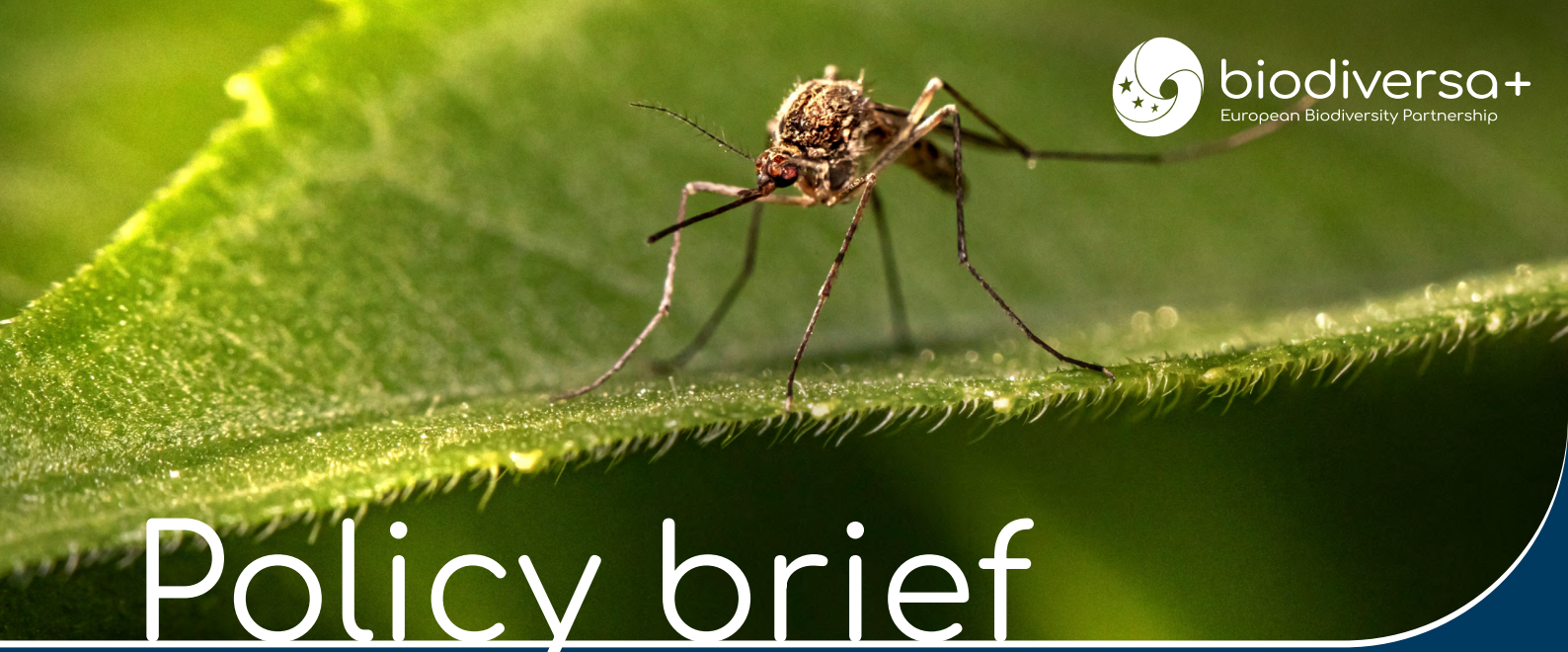

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Policy brief

Reducing zoonotic risk through nature restoration

Context, challenges and recommendations for National Restoration Plans in the implementation of the Nature Restoration Regulation.

Nature restoration and health

The EU Nature Restoration Regulation (NRR)[1], adopted in August 2024, sets ambitious targets to restore degraded ecosystems by 2030 and beyond. Research has, however, identified risks: **over 75% of emerging infectious diseases are zoonotic**, and land-use change is a major driver of spillover risk. Restoration is a primary tool to reverse the land-use changes that drive spillover events, moving from unstable, simplified ecosystems to resilient, self-regulating ones.

The key policy question is **how to ensure restoration strengthens ecosystem resilience while mitigating existing zoonotic disease risks**.

