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One Health: The Future of Ecosystem Health and Where to Start

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ABSTRACT Highly relevant to our current and future global state is the need for ecosystem conservation. Rewilding, the process of introducing wildlife to degraded areas, is one such method of conservation. Rewilding is primarily applied from an ecological point of view and largely fails to consider the public health and systemic implications of habitat restoration. As such, a new conservation paradigm is warranted. One Health is a global health approach that considers the complex interplay between humans, animals, and their shared environment. While One Health examines the social, political, and economic context of degraded areas to prioritize systemic advancement and disease prevention in conjunction with conservation, the large scope and transdisciplinary nature of One Health makes it challenging to implement. Rewilding efforts conducted by the Conservation Landscape Institute (CLI) in South Africa's Eastern Cape are an ideal candidate for a One Health approach. With stable funding, infrastructure, and institutional support, CLI is ideal for a transition to a One Health framework that can serve as a model for One Health implementation worldwide. As concerns about systemic inequality, disease prevalence, and ecosystem degradation grow, it is necessary to take advantage of the opportunity provided at CLI to establish a functional case study by which One Health implementation can be achieved on a global scale.

KEY WORDS One Health, ecosystem restoration, human-animal-environment interface

INTRODUCTION

The conservation of ecosystem services, described as the services that underpin all aspects of human life, is crucial for maintaining global health but is threatened by human activities such as population growth and industrialization[1]. Ecosystem functionality is the ability to provide ecosystem services—increasing land degradation as a result of harmful human practices impacts this functionality and subsequently harms human, animal, and environmental well-being, leading to increased emphasis on maintaining ecosystem integrity[1-3]. As restoration progress accelerates, it is important to evaluate current conservation practices and their impact on public health[2,4].

One response to ecosystem degradation is rewilding, the process of reintroducing native wildlife to damaged areas to restore the natural habitat[5]. While rewilding has been shown to increase biodiversity, it has been critiqued for its narrow scope and the potential for unintended consequences[5-6]. Rewilding is typically approached through the lens of species restoration, yet the process results in novel interactions between animals, humans, and the environment as native fauna are reintroduced to areas with human activity[7]. Systemic factors, namely the social, political, and economic state of a community, are directly connected to the local environment. Changes to that environment therefore have an explicit impact on human systems and vice versa[8]. Without

thorough consideration of the systemic factors surrounding degraded areas, the outcome of rewilding becomes unpredictable[2,6]. For instance, rewilding can pose a high risk for disease transfer, particularly of zoonotic diseases such as rabies[9].

The study of public health explores the social, economic, political, environmental, and overall systemic factors that influence individual and population well-being[10]. Given the multitude of interactions between humans, animals, and the environment within wildlife restoration, rewilding is a matter of public health[8,10]. However, the current rewilding framework does not explicitly consider its public health implications. While not unviable, this gap in the rewilding approach constitutes a missed opportunity to advance community welfare in conjunction with ecosystem restoration. Moreover, rewilding does not adequately address the risk of disease transfer within human, animal, and plant populations posed by species reintroduction. This is where One Health comes in.

One Health is a transdisciplinary approach to public health rooted in the notion of a shared human-animal-environment interface[11,12]. In addition to considering the ecological factors of degraded areas, a One Health approach examines the greater systemic context such as the local economy and disease prevalence. As such, a One Health approach to ecosystem restoration offers a comprehensive means to simultaneously achieve sustained ecosystem restoration and the enhancement of public health. However, practical challenges limit One Health implementation, necessitating an effective case study to encourage widespread use. A thorough evaluation of the restoration activities in South Africa's Eastern Cape reveals that the Conservation Landscape Institute is a strong candidate for a One Health approach that can ultimately serve as a blueprint for One Health activities worldwide.

WHAT IS ONE HEALTH

To examine human, animal, or environmental health in isolation is to overlook a large part of the picture, such as what One Health aims to remedy[12]. First officially coined in a 2004 Wildlife Conservation Society symposium, the term One Health has various definitions, but they all center around the human-animal-environment interface and calls for a transdisciplinary approach to collectively address human, animal, and environmental health [12]. The impetus for what we now call One Health is rooted in concerns over zoonotic diseases, which are infectious diseases that can be transferred between humans and animals[13-14].

