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Policy Brief

Biodiversity and Zoonotic Diseases: Lessons for Effective Biodiversity Governance and Resilience to Pandemics in Africa

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UNESCO
United Nations Educational, Scientific and Cultural Organization

CNRU
RWANDA National Commission for UNESCO

Key points

Reducing disruptive human-wild animal contacts can help stem the emergence of new pandemics. This policy brief outlines the gender, economic, social, and health-related dynamics that offer solutions to pandemic-wildlife challenges. The food insecurity created by pandemics presents a particular threat to women as caretakers and nutritional providers to children and has implications for how people interact with wildlife and wildlife habitats, highlighting the importance of addressing food insecurity as an integral part of avoiding the next pandemic. The creation of a formal, multi-sectoral, multi-institutional framework on pandemic prevention must integrate biodiversity and human health and provide a framework for a One Health approach to foster preparedness and enable prevention in an integrated, equitable, and responsive manner.

Several structural strategies and deeper transformations are necessary to this end:

- strategic land use planning that protects ecosystem functioning and limits the potential for zoonoses
- reduction of the consumption of wild meat and human invasion into natural habitats
- protection of wildlife habitats and control and elimination of illegal wildlife trade
- authentic participation in decision-making that acknowledges and promotes the value of traditional knowledge about the environment
- removal of inequalities in the economy and creation of sustainable production systems that support food security and climate resilience

1. Introduction

Humanity has faced different pandemics throughout history, some more severe than others. The COVID-19 pandemic offers an opportunity to reflect and adapt practices as societies deal with and learn from this global crisis. The COVID-19 pandemic is a zoonotic disease like Zika, Ebola, and avian influenza. Recent research on global shifts in land use patterns and mammalian population trends indicates that domesticated animals and wildlife like bats and rodents are responsible for many such zoonotic viruses. An estimated 75% of new infectious diseases are a direct result of human-animal contact.

There is a unique opportunity to link biodiversity conservation and financing with post-COVID-19 recovery plans to avoid future pandemics. The drivers of zoonotic disease outbreaks today originate primarily in the way humans interact with nature. This policy brief provides a review of the conditions that enable zoonotic diseases to emerge and spread, opportunities to avoid future pandemics, and clear recommendations and steps forward within the African context. The focus is on building strong institutions and reinforcing the links between science and policy decisions in Africa. The aim is for governments to use this policy brief in developing post COVID-19 recovery plans together with planning for biodiversity and environmental management.

We also propose a framework for avoiding the next pandemic that emphasizes five key lessons and builds on the strengths inherent within African countries, including strong traditional knowledge systems deeply connected to the environment, strong connections with UN Agencies (UNESCO, UNDP, UNEP) that support programs such as the Man and the Biosphere Program (MAB) and World Heritage sites, and commitments to multilateral environmental agreements such as the Ramsar Convention, Convention on Biological Diversity (CBD), the Convention on the Conservation of Migratory Species of Wild Animals (CMS), and others. The six areas for a robust rebuilding post-COVID-19 pandemic are attention to land use planning and restoration strategies, traditional knowledge, gender issues, authentic participation, one health by design approaches, and governance.

2. Biodiversity and Zoonotic Diseases – How Are They Linked?

The way humans eat, travel, and consume energy influences our interactions with the rest of the natural world, including wildlife. Throughout history, humans have altered local and regional environments, and in the last century, anthropogenic disturbances to the environment have extended on a global scale. Human behavior has a great influence on the spread of zoonosis (an infectious disease that has jumped from

a non-human animal to humans). The United Nations Environment Programme and the International Livestock Research Institute have highlighted that people, livestock, and wildlife share many microorganisms and diseases, and about 1,400 microorganisms are known as potential causes of human infections. New diseases in humans can emerge either as a result of a change in the nature or behavior of commensal microorganisms that cause disease or through infection by novel organisms, usually through contact with animals and the environment, where most microorganisms exist. The recent COVID-19 pandemic, for example, is speculated to have been circulating in populations of pangolin, bat, and other animal species, and given the use of certain wildlife species for traditional medicines and food, frequent human-animal interaction may be a major cause for viral cross-species transmission.

