress physiology	Unpredictable or high-intensity events can trigger startle or avoidance responses, while persistent exposure can function as a chronic stressor with downstream consequences for fitness.
Habitat displacement and selection	Animals may avoid noisy areas, effectively reducing habitat availability and changing local community composition.

Progressively, **these mechanisms** provide a clear **pathway from individual responses** to **adverse outcomes at the ecosystem level (Figure 1)**. By altering movement, habitat use, and species interactions, **noise** can **modify ecosystem services** supported by biodiversity. For instance, noise pollution is known to impact pollination and seed dispersal dynamics, highlighting how sound can cascade from behavioural changes to functional outcomes relevant to people and ecosystems.

Evidence indicates that **noise pollution can create legacy effects** that **persist even after the source is reduced or removed**. In a natural experiment following the closure of an airport, several bird species shifted their dawn song onset back toward control-site schedules, but some species continued to sing earlier near the closed airport, suggesting that chronic exposure can leave persistent behavioural signatures and that recovery times may differ across species. Noise pollution can also accelerate biological ageing. **For policy, this means waiting to act risks locking in long-term changes, with potential downstream consequences for reproduction and community dynamics.**

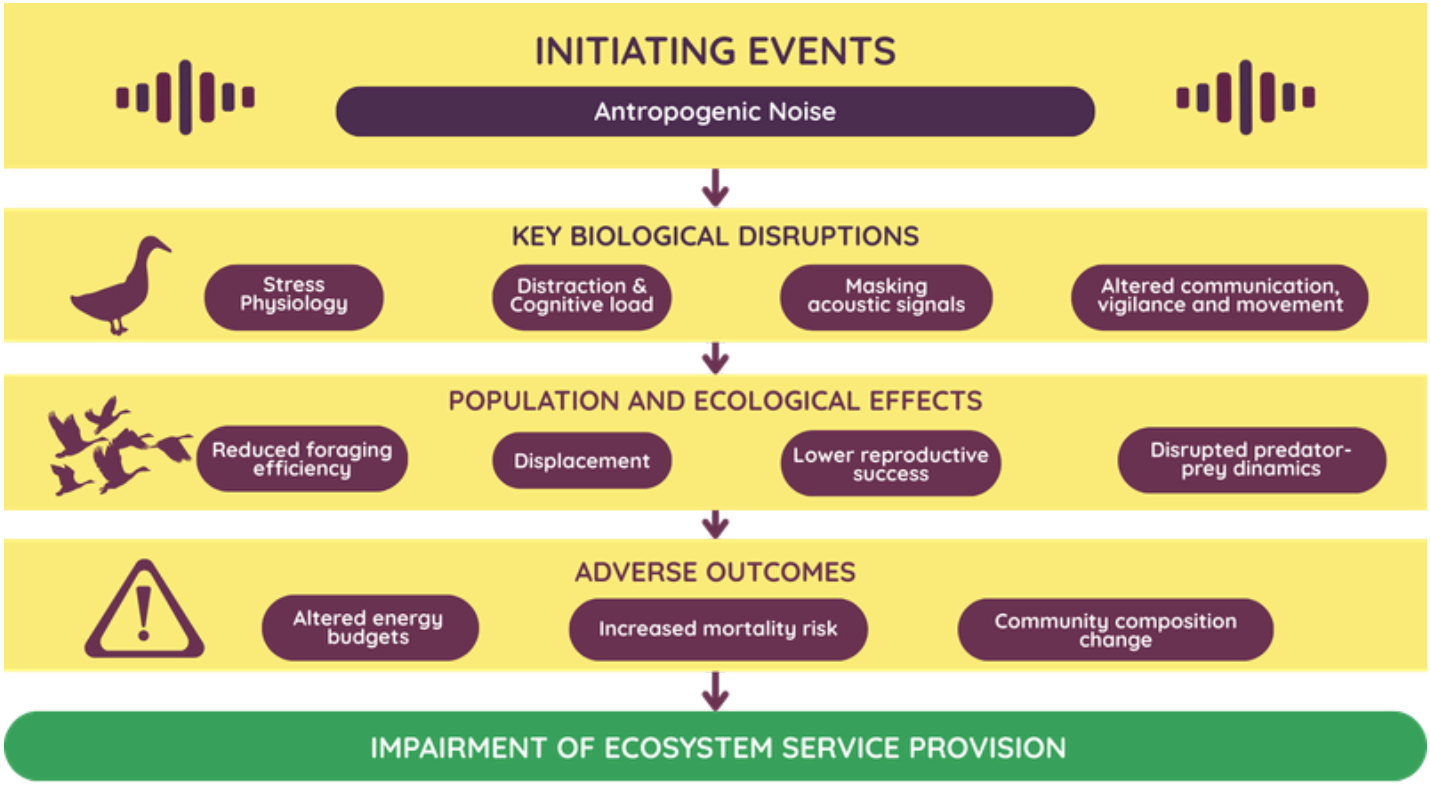

Figure 1. Conceptual pathway illustrating how anthropogenic noise leads from biological disruption to population, community and ecosystem level impacts, resulting in impaired delivery of ecosystem services.

BIODIVERSITY-RELEVANT NOISE ASSESSMENT