Key messages

- **Nature restoration is a proactive public health strategy**. Intact and biodiverse ecosystems act as a "biological buffer," stabilising pathogen dynamics and reducing the long-term risk of zoonotic spillover compared to degraded landscapes.
- **Zoonoses are driven by habitat destruction**. While degradation creates the primary risk, well-planned restoration provides the solution by rebuilding ecological complexity. High-quality restoration reduces the dominance of high-risk "reservoir" species (like certain rodents) through the "dilution effect."
- **Risk management ensures success**. While restoration is a net positive for health, "safe-by-design" planning is essential to manage localised, context-specific risks during the transition phase, ensuring public trust and social acceptability.
- The **One Health** approach, when integrated from the design stage of National Restoration Plans, enables policymakers **to anticipate, reduce and manage zoonotic risks without compromising ecological or health benefits**.

1. Footnotes can be found in the information sheet online.

Key observations

Understanding the zoonotic risks associated with nature restoration

What is a "zoonotic risk"?

A zoonotic risk is the **probability that a pathogen of animal origin will be transmitted to humans**, leading to infection, with health, social, and economic consequences. This risk depends on three interacting components:

- animal reservoirs (wildlife or domestic fauna),
- pathogens (e.g., viruses, bacteria, protozoa) and vectors (e.g., ticks, mosquitoes),
- intensity of human–wildlife contact.

The highest risk currently exists in fragmented, degraded edge habitats. Nature restoration can either reduce or amplify these risks, depending on the design and implementation of the restoration project.

How restoration can reduce or amplify zoonotic risks?

The relationship between land degradation, ecosystem complexity (compositional, structural, functional), and zoonotic spillover is context-dependent, varying with ecosystem type, pathogen ecology, species involved, and patterns of human use. However, we present general key points which should be considered when planning and implementing restoration measures.

a. Modification of animal communities

Habitat restoration changes wildlife populations in space and time. In low-diversity ecosystems, a few highly competent reservoir species (species that are effective at hosting, maintaining and transmitting pathogens to vectors e.g., certain rodents or deer supporting tick cycles) may dominate. By contrast, **complex species assemblages**, meaning diverse, well-balanced communities that include a diverse array of predators, competitors and multiple host species, tend to reduce dominance of high-risk hosts and stabilise disease dynamics (the "dilution effect").

b. Change in vector abundance

Wetland, forest, or landscape restoration can modify vector habitats and human access patterns. When well designed, with appropriate habitat structure, connectivity, and trophic balance, restoration strengthens biodiversity and helps regulate host–vector systems rather than amplifying risk.

c. Human-wildlife interactions

Restoration projects are often accompanied by new recreational or ecotourism activities, increasing contact between humans, wildlife, and vectors. As ecosystems require time to stabilise, including reaching balanced host–pathogen dynamics, **recreational access should be phased and aligned with ecological recovery timelines to minimise exposure risks**. However, the risk of inaction outweighs the manageable transition risks of restoration.

Handling risks at the governing level

Political and social risks

A systematic appraisal of 30 national and international policies on landscape restoration, zoonoses, and related health frameworks published since 2015 found that while most highlight ecological and socio-economic benefits, **only 10% address unintended health or social consequences**. Health sectors are rarely involved, and monitoring overlooks these aspects. This lack of anticipation can fuel controversy, erode trust, and politicise health risks to oppose restoration.

Integrating zoonotic risk through a One Health approach

The **One Health approach** acknowledges the interdependence of human, animal and ecosystem health, making it particularly relevant to restoration projects that reshape habitats, wildlife, and land use. Integrating One Health considerations into national restoration plans would:

- **Strengthen policy coherence** by involving health and veterinary authorities from the design stage;
- **Mobilise joint expertise** in ecology and epidemiology;
- **Improve data sharing** between environmental and health sectors.

Restore nature and reduce zoonotic risks

Landscape degradation (e.g., deforestation, fragmentation, biodiversity loss) is consistently linked to increased disease risk (red), especially for mosquito-, bat- and rodent-borne diseases. In contrast, several restoration actions are associated with reduced or neutral effects (blue or white). These observations are gathered in the "heat map" shown in Figure 1.