Studies show deforestation, intensive farming, and climate change are some of the main reasons for a virus to spill over into the human population; these land-use changes in the habitat of a virus-host can create an enabling environment for a virus to jump to humans or their livestock. Anthropogenic land-use changes such as agricultural intensification, urbanization, and resource extraction affect ecological integrity and biodiversity by disrupting food web structure and function, altering terrestrial and aquatic biogeochemical cycles, shifting ecosystem functioning, putting wildlife and disease vectors into closer proximity to humans, and enabling spread of non-native species, including pathogens.

These changes have also led to increasing cases of human-wildlife conflict in Africa, especially intense in regions where dense human populations live in close proximity to nature, and where livestock and agricultural crops form a significant part of rural livelihoods. Changes in ecosystem structure and function can also modify host-pathogen interactions and lead to the emergence of infectious diseases in humans and domestic animals. This emphasizes the need to protect and restore ecosystems and develop land-use planning practices and frameworks that protect ecosystems and minimize disturbances that alter ecosystem dynamics and increase risks of zoonoses.

3. Important Lessons for Effective Biodiversity Governance and Resilience to Pandemics

Lesson 1: Capacity strengthening of women as agents of conservation and public health must remain at the fore

The nexus among gender, zoonotic diseases, and biodiversity is mutually buttressing. For women, their role in both pandemic prevention and environmental conservation is predicated on their gendered roles in the labor market and their particular vulnerability to poverty. Women are less likely to have assets compared to men, so the particular financial vulnerabilities engendered by COVID-19, e.g. death or illness of a partner, unemployment, limited movement for income-generating activities, place women in particular harm. Their positions closer to the poverty line mean they may be the first to turn to environmentally unsustainable practices for economic survival, such as collecting plants in protected areas or overharvesting.

Women's central position at the intersection of conservation and public health is driven in large part by their contribution to food provisions. They are responsible for the bulk of the cooking and food acquisition at the family level in the Global South, so the food insecurity presented by pandemics is of particular threat to women as caretakers. If biodiversity-friendly agriculture does not yield enough provisions, women bear the brunt of food insecurity and may turn away from biodiversity-compatible practices to less sustainable ones. As the principal small-scale farmers in most African communities, women are in a position to respect or violate conservation areas during the agricultural process. Additionally, as the daily food providers to dependents, women are more likely to seek out bushmeat to feed their families during economic shocks. They tend to sell and cook bushmeat for income more than men, placing them in contact with communicable zoonotic diseases.

Further, public health outbreaks can be an impetus for forced migration if mobility mandates are not in place, and research indicates that women and children are particularly vulnerable during displacement. Fear of contagion, housing insecurity caused by death or illness of a breadwinner, or movement in hope of better employment during economic insecurity caused by pandemics can displace families, which may increase the likelihood of interaction with conservation spaces.

Environmental management at the community level may be compromised due to displacement or other economic shocks caused by public health crises like

pandemics. A woman's standing in their community is often determined by her status as a property owner or their access to financial resources. When they disproportionately suffer financial deprivations relative to men during pandemics, they may lose their stake in communal decision-making and management over shared environmental resources and land.

Despite women's environmental vulnerabilities during a pandemic, their capacity to serve as agents of both conservation and public health must remain at the fore. In terms of conservation, women have a particularized knowledge of the natural spaces around them that is distinct from that of men. Women often have an expert understanding of natural resources and landscapes closer to their homes, have a mastery of daily land use as opposed to sporadic land use, and use gender-specific ecological services. This means women have a unique knowledge of the environment that is critical to well-informed conservation strategies, but that this expertise is more difficult to harness if those women are displaced or struggling for economic survival under new conditions. Ultimately, pandemics and the socioeconomic instability they sow undermine women's leadership capacity as powerful agents of conservation. Because of their labor roles, women are in meaningful positions to be stewards of environmental conservation--and maintaining public health is key to empowering them to do so.