In view of the widely available data on **transportation and industrial noise in strategic noise maps produced** for the **Environmental Noise Directive** (END), it is tempting to use **conventional** EU-**indicators for noise** to assess the impact on biodiversity. These indicators are **anthropocentric**, emphasising **sound frequencies within the human hearing range** (A-weighting) and averaging over periods relevant for human activities (e.g. day–evening–night noise level, Lden). Due to the diversity of species, this **approach needs to be extended to account for**: **(1) differences in the sensitivity of organisms** to sound and vibration frequencies (go beyond A-weighting); **(2) seasonal and diurnal changes** in the need for quietness (go beyond day-evening-night); **(3) the environment and height** where the species reside (beyond façade exposure at 4m).

1

The **inability for humans to hear specific sounds does not** necessarily **mean there is no effect on wildlife**. Since the significance of sounds varies greatly across species, **environmental impact assessments should avoid overestimating the importance of sounds that are highly meaningful to humans**, such as speech, music, or even mechanical noises like aircraft sounds and ignore others. Hearing thresholds – the lowest sound level at which an animal responds – have been measured for only a limited number of species (examples in **Figure 2**). Several mammals exhibit greater sensitivity to high-frequency sound. In contrast, bird and amphibian hearing thresholds span a narrower frequency range. Predator species often display lower hearing thresholds, enhancing their ability to detect prey. Because high frequencies are absorbed by air, sensitivity to higher frequencies rarely leads to stronger effects far away from the source.

2

For **biodiversity**, **seasonal variations in effects** are of utmost **importance** because of the **reproductive cycle**. In addition, activities that could be disturbed by anthropogenic noise show clear diurnal dependence. E.g., the strongest bird vocalisation activity starts within one hour after **twilight** in spring. Time zones and daylight-saving time, and thus diurnal patterns of human activity (e.g. rush hour), do not coincide with solar time and biodiversity needs. This should be considered in impact assessment.

