

Integrating Biodiversity and Nature-Based Solutions in Airport Operations

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Introduction

Biodiversity management has long been a part of airport operations, primarily for safety reasons. Wildlife hazard management helps mitigate risks like bird strikes, while habitat control—such as managing grass and trees—ensures visibility, prevents fires, and reduces erosion. However, as biodiversity declines globally and its links to climate change become clearer, airports increasingly recognize their role in not only managing biodiversity for safety but also in protecting and restoring ecosystems.

Airports and biodiversity may seem at odds. Aircraft operations can negatively impact ecosystems through habitat disruption, pollution, and noise. At the same time, airports can play an important role by effectively managing their territories, which can sometimes serve as biodiversity reservoirs. This can help balance operational safety with ecological preservation.

Regulatory frameworks, such as ICAO's Annex 16, address environmental protection in aviation. Airports now integrate biodiversity considerations into their sustainability strategies, ensuring that safety and conservation efforts are aligned.

Climate change impacts are also a growing concern for airports. Nature-based solutions (NBS)—such as wetland restoration, tree planting, and green infrastructure—can enhance climate resilience while supporting biodiversity.

Aligning with Global Sustainability Goals

Biodiversity encompasses all living organisms within an ecosystem, playing a crucial role in maintaining balance and providing essential resources like food, water, and shelter. Airports influence biodiversity through land use, water management, and air quality control. Aircraft operations and airport development may seem to be in contradiction with the goal of preserving biodiversity, but airports can in fact advance the UN's Sustainable Development Goals (SDGs) related to biodiversity protection, by integrating biodiversity management with infrastructure planning and operations while maintaining adequate safety levels.

Evolving Biodiversity Management Practices

Airports must manage wildlife and vegetation to ensure operational safety. Traditionally, this meant habitat elimination to deter hazardous wildlife. Guidance documents such as ICAO's Doc 9137 and the US Federal Aviation Administration's (FAA) guidelines on hazardous wildlife attractants provide standards for minimizing wildlife risks near airports. Modern approaches shift from outright species elimination to risk management, reconciling safety with conservation.

A key step is understanding local biodiversity through species inventories and habitat mapping. Identifying flight paths and habitat zones helps airports develop informed strategies that mitigate risks while preserving ecosystems.

Inventories are a way to improve data collected at airports in order to enhance the knowledge of wildlife behavior as part of wildlife risk management; the presence of certain habitats or species that may be protected or on the contrary should be dealt with (e.g., invasive alien species); and of the scientific community about the general biodiversity status.

Enhancing Biodiversity Through Landscape Management

An effective biodiversity strategy includes adapting landscape management plans. Vegetation and soil maintenance influence both biodiversity and operational safety, requiring site-specific approaches. While no universal plan applies, key objectives include:

- Reducing or eliminating chemical inputs.
- Increasing plant diversity to minimize monoculture lawns.
- Adjusting cutting height, timing, and frequency to support functional needs and local species.
- Recycling vegetation waste.

Minimizing mowing frequency can help wildlife complete life cycles while reducing attraction to hazardous species like raptors, which rely on open visibility to hunt.

Biodiversity management also extends beyond airport boundaries, as changes on-site can affect surrounding ecosystems. Migratory patterns and wildlife corridors must be considered to ensure sustainable, long-term biodiversity conservation.

Managing Noise, Light Pollution, and Environmental Impacts

Noise and light pollution add further complexity to biodiversity management. Many airports have extensive

noise mitigation programs to protect local communities, but noise can also be used strategically for wildlife control—for example, using noise cannons to deter birds.

Light pollution is another challenge. Reducing unnecessary lighting is one of the simplest and most effective ways to minimize its impact on wildlife. Implementing shielded or downward-directed lighting can further help reduce disruption to nocturnal species.

For any airport project, environmental assessments are crucial to evaluating potential biodiversity impacts. A structured approach, following the principles of Avoid, Reduce, and Compensate, ensures that negative effects are minimized. Additionally, regulatory requirements—such as environmental impact assessments or reporting obligations for endangered species—must be factored into airport biodiversity strategies.

Nature-Based Solutions for Airports

Biodiversity loss and climate change are interconnected challenges. Nature-based solutions (NBS) provide a way to address both, enhancing resilience while restoring ecosystems. As defined by the International Union for Conservation of Nature (IUCN), NBS involve protecting, managing, or restoring natural ecosystems to provide environmental and social benefits.

Examples of NBS applicable to airports include:

- **Vegetation buffers** to stabilize slopes and reduce erosion.
- **Wetlands** to regulate flooding and improve water infiltration.
- **Coastal vegetation** (e.g., dunes, mangroves) to protect against storms.
- **Green roofs and permeable surfaces** to mitigate heat island effects and manage stormwater.

While NBS offer multiple benefits, not all solutions are suitable for airports. Each project must be carefully evaluated to ensure it does not introduce new wildlife hazards that could compromise flight safety. For example,

converting paved surfaces into vegetated areas near terminals poses minimal risk, whereas creating wetlands near runways could attract birds and increase collision risks.

Strategic implementation of NBS can provide additional benefits, such as extended infrastructure lifespan, improved energy efficiency, and enhanced aesthetics. By integrating biodiversity conservation into airport design and operations, airports can play a proactive role in climate resilience while ensuring safe and efficient aviation activities.

Conclusion

Sustainable biodiversity management at airports requires a comprehensive approach that aligns safety requirements with conservation efforts. Raising awareness, conducting thorough ecological assessments, and implementing nature-based solutions can help airports contribute to biodiversity protection while maintaining safe operations. By integrating these principles, airports can be part of the global movement towards a more sustainable and resilient future. The ICAO Committee on Aviation Environmental Protection, CAEP WG2 – Airports and Operations will develop during the CAEP/14 cycle an Eco-Airport Toolkit e-publication on this topic.