There are a number of steps that can be taken to support and build pandemic avoidance and resilience capacities:

- Microloans: Investing in women's small- and medium-sized enterprises focused on raising domestic protein (chickens, guinea pigs, rabbits) could reduce women's dependency on bushmeat and the income it generates.

- Putting women's names on assets to increase entrepreneurship: A notable challenge to enabling women to survive pandemic-induced deprivation, and refrain from environmentally unsustainable practices for survival, is to ensure they own assets in their own name. Many women spend decades farming land to which they have no title, which means they can't use the land as collateral to take out bank loans to build the businesses that would make them resilient to pandemics.

- Payment for Ecological Services (PES): Gender mainstreaming in PES plans is more likely to alleviate financial vulnerabilities that can drive women to environmentally unsustainable practices and toward fulfilling their roles as environmental stewards. This requires a recognition of the value of environmental resources women depend on, and creating schemes that compensate them accordingly.

- Increased vocational training for women in environmental management: Conservation areas across Africa have benefitted from the training and employment of women as environmental stewards. Increased employment in this area not only eases women's financial vulnerabilities during a pandemic but increases their power to mitigate environmental damage caused by public health crises.

- Policies to increase female students in STEM: Female scientists and practitioners are underrepresented at the highest levels of medicine and public health, and at nearly all levels of biology, technology, engineering, and other science fields vital to environmental conservation. By increasing investment in young women in STEM, both conservation and public health efforts will increase their intellectual and professional capacities, the number of leaders, and gain important gender-specific insights on how to tackle pandemic-induced problems that threaten health and conservation.

Lesson 2: Governments must operationalize One Health solutions that integrate the scientific understanding of ecological resilience with political, social, and economic solutions

Zoonotic diseases that cross over from wildlife are responsible for 75% of new or emerging infectious diseases globally. The spillover between wildlife and people is human in origin, including changing land-use patterns, resource extraction, livestock density, global trade, antimicrobial drugs, and climate change. This is One Health: the concept that human, ecological, and animal health are inextricably intertwined. Humans rely on the environment. The natural biomes of land and water are necessary for our survival, and only upon meeting basic needs, and ensuring the future of them, can we advance successfully to other SDG topics such as decent work and economic growth, reduced inequalities, and peace and justice. These issues are even more pressing on the African continent due to the rapid population growth on the continent, which is predicted to triple by 2050, which also means changing land-use patterns for increased agricultural needs, more populations living in direct contact with the natural world, and at more risk for zoonotic transmission, and increased need for materials and space for the built environment to accommodate the growing population including housing, transportation, and manufacturing.

There is an urgent need to develop and implement ways to make decisions and operationalize One Health solutions that integrate the scientific understanding of ecological resilience with political, social, and economic solutions for ongoing development, the nexus behind UNESCO. How can this goal be achieved while the human population grows daily, putting pressure on biodiversity? Policies and programs are needed that present and incentivize options for development and help everyone from policymakers to construction managers to homeowners and farmers make choices that build a more resilient future, which includes pandemic resiliency.

One Health by Design is a decision-making methodology that uses human, ecological, and animal health as primary decision-making filters. For every decision to be made, we must ask, “Will this improve human health? Ecological health? Animal health?” The answers should not promote one at the cost of another, often called the “cost of business”, but instead look to leverage the connections between different kinds of health for a generative solution - to leverage synergies and make the whole greater, and more systematically resilient, than the sum of the parts. It is a methodology that integrates scientific knowledge with proven physical design and implementation processes and results in physical changes we are able to apply today and tomorrow.