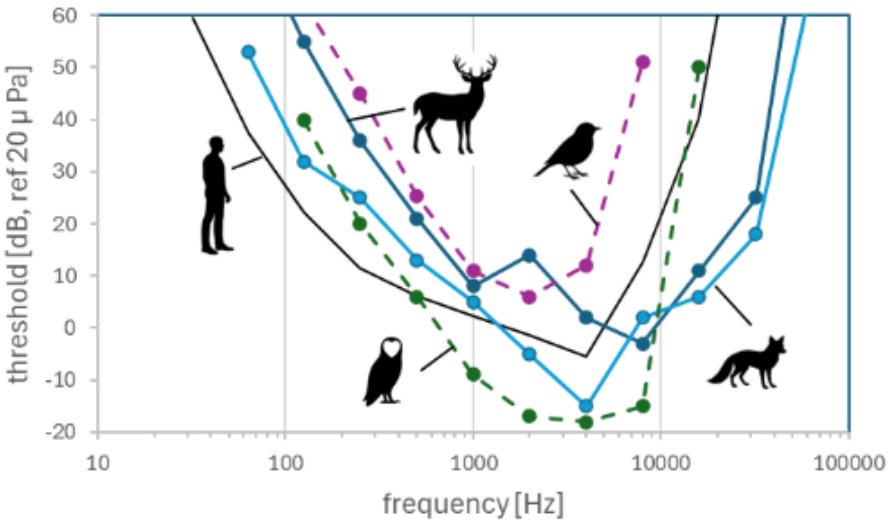

Figure 2. Hearing threshold (behaviour) for some example species (whitetail deer, red fox, barn owl, average song bird) compared to human hearing threshold.

3

Noise exposure depends on source and observer height, terrain, and ground cover. The distance from a sound source at which a ground-dwelling animal can detect sound is less, especially in hilly terrain, than for species living near tree canopies or hunting in flight. The highway noise maps in **Figure 3** illustrate this: the highly sensitive hearing of owls is more affected than that of foxes, putting owls at a disadvantage when locating small prey. Songbirds may be less disturbed because their hearing is worse, while deer benefit from the relative quietness of valleys shielded from direct highway noise exposure.

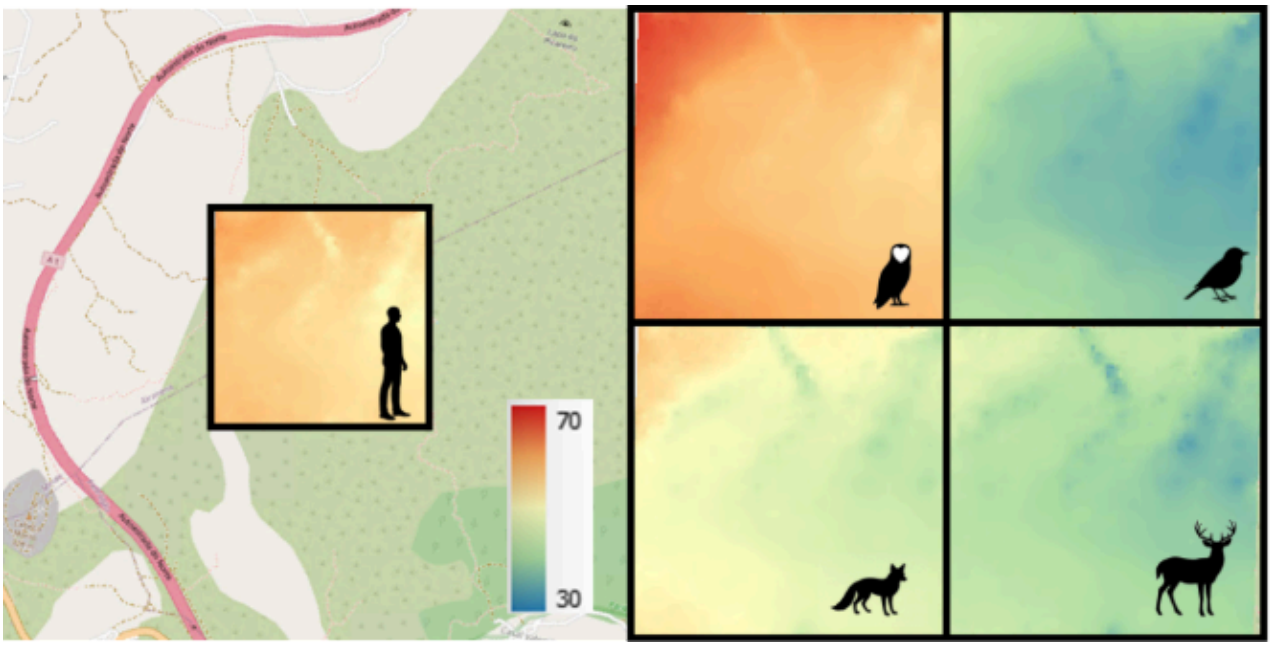

Figure 3. Noise map of a square kilometre near a highway, the four variants include different height of the animal's position (5m for owl and songbird, 0.5m for fox and deer) and different hearing thresholds (**Figure 2**). Levels are in dB above hearing threshold for each specific species.

