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NATURAL DISASTERS AREN'T THE PROBLEM: POVERTY AND ENVIRONMENTAL DEGRADATION IN RURAL COASTAL TANZANIA

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A MASTER'S RESEARCH PAPER

Submitted to the faculty of Clark University, Worcester, Massachusetts, in partial fulfillment of the requirements for the degree of Master of Arts in the department of International Development, Community, and Environment

And accepted on the recommendation of

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ABSTRACT

Natural Disasters Aren't the Problem: Poverty and Environmental Degradation in Rural Coastal Tanzania

Sarah Martin

This paper examines how two theoretical frameworks, systems and resilience thinking, provide differing understandings of natural disasters, poverty and environmental degradation in rural coastal Tanzania. Both frameworks aim to expand the scope of reductionist thinking, in order to better understand the complex interrelationships between various actors, which may have not otherwise been considered. Although both theories have their individual strengths and weaknesses, neither have been able to catalyze effective solutions to these problems. As a result, I propose a hybrid version of systems and resilience thinking, as a means to best examine poverty and environmental degradation in rural coastal Tanzania. Ultimately, this re-framing would contextualize this problem within a greater network of issues, and more appropriate solutions could be offered.

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Introduction

On the surface, rural coastal Tanzania is fraught with dichotomies. Although Tanzania is considered one of the poorest countries in the world, it is also one of the “wealthiest nations on Earth” (Thaxton, 2007) in terms of its biodiversity. Rural coastal Tanzania is known around the world for its pristine coastline, iconic Mount Kilimanjaro and for some of the finest wildlife reserves in East Africa (Salazar, 2009). Yet, this same region also suffers from severe drought, coastal erosion, frequent storm surge, salt water intrusion on crops, and coastal flooding. Those living in rural coastal villages also have to cope with declines in fish and shrimp species, mangrove populations and lack of clean drinking water. The complexities and contradictions are immense and overwhelming, as well as the proposed solutions to these problems.

Rural coastal communities in Tanzania are exceedingly susceptible to the negative impacts of exogenous shocks, such as hurricanes or droughts. Concurrently, the individuals living in this region often lack adequate preparatory and coping mechanisms to prepare for, as well as mitigate, the impacts of a shock – resulting in the loss of key assets and resources. Since these communities rely heavily on natural resources for their livelihoods, as well as for food and medicine, these natural disasters often have long-term negative impacts in this region.

Historically, government policies and development interventions in Tanzania have approached the issue of natural disasters, poverty and environmental degradation from a reductionist framework, one focused on the scientific method and isolating these problems into individual parts. While this remains commonplace, it is becoming increasingly apparent that this is not always the most effective approach. By focusing on one specific problem area, without fully contextualizing its various complexities, development efforts can be short-lived, ineffective, or result in unintended consequences.

This paper examines how two theoretical frameworks, systems and resilience thinking, provide differing understandings of natural disasters, poverty and environmental degradation in rural coastal Tanzania. Both frameworks aim to expand the scope of reductionist thinking, in order to better understand the complex interrelationships between various actors, which may have not otherwise been considered. Although both theories have their individual strengths and weaknesses, neither have been able to catalyze effective solutions to these problems. As a result, I propose a hybrid version of systems and resilience thinking, as a means to best examine poverty and environmental degradation in rural coastal Tanzania. Ultimately, this re-framing would contextualize this problem within a greater network of issues, and more appropriate solutions could be offered.

The paper begins by examining the current mainstream narrative regarding issues of natural disasters, environmental degradation and poverty within rural coastal Tanzania. In the following sections, the theoretical underpinnings of systems thinking and resilience thinking are examined, and consequently applied to the context of Tanzania. I examine how systems and resilience thinking perspectives would approach issues of environmental degradation and poverty in rural coastal Tanzania. I then propose a hybrid framework, the Systems-Resilience Approach, which aims to reframe the aforementioned problems within a wider network of issues and incorporate three pillars: (1) multi-directionality, (2) approximation and (3) inherent power. This framework could ultimately provide space for alternative solutions that could aid in remediating the effects of environmental degradation and poverty, and thus reduce the impact of natural disasters. In the final sections, specific case studies are examined in order to further contextualize these issues within a number of contexts and to provide details on how the Systems-Resilience Approach can best be operationalized in the field.