What does this look like in practice? Most places where people spend their time were designed by people - the built environment, including our houses, cities, and workplaces. People are surrounded by, and use materials every day. There were, and are, choices made at each step of the way. Natural resource extraction and processing make up more than 90% of global biodiversity loss and water stress, and around half of global greenhouse gas emissions. Buildings and construction combined comprise 36% of global energy use and 39% of energy-related carbon dioxide (CO2) emissions.

An intelligent approach to preventing the next pandemic can come through the choices made in the built environment. What if humans made decisions with health as a priority, thinking of everything from air and water pollution, to social and environmental justice issues that correlate to public health and environmental health issues?

Decisions are often made in an absence of knowledge about ripple effects or cascading impacts, or how decisions could be leveraged across disciplines, or are being made for individual economic benefit. Below are some examples of decision-making points that can inform policies and guidelines to help people make One Health-based choices:

Materials: During the construction of a school, hospital, or home, there are choices to make at a very physical level: Should clay tiles or steel sheeting be used for the roof? Should concrete, fired bricks, or earth block be used for walls? Septic system or blackwater wetland? Plant typical ornamental plants, or find a suite of native species to use? Is the lowest carbon footprint available being employed? What are the impacts of the materials and the system? What are the mining methods? What chemicals are used in the process, and where do they originate? How energy-intensive is the production process? How far do the materials need to travel to arrive at the site? Can they be produced locally? What will happen to them when their lifecycle is over? For each of these choices someone makes in any construction project, we must ask: Does this hurt or improve human health? Ecological health? Animal health?

Site-based decisions: With any project, whether housing or industrial, there are natural systems at play including soils, aquifers, plant and animal ecosystems. Building a new school or hospital involves siting the building. Often it will face the street or a human-imposed grid. Considering the design, orientation can be critical to increase airflow and thermodynamics that help reduce heating and cooling loads and airborne infections. There is an opportunity to leverage basic building blocks for synergy, for example, earthen bricks instead of fired bricks that can improve local environmental conditions by reducing local deforestation and air pollution. Drainage, sewage, water tables, and biodiversity are additional considerations. For example, options could include blackwater wetlands with native species that recharge water systems, and earthen bioswales that become bird breeding grounds instead of barren, CO_2 producing concrete channels and toxic waste producing septic systems.

Regional systems: Site-based decisions link broadly to create, or destroy, regional systems by affecting air, water, and soil quality. Health care professionals, for example, treat everything from COVID-19 to water-borne diseases, respiratory disease, cancer, and high blood pressure - these can be affected by regional factors far beyond their daily control. So while construction industry decisions that happen in an adjacent district or country may not seem to be relevant to a healthcare worker or an ecologist, they indeed are very important.

It is crucial to remember that humans live in watersheds and share food systems and airsheds: activities far from us can still affect us. Pollution upstream, non-point air pollution, land-use decisions on how to grow produce - these are all decisions made by businesses using short-term economics as decision-making points. Communities and governments must identify priorities that ensure one business does not benefit economically at the cost to people and ecosystems who eventually bear the costs of that business.

Many countries are moving in this direction, realizing that decisions made with intent to reach their mandates, and benefit the population, may, through the complex web of One Health, inadvertently cause more harm than good. For example, decisions by the Department of Agriculture to improve output may end up resulting in costs absorbed by the Department of Health in diseases, such as malaria, which is tied to land use patterns - or the Department of Energy, as erosion causes a reduction in hydroelectric power generation downstream.

Botswana, Madagascar, Rwanda, Zambia, and Uganda are among the African countries that have undertaken the Wealth Accounting and Valuation of Ecosystem Services (WAVES) approach which supports long-term development as a process of accumulation and sound management of a portfolio of assets including manufactured capital, natural capital, and human and social capital. Natural capital includes the geology, soil, air, water, and all living things in a country or region, and natural capital provides humans with a range of services, often called ecosystem services, relied upon for wellbeing and development (see Figure 1). Low-income countries depend on natural capital for 47% of their wealth. Unfortunately, in some of these countries, natural capital is being depleted unsustainably, leading to an overall decrease in wealth and a failure to improve wellbeing. This scenario also compromises biodiversity conservation efforts and reduces the capacity for resiliency to pandemics.