UNDERWATER NOISE: IMPACTS, DIFFERENCE AND SOLUTIONS

Underwater noise differs from **airborne noise** because **sound travels much faster** (about 1,500 m/s in water compared to ~340 m/s in air), and over far greater distances in water (Dahl et al., 2007), allowing low-frequency noise from commercial shipping and seismic exploration to propagate across ocean basins and elevate ambient noise levels at large spatial scales. Like terrestrial species, **many aquatic species rely on acoustic cues and are impacted by anthropogenic noise**.

Recognising these **impacts**, r**egulatory action on underwater noise pollution has been evolving since 1982**, when the United Nations Convention on the Law of the Sea (UNCLOS) defined marine pollution to include energy, paving the way for noise regulation. The **first global body to identify anthropogenic underwater noise as a priority** issue was the International **Whaling Commission in 1998**, and the regulation has since continued to expand both internationally and within Europe. The **Marine Strategy Framework Directive** (MSFD) provides the EU's most comprehensive regulatory mechanism, addressing **underwater noise under Descriptor 11**, with indicators for continuous and impulsive noise and **binding thresholds established under the Zero Pollution Action Plan**.

Unfortunately, recent assessments show that **current actions remain insufficient** to meet long-term zero-pollution objectives for underwater noise. Reports such as the Zero Pollution Monitoring and Outlook Report highlight the **need for clearer operational standards, harmonised enforcement, and stronger implementation** across Member States.

In terms of **mitigation**, a mixture of **technological and management solutions** can **reduce the potential impacts of underwater noise pollution**. Complementary but voluntary guidance, such as the Convention on Biological Diversity Technical Guidance No. 99, encourages noise considerations to be integrated into marine spatial planning and environmental impact assessments, although uptake remains inconsistent. The International Maritime Organization offers guidelines to reduce underwater noise from shipping, including **propeller optimisation** to reduce cavitation and operational changes, such as **slower transit speeds**, to **lower noise outputs**. **Bubble curtains** can be deployed around pile driving operations to reduce impulsive noise, while **spatial and seasonal restrictions** on seismic surveys can protect sensitive species during breeding and migration. Real-time acoustic **monitoring networks can also help** reroute vessels away from vulnerable areas. Together, these measures show that while progress has been made, **sustained regulatory updates and broader adoption of noise reduction technologies are crucial** for safeguarding underwater ecosystems.

Anthropogenic noise causes widespread disturbance to wildlife across terrestrial, aquatic, and marine environments.

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REGULATORY ACTION TO CONTROL NOISE POLLUTION

Environmental noise regulation at the international level has **largely focused on human protection**. However, **recent developments** indicate a **shift towards** safeguarding **biodiversity** from the impacts of noise.

Two **major conservation conventions address noise impact on biodiversity**: the **Convention on Biological Diversity** (CBD) and the **Convention on the Conservation of Migratory Species of Wild Animals** (CMS). Under both conventions, **anthropogenic noise is formally recognised as a form of pollution** that can adversely affect biodiversity, although under the CMS, this applies only to marine noise.

Within the **Kunming-Montreal Global Biodiversity Framework** (GBF), the CBD **set an ambitious target to reduce pollution from all sources by 2050**, as one of the key drivers of the biodiversity decline. Although noise pollution is not explicitly mentioned in the GBF, accompanying guidance (on target 7) clarifies that **"all pollution sources" include anthropogenic "sound"**. Therefore, to meet this target, countries are expected to tackle noise pollution. This is already **reflected in the National Biodiversity Strategies and Action Plans** (NBSAPs) adopted by several countries, with various emphasis, including Belgium (noise in general), France (noise in marine ecosystems) and Germany (noise as an effect of land-take), which outline national commitments to achieving the targets set out in the GBF.