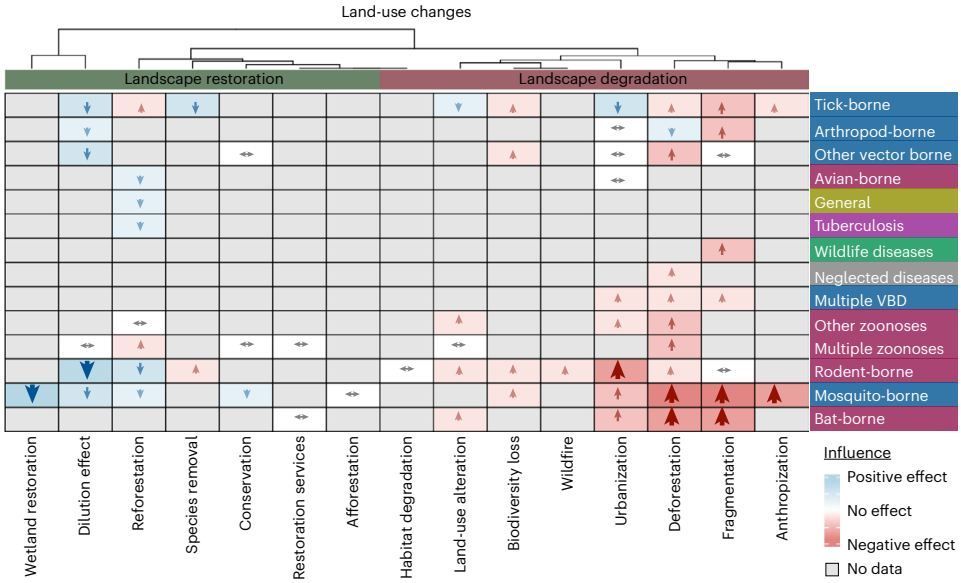

Figure 1: Heat map showing the size and direction of reported effects of land-use changes (LUC) and biodiversity–disease relationships on disease transmission risk across different disease groups (vector-borne diseases in blue, zoonoses in pink, general in gold, neglected diseases in grey, wildlife diseases in green and tuberculosis in purple): blue with a downward arrow indicates a decreased disease risk, red with an upward arrow indicates an increased risk and white with a bidirectional arrow indicates a reported non-significant effect.

Well-designed restoration reduces zoonotic risks by:

- **Rebuilding complex species assemblages**, i.e., diverse, balanced communities, that prevent dominance of highly competent reservoir hosts;
- **Improving habitat quality and connectivity**, reducing ecological stress and unstable host–pathogen dynamics;
- **Avoiding fragmented, simplified landscapes**, which the heat map shows are frequently associated with increased transmission risk.

In short, restoration reduces risks already generated by ecological degradation when it strengthens ecological (i.e., functional and structural) complexity and stability.

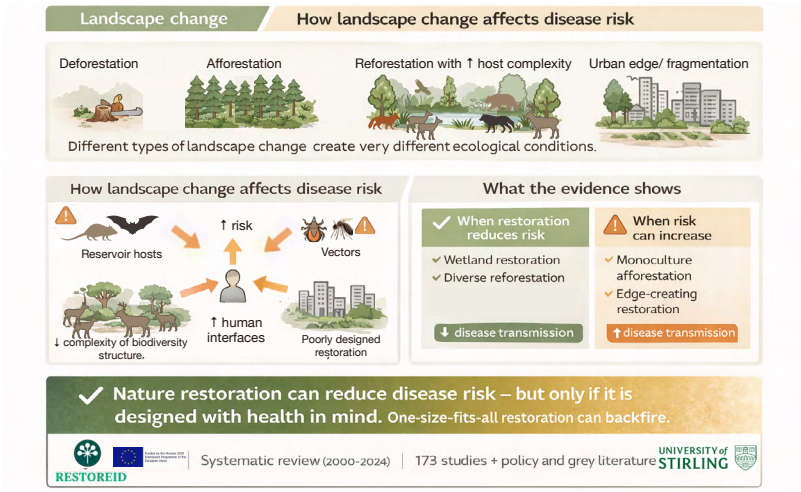

Figure 2: When nature restoration reduces disease risk and when it doesn't, www.restoreid.eu

Recommendations for national policy makers

1. Design (Conception and Planning)

Restoration design should integrate context-specific zoonotic risk considerations from the outset (Articles 4–13), supported by the Context-Based Decision Pathway[1].