As a transdisciplinary approach, One Health is not simply a combination of medicine, environmental science, and the humanities, but rather a systemic approach that supersedes any individual discipline. While more myopic approaches may consider abiotic factors, conservation, and human health as distinct subjects, One Health necessarily examines how these concepts overlap to collectively inform health. Although a current limitation of One Health is that it does not explicitly examine the overarching trends that shape planetary health, such as overpopulation, the scope of One Health continues to expand, and it remains the broadest approach that equally considers humans, animals, and the environment in global health[15].

Although well-conceptualized, the sheer number of factors One Health aims to consider can make it difficult to implement in the complex scenarios that often warrant a One Health approach[16]. Through an extensive comparison of One Health response to the zoonotic disease outbreaks of SARS-CoV (2002/2003), MERS-CoV (2012), and SARS-CoV-2 (2019), Schmiege *et al.* identified key patterns for successful One Health implementation[17]. While all three periods saw One Health implemented as a prevention and control tool, only select studies in the latter periods framed One Health as a transdisciplinary method, and even fewer fully utilized the human-animal-environment interface of One Health. The authors posit that difficulties in institutional coordination and environmental emphasis may be resolved in the future through specific and targeted One Health actions. With extensive infrastructure, funding, and partnerships as well as a highly targeted goal, the Conservation Landscape Institute, a conservation group based in the Eastern Cape of South Africa, is primed for comprehensive One Health implementation.

TANGLEWOOD AS A ONE HEALTH DESTINATION

A Response to Ecosystem Degradation: CLI and the Opportunity for One Health

Global trends such as population growth increase the demand on food production, which in turn requires intensive agricultural practices. These practices, including land over-utilization, pesticide and herbicide use, river system pollution from nutrient runoff, intensive irrigation with high salinity water, and plowing native thicket, have contributed to major ecosystem degradation in South Africa's Eastern Cape, with approximately 92% of the Eastern Cape's Albany Thicket Biome experiencing some degree of degradation since the arrival of European

settlers[18]. Responding to this loss is the Conservation Landscapes Institute (CLI), a South African non-profit organization that aims to create a biodiversity corridor in the Eastern Cape while “also aiming to ensure socio-economic beneficiation through a nature-based economy” (CLI, 2022). The vision of CLI is to rewild degraded areas in the Eastern Cape and then connect conserved and restored areas to create a protected corridor potentially covering one million hectares (Chadwick, 2023). A nature-based economy, which bases economic enterprise on wildlife and renewable natural resources, will be subsequently integrated into these connected areas (Chadwick, 2023).

Although One Health is not explicitly named in their vision, a One Health approach is necessary for CLI activities as the changes this project poses to the Albany Biosphere will significantly impact humans, animals, and the environment. First, rewilding and connecting previously isolated areas pose a major concern for disease transfer if proper reintroduction and testing policies are not followed. In the Eastern Cape, the infrastructure and funding for advanced disease surveillance are not widely available nor are vaccines and education about zoonotic diseases. A One Health approach considers all these factors and implements reintroduction and testing protocols that are feasible given the local context. Second, the CLI endeavor is necessarily social, economic, and political. Land-use change and transition to a nature-based economy require an understanding of community systems and collaboration with local institutions and leaders to facilitate conversions that will impact human and animal ways of life[19]. For example, land-use change in regenerative agriculture decreases the need for fertilizers which means less nutrient runoff, improved water quality, and new economic opportunities that benefit both the local community and ecosystem. Because One Health operates at this human-animal-environment interface and explicitly considers the disease risk and community systems inherent to CLI, there is a strong premise for adopting a One Health approach in Albany Thicket restoration efforts.