While the enormity of the issues at hand, including global pandemics, climate change, and biodiversity loss, are large, approaches do exist to link scientific knowledge to on-the-ground practical approaches to reduce pressures on the environment, improve human wellbeing, and enhance resilience to pandemics. There are approaches available to show people the cause and effect of different choices being made every day for the growing population. There is an urgent need to create guidelines, and make choices

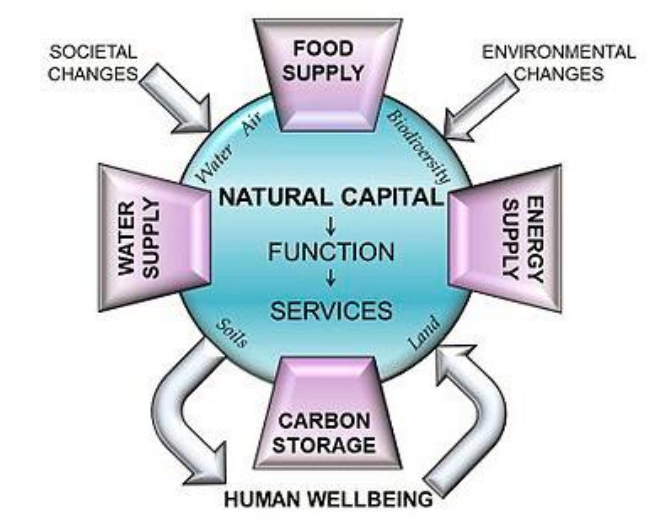


Figure 1. The components of natural capital that provide essential goods and ecosystem services which support key global issues such as food, water, and energy supply, and climate change Source: https://www.wikiwand.com/en/Natural_capital

that benefit human, ecological, and animal health together, an issue of vital importance to the growing continental and global populations. By planning for, and making decisions based on One Health outcomes, we are planning for better outcomes for biodiversity, health, and communities.

Lesson 3: There is an increasing need to prioritize investments in biodiversity conservation efforts towards pandemic resiliency

Investments are urgently needed to strengthen and expand protected areas, which are an important step to address land use change and implications for the spread of zoonotic diseases. Hand in hand with this focus should be attention to wildlife outside of protected areas, using policy instruments and regulations. The creation of biosphere reserves, which are under the intergovernmental MAB Programme of UNESCO, offers an approach that promotes solutions reconciling biodiversity conservation with sustainable use within an interdisciplinary framework involving ecological, social and economic aspects. This has been and should continue to be coupled with other efforts to reduce human-wildlife conflicts, including co-management approaches and community participation in protected areas management, World Heritage designation, and valuing of traditional knowledge in biodiversity conservation. These approaches have been shown to increase effectiveness of biodiversity conservation, and will contribute to building resilience to future pandemics.

The implementation of landscape restoration approaches is another critically important investment area for pandemic resiliency. Many countries in Africa are embracing and implementing landscape restoration and ecosystem-based adaptation strategies, with support from World Bank, UNEP, UNDP and other organizations, to protect and restore wildlife habitats and build ecosystem resilience. The Bonn Challenge, a global goal to bring 350 million hectares of degraded and deforested landscapes into restoration by 2030, is another initiative that has the potential to support strategies to protect wildlife habitat and avoid spillover and zoonoses.