The **CMS has adopted several non-binding resolutions recognising harmful noise impacts**, mainly focused on marine ecosystems and cetaceans (e.g., Resolution 9.19 (2008) and Resolution 12.14 (2017)). While its noise work has recently expanded to other migratory species, it remains **centred on marine sources**, with terrestrial and freshwater soundscapes still lacking comparable international frameworks (Duarte et al., 2021).

At the **national level**, **regulatory activity addressing the adverse impacts of anthropogenic noise has a long tradition**. In many countries, noise **legislation is human-centred.** Frequently, noise is also dealt with by **zoning and land-use**, mostly at the regional and local levels. **Noise impact on biodiversity** is assessed and mitigated by **EIA** and **nature conservation legislation**. In a few countries, such as Malta, specific noise-abatement rules exist in relation to Natura 2000 (e.g. requiring notification of activities of more than 25 persons). Some countries, like Finland, adopt a more positive approach to sound, requiring planning authorities to preserve the soundscape quality by a range of measures, including improving noise conditions at sensitive sites, developing quiet areas, and implementing planned noise barriers.

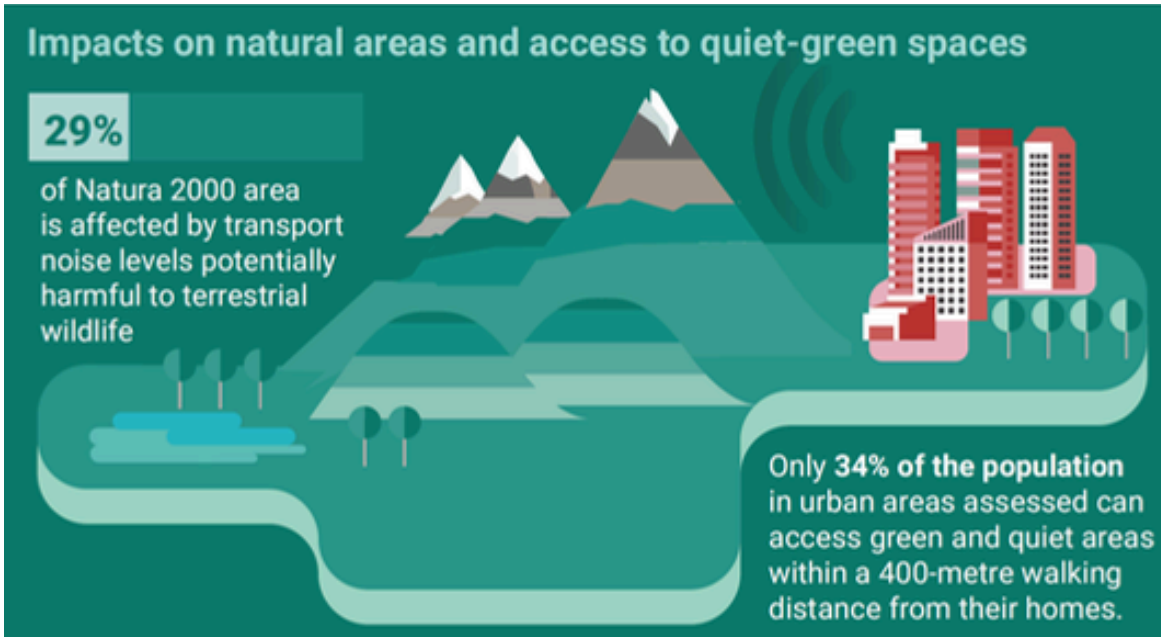


Image © Environmental noise in Europe 2025 (EEA Report 05/2025)

NOISE POLLUTION WITHIN THE EU REGULATORY FRAMEWORK

The **EU has recognised the importance of mitigating noise pollution in the Environmental Noise Directive** (END), which aims to **manage and reduce noise pollution to protect human health**. Reducing noise for human health **also benefits biodiversity**, as the END covers **"quiet areas in an agglomeration or in open country"**. It provides for the following key instruments: strategic noise mapping, noise action plans (NAPs) and public information. The END does not impose concrete noise reductions, as does the Zero Pollution Action Plan. Some countries (like Slovenia in the Triglav National Park) have designated quiet areas in Natura 2000-sites, with accompanying noise-related measures.

