



NATURE-BASED SOLUTIONS

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DEFINITIONS

Term coined in 2009 by World Bank and IUCN

Nature-based solutions (NbS) are:

- based on the concept of ecosystem services, by which nature provides services to society.
- actions that protect, restore, or sustainably manage ecosystems to address societal challenges (IUCN).
- actions to protect, sustainably manage, and restore natural and modified ecosystems that address societal challenges effectively and adaptively, simultaneously benefiting people and nature (UNEP).
- actions that incorporate natural features and processes to protect, conserve, restore, sustainably use, and manage natural or modified ecosystems to address socio-environmental challenges while providing measurable co-benefits to and benefit both people and nature (US Dept of the Interior).

Human actions benefiting natural systems $\xrightarrow{\text{benefiting}}$ People

DEFINITIONS

In the explicit context of zoonoses prevention:

Ecological countermeasures:

- highly targeted, landscape-based interventions to arrest the drivers of land use-induced zoonotic spillover
- term complements medical countermeasure and veterinary countermeasure concepts.
- consistent with biosecurity/national security framing.



Reaser et al 2021

- Reaser et al. (2021) *Restoration Ecology*
- Reaser et al. (2023) *Health Security*
- Plowright et al. (2024) *Nature Communications*

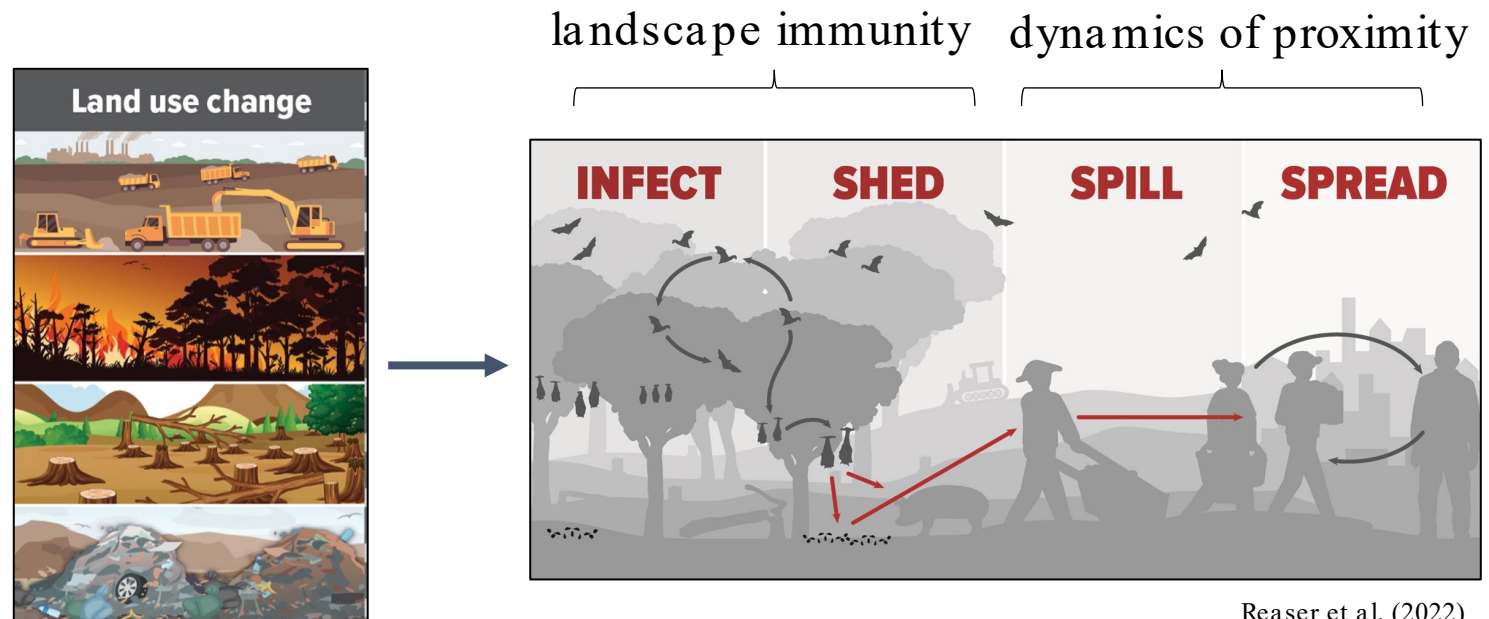




GOAL: FOSTER LANDSCAPE IMMUNITY

Protect and restore **landscape immunity**...

- the ecological conditions that, in combination, maintain and strengthen the immune function of wild species within a particular ecosystem and prevent elevated pathogen prevalence and pathogen shedding into the environment.