Tanglewood is Resilient to Potential Challenges of One Health Implementation

Seeing how CLI necessitates a One Health approach, it is important to consider the potential challenges of One Health implementation. A comprehensive review by dos S. Ribeiro *et al.* identified specific challenges to One Health implementation first by “phase” then by “theme”[20]. For the first phase, “conditions for starting,” notable challenge themes include “lack of resources and funding for One Health initiatives” and “lack of academic and institutional support.” For the second phase, “execution,” “surveillance,” and “collaboration” were major challenges while “evidence” was the primary challenge for the third phase, “monitoring and evaluation.”

Central to CLI's mission is the acquisition of the Tanglewood Conservation Area in 2020, an 850-hectare area that acts as a starting point for CLI restoration, research, and training activities (CLI, 2022). Since its inception, Tanglewood has obtained funding, received volunteers, and developed partnerships with local and international academic institutions, non-profits, and donors (Table 1 A-D). Moreover, Tanglewood has hosted over 145 key individuals from government, non-governmental, corporate, and donor organizations, further solidifying the funding, institutional support, and collaboration components crucial for a One Health approach (Chadwick, 2023). Infrastructure upgrades include a staff and volunteer laboratory where a multitude of abiotic and biotic surveillance is conducted (Table 1 F-G,I). Data from restoration efforts, research projects, and ecosystem monitoring constitute the first steps of evidence that can be used to evaluate One Health progress (Table 1 E-H). Collectively, these factors render Tanglewood resilient to the issues of funding and resources, academic and institutional support, surveillance, collaboration, and evidence, as identified by dos S. Ribeiro *et al.* (Table 2)[20].

In addition to Tanglewood, Amakhala, a privately owned wildlife reserve in the Albany Biosphere and CLI partner, saw an increase in revegetation and biodiversity after transitioning from a livestock farm to game reserve[21]. Amakhala functions as an in-house model for rewilding and land-use change in the Eastern Cape and offers a strong basis for the attainability of CLI goals. Coupled with the current progress at Tanglewood and the success at Amakhala, CLI includes the funding, institutional partnerships, infrastructure, and targeted vision that are necessary to overcome the barriers that currently limit the use of One Health. Broad lessons, such as how to foster interdisciplinary collaboration, can be gained from successful One Health implementation in CLI and used by various governmental and NGO entities as they look to restore degraded ecosystems. Starting with CLI, it is ultimately through the widespread adoption of One Health initiatives that we can move toward global sustainable practices that more accurately address the complexities of human, animal, and environmental health.

CONCLUSION

The increased public and academic attention placed on maintaining the integrity of ecosystem services and functionality warrants an evaluation of current means of conservation and potential areas of improvement[4]. Rewilding is one practice that, while efficacious in certain senses, is structured in a manner that leaves room for unintended consequences[6]. This is largely a result of the attempt to approach rewilding as an isolated process. Fencing and rewilding in a degraded area place arbitrary boundaries on an immensely complex system. The local water systems, global weather patterns, human-driven pollution, and much more all affect degraded areas, yet are not accounted for in a rewilding framework. One Health, on the other hand, is founded upon the importance of interconnected systems. One Health is a new term to describe an age-old truth in public health: the interdependence between human, animal, and environmental systems in understanding the health of individuals and populations[12].

As opposed to the current Conservation Landscape Institute (CLI) standard of rewilding, One Health enables conservation goals to be achieved in concert with the global, regional, and local human-animal-environmental interface. Despite its potential, current barriers to entry limit the widespread adoption of a One Health approach[16,20]. With extensive infrastructure, funding, and partnerships, CLI and especially Tanglewood have the necessary building blocks to overcome these barriers and develop detailed policies, procedures, means of measurement, and collaborative structures related to One Health. With CLI as a blueprint, the barrier to One Health use decreases globally as diverse conservation projects have a functional One Health model to reference. The unique circumstances at CLI make it a strong candidate for One Health implementation that can ultimately change the way we approach ecosystem-level conservation. From a public health perspective, it is imperative that we take advantage of this opportunity and lead the development of a new conservation paradigm that can promote prosperity in our global ecosystem.

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