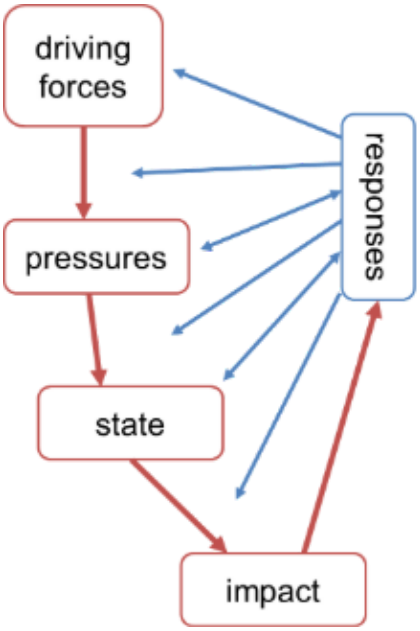
Beyond the END, **other EU regulatory instruments addressing noise pollution vary from product standards** for motor vehicles, outdoor equipment, **to strict permitting rules for industrial activities** (Industrial Emissions Directive) **and strategic and environmental impact assessment** (SEA and EIA Directives). The **EU nature conservation legislation**, e.g., Birds and Habitats Directives (HD) and Nature Restoration Law, are also **important for this context**. Its instruments, like conservation objectives, non-deterioration obligations, appropriate assessment (AA) and nature restoration plans, also apply to noise, impacting natural habitats or protected species.

Court decisions support this as well (see Miron and Cashman, 2024). **New plans or projects likely** to **significantly harm Natura 2000** sites or **protected species**, based on their type, size, or location, must **undergo prior EIA, SEA, or AA**. If approved due to overriding public interests, any adverse effects must be mitigated or compensated, including noise. Non-deterioration obligations also apply to existing activities causing harm to Natura 2000 sites or protected species, even without physical changes, as illustrated by court cases like C-404/09 (noise from mining in Spain) and C-383/09 (wild hamster decline in France). These duties can require habitat restoration (Brussels court ruling, 2025).

Under the Habitats Directive, Member States must actively maintain or restore habitats and species to a favourable conservation status. Since many **Natura 2000 sites are exposed to noise pollution**, **mitigating noise impacts is a clear, binding obligation.**

In summary, noise impacts on European protected nature must be assessed, and **noise reduction measures may be required to ensure effective mitigation, conservation, or restoration.**

ANTHROPOGENIC NOISE: MITIGATION MEASURES



To stress the pathway between an activity and its environmental impact, the European Environment Agency (EEA) has built on earlier work from the Organisation for Economic Co-operation and Development (OECD) to propose the DPSIR (**D**riving Forces, **P**ressure, **S**tate, **I**mpact, **R**esponse) framework. A typical driving force could be the need for people to commute from one city to another. This creates pressure on the environment through the noise it generates. As sound does not stay in the environment for a long time and leaves no trace, choosing the location of the activity can affect the local state of the environment. Avoiding crossing areas that are important for biodiversity reduces the impact on the state of biodiverse areas. The impact depends largely on the sound recipient and can lead to responses, like avoidance behaviour.

Source-based responses are often the most effective, in the form of direct noise reduction (like the transition to electric vehicles, the promotion of low-noise tyres and the lowering of speed limits, retrofitting rail vehicles) as well as construction and design standards (e.g. the lowering of roads and the use of noise-reducing road surfaces). **Time-based and local restrictions** (like night bans at airports and temporary or seasonal road closures) can be effective if possible negative effects that might impact other areas or times of the day are avoided (e.g. by designating suitable bypass routes).