Reaser et al. (2022)

- Plowright/Reaser et al. (2021) *Lancet Planetary Health*
- Reaser/Tabor et al. (2021) *PARKS Journal*
- Reaser et al. (2022) *Conservation Letters*

GOAL: FOSTER LANDSCAPE IMMUNITY

SYSTEM	ACTIONS	REFERENCE
Lyme disease	Invasive plant removal	Willams & Ward 2010 Env Entomology
Hanta virus, leptospirosis, etc.	Eradication of invasive rodents	Island Conservation Islandconservation.org
Schistosomiasis	Reintroducing native sp. for biocontrol	Sokolow et al. 2015 PNAS
Hendra virus	Forest restoration	Eby et al. 2023 Nature

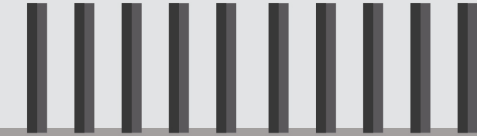
Primary pandemic prevention is a set of actions that reduce the risk of pathogens spreading from animals to humans. It focuses on actions that take place before a spillover event. Plowright et al. 2024, *Nature Communications*

Prevention at source..ditto

Land Use-Induced Spillover

Healthy Ecosystem

- Intact structure and function
- Wildlife stress within normal limits



Landscape Immunity

"Dominos" are secure
Pathogen dynamics within wildlife stable in space and time.

Unhealthy Ecosystem

- Disrupted structure and function
- Wildlife adversely stressed

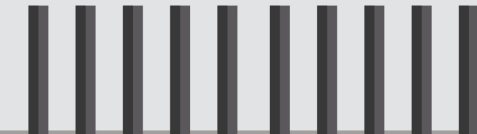


Spillover

"Dominos" fall
Pathogens proceed through the infect-shed-spill-spread cascade. This is facilitated by infected animals and humans being in close proximity.

Fostering Landscape Immunity

Scenario 1



Foster landscape immunity to secure "dominos" in place.

e.g., establish protected and conservation areas; restore human-altered landscapes.

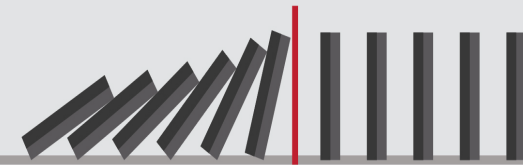
Scenario 2



Use ecological countermeasures to manage the dynamics of proximity by separating "dominos" across space and/or time. May involve "domino" removal.

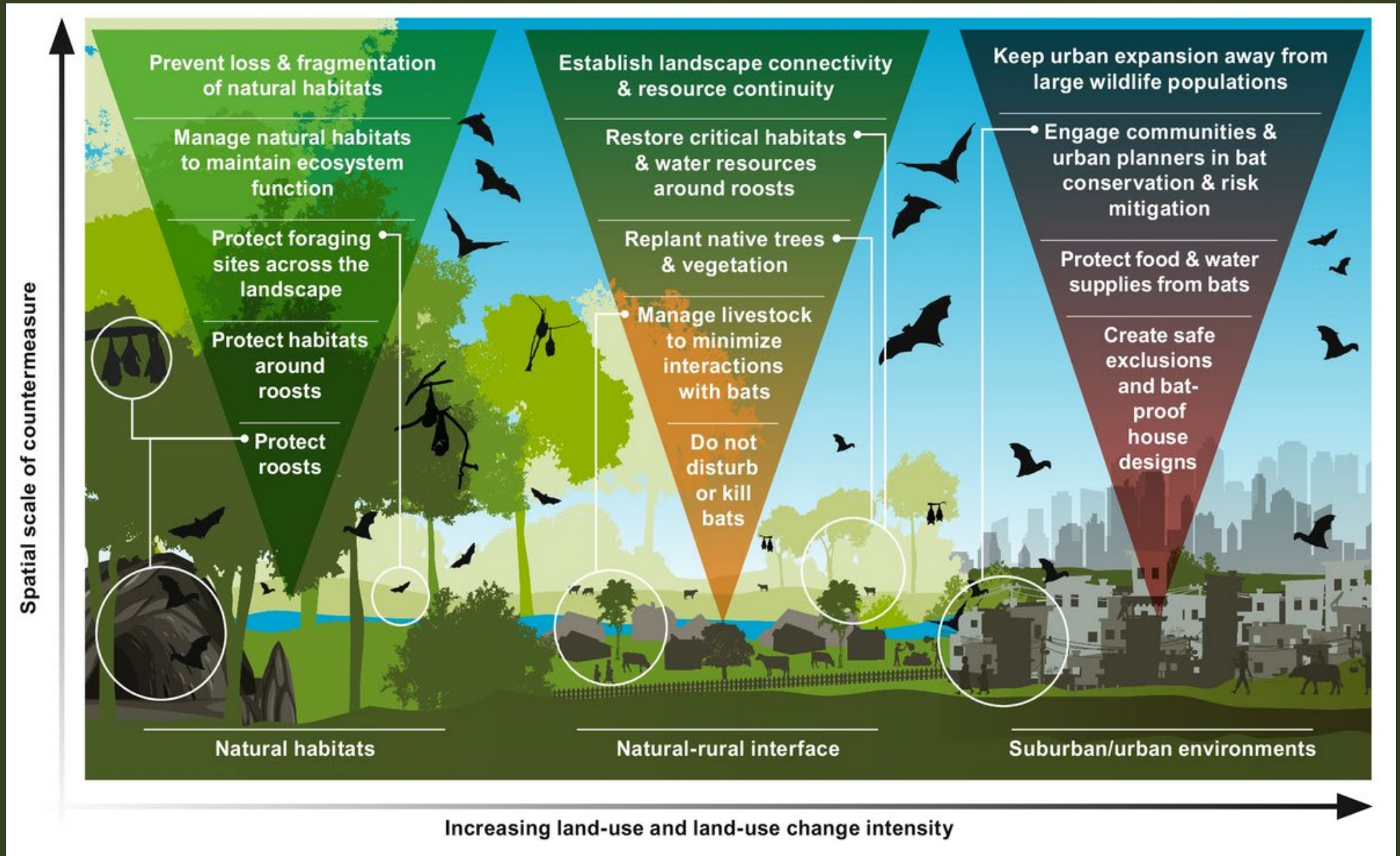
e.g., separate wildlife food resources from domestic animal and human environments; eradicate invasive species that facilitate spillover.