Lesson 4: A formal, multi-sectoral, multi-institutional governance framework on pandemic prevention is needed in Africa

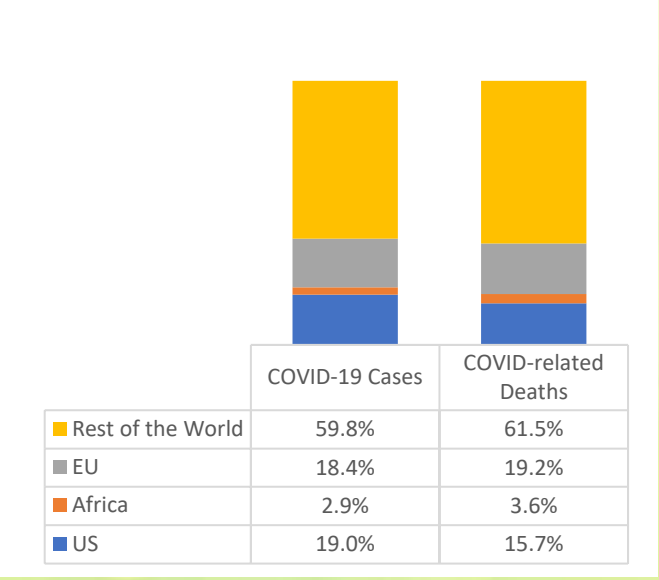
Governance responses to prevent a future pandemic require a concerted approach and intentional investment in planetary health as a prerequisite for ensuring public health. Humans are clearly a part of the fragile web of life, not its masters, and attaining planetary health in the extraordinary circumstances of the global pandemic will entail the profound transformation of economic systems, values, attitudes, and ideologies. The numerous existing multilateral environmental agreements and their protocols, the 17 Sustainable Development Goals and associated targets and indicators, the Post-2020 Global Biodiversity Framework, and the new One Health approach offer important governance instruments. To date, however, they remain separate and independent while coordination and integration are imperative. In the current institutional landscape, there are many spokes but no hub, and therefore no wheel.

Building on best practices from the environmental conventions and the new integrated approaches as well as Africa's continental response to COVID-19, a formal, multi-sectoral, multi-institutional framework on pandemic prevention is needed. Such a framework would provide the basis for a hub that fosters preparedness and enables prevention in an integrated, equitable, and responsive manner. A centralized, common hub would make the range of efforts by existing institutions and their agreements, programs, data-sharing mechanisms, and strategic plans, more coherent and targeted. It would create a space of integration to move the spokes forward in a unified direction. The successful experience across the African continent in dealing with the pandemic illustrate the importance of immediate and concerted governmental action in addressing critical issues before they become significant problems.

The response by the African Union's public health institution, the African Center for Disease Control (CDC), to the COVID-19 pandemic is exemplary of a functioning hub model. Just a 3-year-old organization, Africa CDC has coordinated a successful continental-wide approach to COVID-19, adopting a One Health methodology and significantly slowing the spread of the virus.

Before the pandemic, in 2019, most African countries were expected to be the least capable of responding to a pandemic. The continent, with a population of 1.3 billion, was predicted to have 10 million COVID-19 cases. Instead, it has had far fewer, ~3 of the world's total, because of an effective governance approach. As Figure 2 illustrates, the United States and the European Union (with populations of 330 million and 447 million respectively) together accounted for almost 40 percent of global COVID-19 cases as of June 2021.

In February 2020, the early days of the pandemic, the Africa CDC established the Africa Task Force for the Novel Coronavirus and convened Africa's 55 ministers of health to coordinate an integrated, swift, unified continent-wide strategic approach. Africa CDC's headquarters, the central hub, is in Addis Ababa and is part of a strong global network of cooperation and partnership. Five Regional Collaborating Centers (RCCs) are responsible for coordinating national-level COVID-19 response efforts with the hub. At the national level, the Africa CDC depends on ministries of health and National Public Health Institutes (NPHIs) to harmonize and implement public health activities. Recognizing that national ownership and implementation is critical, Africa CDC led multiple capacity-building efforts to help equip institutions with the necessary training, data, and skills to adequately respond at the national level.