State-oriented responses (e.g., urban sprawl) are often linked to spatial planning and zoning and can help avoid dispersing noise sources across sensitive biodiverse areas.

Nature-based solutions could fit very well in biodiverse areas. Maintaining natural, porous ground surfaces by preserving plant litter and humus layers enhances this natural buffering capacity. In natural settings, as noise barriers, earth berms are often preferable to concrete walls, both because they integrate better into the landscape and because they often acoustically outperform hard barriers. Vegetation, when carefully designed, can contribute to noise reduction as well: Dense tree belts can be effective, particularly when replacing grassland or bare, rigid surfaces. Although vegetation alone is not a universal solution, it can play an important supportive role in broader noise mitigation strategies.

Information, education and engagement can influence behaviour as well as the acceptability of policies. A **higher level of awareness** and appreciation of the (co-)benefits of noise mitigation measures may **help to increase compliance**. Considering ways in which measures may disproportionately affect some social groups, a sense that policies are fair can help to secure acceptance and compliance.

In most situations, **prevention beats post-hoc mitigation in cost and efficiency**. If **mitigation is nevertheless needed**. It should go **alongside long-term monitoring** to verify recovery trajectories after interventions.

The **table** below **presents examples of noise mitigation measures**, outlining their classification within the **DPSIR framework** (Driving Forces, Pressure, State, Impact, Response), alongside notes on **potential co-benefits, levels of public support**, and direct **societal costs**.

DPSIR	Mitigation measures	Notes
D	**Reducing motorised traffic**	Traffic reduction lowers noise in targeted areas and corridors, while delivering co-benefits for climate mitigation, reduced light pollution, improved air quality, and physical activity. Public support depends on policy design and increases when attractive alternatives, such as public transport, are provided.
D-P	**Reducing vehicle noise at source through lower speeds and electrification**	The modernisation of vehicles and the adoption of quieter driving practices can help to reduce sound levels across the road network. Changes in technology can be slow to permeate, since people change their vehicles infrequently. Cost implications are mixed: electric cars are expensive, but individuals can often save money by adopting 'eco-driving' practices.
P	**Reducing sound levels of outdoor equipment**	Imposing regulations on what equipment can be used on, for example, building sites, farms and factories, can reduce noise at local level. The cost is borne largely by individuals and companies, although public subsidy may also made available.
P-S	**Rerouting (road and air traffic)**	Changing routes can help to protect specific habitats from noise pollution. Infrastructural projects are likely to be expensive for the public sector. Public acceptability may be influenced by disruption to habitats, but the overall ecological motivation may help to temper this.
P-S	**Lowering roads and railways, adding natural barriers**	Reducing the elevation of roads and railways can help to create a natural barrier to limit sound propagation, as can adding barriers through planting and landscaping. Planting trees will have co-benefits for climate change adaption and mitigation. Such measures are unlikely to raise public concerns.
P-S	**Relocating sound generating activities (e.g. concert, sports events)**	Moving loud events to areas where the impact may be reduced or displaced may help certain wildlife populations and there may be co-benefits for local residents. There are risks that relocated events may require accompanying transport infrastructure. Costs are likely to fall on businesses, and public subsidies may be appropriate.
S	**Placing curfews on noisy activities (e.g. maintenance, socialising)**	Curfews on socialising and industrial operations can help to reduce sound levels. There may be costs to businesses such as restaurants that have to close early or factories that would otherwise run processes overnight.
S	**Restricting visitor numbers in tourist destinations**	Limiting visitor numbers to tourist destinations can help to limit the impact on sensitive areas of activities such as festivals, camping and ski resorts. Seasonal variations may be appropriate, in order to reflect differing impacts throughout the year. Whilst local residents may welcome this, there may be pushback from businesses and associated costs to the economy.
S	**Using planning to limit spread of economic activities and urban sprawl**	Planning controls can be deployed to keep noisy activities out of sensitive areas or at least to concentrate and contain these activities. Although direct costs might be low, decision-makers will need to consider trade-offs and pressure for urban expansion.