Scenario 3



Establish ecological countermeasures (barriers) to stop "dominos" from falling at a certain point.

e.g., keep wildlife from leaving their habitats and/or domestic animals and people from entering wildlife habitats.





Center for the Ecology of Infectious Diseases UNIVERSITY OF GEORGIA

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Protecting human health through landscape immunity

When humans alter the natural landscape, it increases the risk of zoonotic spillover, which is when a disease jumps from wildlife to humans. Disease spillover can be dangerous because it introduces novel illnesses that may be difficult to control or treat in human populations.



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LANDINM Project – Landscape Immunity

Presentation of the LANDINM Project Subprojects and objectives The LANDINM team Dissemination and outreach



**Landscape
Immunity**

The LANDINM Project

The Ecological Transition undertaken by the EU pursues notable changes in the sources of energy resources, in transport and in the use of natural resources. Within the framework of the **EU Biodiversity Strategy for 2030**, these changes should be focused on **improve the diversity of ecosystems to make them more resilient to changes, improve ecosystem services and, with it, the health and quality of life of living beings, including humans.**

Healthy ecosystems offer key ecosystem services in the Ecological Transition and for the future of humanity. Among the multiple ecosystem services is the **landscape immunity, which refers to the ability of biodiversity to**



A One Health approach to conservation

The relationship between environmental, animal, and human health is complex. Developing an effective, integrated approach to addressing the underlying challenges requires a wide range of strategies and interventions.

To achieve healthy ecosystems, people, and animals, WWF has developed guidance on six strategic areas:



1. Landscape immunity

Ensuring “landscape immunity” means safeguarding sustainable and healthy ecosystems in which animal–pathogen–human interactions are in balance and neither wildlife nor humans are overly stressed or forced to aggregate or migrate because of land use-induced changes.

POLICY & PRACTICE ADOPTION

Nature-based solutions as concept and term have been adopted in policy and practice from local to global levels.

Specific to primary prevention, not so much..but:

- Any policy/practice that facilitates ecological protection and/or restoration fosters landscape immunity.
- And, we are making zoonoses-specific progress, e.g.:

CBD Global Action Plan on Biodiversity and Health

General actions: a) Assessing biodiversity and health interlinkages, **including nature’s contributions to people that are related to health**, the environmental determinants of health and the environmental burden of disease at the national level...(Nov 2024)

National One Health Framework to Address Zoonotic Disease and Advance Public Health Preparedness in the United States

Objective 3.7: Support the understanding, development, and **adoption of nature-based solutions**, as appropriate, to increase community and environmental resilience against disruption from and impacts of zoonotic disease and associated environmental changes and drivers. (Jan 2025)

POLICY & PRACTICE ADOPTION

Progress to be made:



> [Lancet](#). 2024 Feb 10;403(10426):525-526. doi: 10.1016/S0140-6736(24)00066-7.

Draft of WHO Pandemic Agreement plays down primary prevention

[Lancet-PPATS Commission on Prevention of Viral Spillover](#); Thomas C Mettenleiter ¹,
Andrea S Winkler ²

- Adopt landscape immunity/ecological countermeasures terms and concepts in science and policy
- Engage with relevant sectors, such those working in agricultural biocontrol, for lessons learned and cross-application
- Promote landscape immunity and ecological countermeasures as aspects of national biosecurity

Leading the way...



The *Lancet*-PPATS Commission on Prevention of Viral Spillover

Preventing future pandemics by reducing the risk of spillovers of viruses between animals and humans.

**PREVENTING
PANDEMICS
AT THE SOURCE**

Pandemic prevention *at source* is the single most effective—and cost-effective—way to prevent pathogen spillover, limit suffering and loss of human life, avoid economic disruption, and mitigate climate change, biodiversity loss, and global inequities.





THE LAST WORD

Homo sapiens is animal...

People are an aspect of ecological systems,
not apart from them.

People must be integrated into the concept
and execution of nature-based solutions
..not just be regarded as the drivers or
beneficiaries.

THANK YOU

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Photo: Jamie K. Reaser