- Apply a "safe by design" approach prioritising restoration that promotes trophic recovery and complex species assemblages, reducing dominance of highly competent reservoir hosts.
- Undertake proportionate ex ante screening to identify:
  - key species assemblages,
  - potential vectors and reservoir hosts,
  - human–wildlife interface zones.
- Design for local context by adapting restoration to ecosystem type[2], land-use history, fragmentation, and endemic disease landscapes.
- Manage interfaces and access:
  - reduce high-risk edge habitats,
  - regulate access to restored areas, particularly during early recovery phases.

See Box 2[3] for specificities of each ecosystem targeted by NRR articles.

2. Monitoring

Monitoring should enable adaptive management of restoration outcomes under Articles 20–21, ensuring biodiversity gains are achieved while maintaining low zoonotic risk.

- Integrate One Health indicators into monitoring systems, including:
  - species assemblage composition,
  - host or vector presence where relevant,
  - ecosystem resilience indicators.
- Apply context-specific monitoring, tailored to ecosystem type and risk drivers (no one-size-fits-all approach).
- Use existing surveillance systems to contextualise restoration:
  - national systems and the European Centre for Disease Prevention and Control for vector and disease trends.
- Leverage existing data platforms:
  - Global Biodiversity Information Facility and European Environment Agency for biodiversity monitoring,
  - MOOD platform for integrating environmental and health data.

Monitoring should support early detection of ecological imbalance or zoonotic emergence signals and inform timely design adjustments[4].

1. Box 1, see information sheet online.
2. Checklists 1, 2 and 3, see information sheet online.
3. Box 2, see information sheet online.
4. Table 1 (indicators to monitor zoonotic risks), see information sheet online.

3. Governance and Implementation

Effective implementation requires clear roles, cross-sector coordination, and transparent processes aligned with NRR provisions (Articles 14–19).

- Strengthen transboundary coordination (Article 14) for shared ecosystems through defined authorities and data-sharing arrangements.
- Integrate health into governance involving public health and veterinary authorities in National Restoration Plans (NRPs).
- Operationalise stakeholder engagement by establishing consultation, grievance, and benefit-sharing mechanisms.
- Build capacity to support cross-sector training and exchanges (environment, agriculture, health, planning).
- Ensure data transparency and usability:
  - provide access to data used in planning and monitoring,
  - identify responsible authorities and support interpretation.
- Communicate clearly on both the benefits of restoration and the management of human–wildlife interactions to support social acceptance and avoid conflicts.

Conclusion: Nature restoration as a lever for One Health

The NRR offers a pivotal opportunity to reshape our relationship within nature. In an era of emerging infectious diseases, human health cannot remain peripheral to environmental policy. Integrating zoonotic risk through a One Health approach does not weaken restoration ambition but strengthens its credibility, resilience and public legitimacy. This integration would allow restoration to become, not just an ecological imperative, but a public health strategy.

The question is not whether to restore nature, but how to restore it intelligently, recognising that ecological integrity and human health are inseparable.

Nature restoration can reduce disease risk – but only if it is designed with health in mind. One-size-fits-all can backfire.

Link to sources

BiodivRestore Knowledge Hub

The scientific publications used in this policy brief can be found in the information sheet of this briefing, downloadable from: www.biodiversa.eu/policy-briefs/

Photos: Unsplash, Pixabay.

Contact

contact@biodiversa.eu
www.biodiversa.eu

@Biodiversa.eu

@BiodiversaPlus

About this Policy brief

This Policy Brief is part of a series aiming to inform policymakers involved in the implementation of the Nature Restoration Regulation with policy recommendations based on the expertise of the BiodivRestore Knowledge Hub experts.

The series of Biodiversa+ Policy briefs can be found at www.biodiversa.eu/policy-briefs/.

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