KEY RECOMMENDATIONS

Key recommendations to **tackle noise pollution and its impact on biodiversity include:**

1. Recognise natural soundscapes as an integral part of nature

Natural soundscapes must be recognised as an integral component of the healthy functioning of the natural environment. The **EU's** existing **nature conservation legislation**, which aims to safeguard nature's integrity, **plays a crucial role in protecting nature against** the harmful impacts of **noise pollution** and should not be weakened. To meet Natura 2000 obligations, such as the requirement to avoid habitat deterioration and species disturbance, noise pollution should be minimised within and around protected sites by preserving quiet corridors and ecological connectivity, with land-use planning playing a key role.

2. Recognise noise pollution as a form of environmental pollution

Noise pollution should be recognised as a form of environmental pollution at all regulatory levels, which impacts terrestrial and aquatic habitats, biodiversity and ecosystem services. Existing regulatory frameworks and standards governing the use of sound or controlling noise should be amended to **incorporate environmental considerations explicitly**. The **EU** and Member States **should support the adoption and further development of noise pollution mitigation measures** developed within international frameworks.

3. Use the instruments of the Environmental Noise Directive to protect nature

The END instruments should be used **to benefit both people and nature** by requiring Strategic Environmental Assessments (SEA) for Noise Action Plans (NAPs), assessing and designating quiet areas within and around Natura 2000 and other protected sites with appropriate regulations, and combining nature restoration and noise action plans at regional or local levels where relevant. Additionally, the EU should provide guidance for organisers of occasional activities near sensitive biodiversity areas to minimise impacts.

4. Foster a more biodiversity-oriented approach to noise mapping and assessment

The **EU** and Member States **should promote biodiversity-focused noise mapping**, as the current CNOSSOS model is designed for human exposure and poorly suited to natural areas. **New models** must account for terrain, soil types, and species-specific hearing and behaviour, **improving noise impact assessments in Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) and enabling better mitigation**. Noise should be assessed at heights and frequencies relevant to key and endangered species. Additionally, alternative noise indicators beyond human-centred (e.g. Lden) should be developed. **The EU should support creating detailed, ecosystem-specific guidelines** to aid Member States and **assessment tools to enable the potential impacts** of planned activities to be evaluated prior to permitting.

5. Preserve and promote pristine wilderness areas

The EU and Member States **should preserve pristine wilderness areas**, **with rich natural soundscapes** that are largely **free from human noise**. These areas should be promoted as Natura 2000 exemplars, facilitating education of the public about the biodiversity gains that can be achieved in the absence of significant noise pollution.

KEY RECOMMENDATIONS

6. Set ambitious targets to reduce noise pollution

Only 30% of Natura 2000 sites currently meet the Quietness Suitability Index (QSI) for 'quiet' status. The EU and Member States **should set ambitious targets**, timelines, and management strategies, using tools like Noise Action Plans (NAPs), **to increase the number and geographic extent of quiet Natura 2000 sites.**

7. Develop a toolkit for noise mitigation

The EU should **initiate the development and dissemination of a comprehensive toolkit for noise pollution mitigation** in relation to biodiversity, intended for widespread sharing and adoption among Member States.

8. Share information

Share information on noise pollution's impact on ecosystems and biodiversity, along with **effective mitigation** methods for critical areas. This helps account for local differences in species and spreads best practices widely.

9. Support education and research

Allocate targeted **funding** to **support education, good practices, and nature-based solutions** aimed at **preventing and reducing anthropogenic noise pollution**. **Strengthen research** investment **to improve ecosystem-based methods** for assessing the impacts of anthropogenic noise on biodiversity and ecosystem disturbance, enabling evidence-based mitigation and policy design.

10. Enhance and initiate awareness-raising campaigns

Initiate, **expand and support awareness-raising campaigns on noise pollution and its impacts** on **biodiversity**, and **advocate for interdisciplinary engagement** to develop science-based policies and measures aimed at reducing noise pollution impacts.

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