	COVID-19 Cases	COVID-related Deaths
Rest of the World	59.8%	61.5%
EU	18.4%	19.2%
Africa	2.9%	3.6%
US	19.0%	15.7%

Figure 2. Cases of COVID-19 around the world and comparison with Africa. Sources: Africa CDC (2021 June 15) and COVID-19 Dashboard by the Center for Systems Science at John Hopkins University (2021 June 16).

For example, Rwanda, a country with one of the highest population densities in the world, ranked 117 of 195 countries by the Global Health Security Index in 2019 in their predicted ability to respond. However, it has only had an estimated 27,100 cases as of June 2021, a 96% recovery rate, and 359 deaths[1]. This is in part due to Rwanda's ability to swiftly respond - adopting, implementing, and communicating public health measures and cooperating across borders. Rwanda worked with local leaders, incorporated measures to protect economically vulnerable populations, and implemented innovative technology, all of which were important factors in enabling the government of Rwanda to respond effectively.

Implementation of the One Health approach, streamlined institutional arrangements, technology transfer, and capacity-building efforts are critical elements in a streamlined and integrated approach to implementation. At the national level, national public health institutions (NPHIs) are responsible for creating and bolstering coordination mechanisms for One Health across multiple sectors in collaboration with relevant stakeholders. This includes data collection and dissemination, as well as developing and supporting strategies and guidelines to tackle and prevent priority zoonotic diseases. In establishing effective, formal data-sharing mechanisms, NPHIs play an important, participatory role in their creation as well as ensuring the interoperability of systems across stakeholders.

Input from the international scientific community is important. In cases of uncertainty, policymakers often turn to scientists to help clarify the causes, impacts, and potential solutions to problems. For example, the independent Intergovernmental Panel on Climate Change (IPCC) was critical in building consensus on climate change. Similarly, the Intergovernmental Panel on Biodiversity and Ecosystem Services (IPBES) has been critical in creating consensus on the state of the world's biodiversity. Dealing with zoonotic diseases will likewise require a consensus-based narrative to combat the politicization of science and misinformation campaigns regarding high-risk economic activities and species. A diverse and engaged scientific community would represent voices informed by both the natural and social sciences and include scholars from the Global South, women, and indigenous peoples, and local communities.

Ultimately, a pandemic prevention framework should enable transformation. It could bring together mechanisms for cross-sectoral information and knowledge transfer, institutionalize mechanisms to assist countries in creating regulations, exchange best practices, and develop new approaches based on a radically different narrative of integrated, mutually reinforcing planetary and public health.

Lesson 5: The integration of authentic participation and traditional knowledge into planning and management is essential for effective biodiversity conservation and resilience-building

Creating space for community participation in conservation activities has been shown to be integral to durable biodiversity conservation. Participation needs to be more than simply informing communities about planned projects or asking them for information, but rather participation must involve communities in the process of designing and implementing activities. Restoring landscapes and conserving biodiversity effectively requires the creation of spaces for true participation, such that interventions are a direct outcome of people's own initiatives and taps into their knowledge and assets. Research has shown that when people are involved in the planning, organization and decision-making of a project from the very beginning, and value biodiversity, the outcomes will be more robust and sustainable, based on the input of local communities' value-systems and traditional knowledge. This takes time and patience, and is not easy to achieve, but most often participation improves outcomes.

[1] Rwanda Biomedical Center https://www.rbc.gov.rw/index.php?id=188

African countries have a rich array of traditional knowledge systems that should be acknowledged and integrated into frameworks for building resilience to pandemics and other environmental perturbations, and to conserving biodiversity. The role of traditional knowledge is often neglected or overlooked in planning and management, but the important knowledge about and relationships people have with the natural world are integral to solving contemporary complex environmental problems. Indigenous peoples around the world play a unique and vital role in sustainably managing a significant share of the world's lands and ecosystems, and their lands are estimated to support and protect 80% of the world's biodiversity. Safeguarding people and their traditional knowledge will be critical to avoiding the next pandemic.

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