The Current Natural Disaster Narrative

Originating from the Age of Enlightenment and the scientific method, the dominant Western worldview is rooted in a mechanistic or reductionist

paradigm. As Richmond (1993) states, the reductionist worldview can be thought of as 'laundry list thinking' – a method that views (1) each factor as having a direct linear cause and effect, (2) each factor can be broken down and analyzed individually, (3) each factor as equally important and (4) understanding the individual parts as equivalent to understanding the characteristics of the system (Richmond, 1993).

Since the late seventeenth century, the reductionist worldview has dominated Western thinking. John Locke, for example, laid the foundations for concepts like property rights and free markets by designating humans as the building blocks of society (Capra and Luisi, 2014). From a reductionist perspective, humans are often seen as separate, and consequently more important, than nature. This is commonly seen as a limitation to this framework, as people inherently depend on a thriving ecosystem to survive and are, of course, part of that ecosystem.

Over time, the foundations of reductionist thinking have been challenged. Although it is still deeply integrated within most facets of Western society, it is becoming increasingly evident that we need to shift towards a more holistic and integrative way of thinking, in order to more effectively remediate environmental and social problems. Within ecosystem management, scientists have focused on maintaining a stable state that follows a single linear

evolution (Berkes, 2007). Yet, as research has continued, scientists are realizing that ecosystems often follow non-linear paths, have multiple stable states, and don't reach an ultimate state of equilibrium (ibid). With this awareness, ecology has moved towards a more systems- and resilience-centered approach.

Despite this progress, however, much of the narrative surrounding environmental degradation and poverty remains reductionist and masks inherent power inequalities. Key development actors tend to frame the impacts of natural disasters within developing countries as somewhat inevitable and natural. This framing, however, lacks adequate recognition of the power inequalities that exacerbate the effects of natural disasters within these regions. When this framing is applied to Tanzania, proposed mitigation and prevention strategies are often ineffective because they lack the ability to address the core problem: the use of a reductionist narrative that masks unequal power structures that have historically perpetuated conditions of vulnerability and poverty within rural coastal communities in Tanzania.

On a global scale, the Sustainable Development Goals (SDGs) act as one of the most influential actors in shaping the natural disaster narrative. The rhetoric that the United Nations utilizes is likely to trickle down into policies and projects, consequently shaping the global perception of natural disasters and how best to lessen their negative impacts. Specifically, Target 11.7b states,

“By 2020, substantially increase the number of cities and human settlements adopting and implementing integrated politics towards inclusion, resource efficiency, mitigation and adaption to climate change, resilience to disasters, and development and implement, in line with the Sendai Framework for Disaster Risk Reduction 2015-2030, holistic disaster risk management at all levels” (Sustainable Development Goals, 2015).

Consequently, when examining the Sendai Framework for Disaster Risk Reduction 2015-2030, similar reductionist themes continue to emerge. There are, however, three ‘Guiding Principles’ that deal with empowerment, and thus make an attempt to address power inequalities. The first states that disaster risk reduction “requires empowerment and inclusive, accessible and non-discriminatory participation” (Sendai Framework for Disaster Risk Reduction 2015-2030, p.17), while the second and third emphasizes the importance of empowering local authorities and communities. This language does not take into account, however, the deep historical structural inequalities that created conditions of vulnerability and poverty in the first place. In order to find effective solutions to reduce the negative impacts of natural disasters, it is important to address and deconstruct these structural inequalities within the discourse of such large scale global initiatives. As an institution, however, the United Nations has to balance a multitude of international influences who don’t want to bring attention to these structural inequalities and thus resist such language being incorporated. As a result, the UN minimizes and marginalizes

the presence of these inequalities, ultimately making it less likely for effective positive change to occur.

This same discourse is also prevalent in Tanzania's national environmental policies. For example, in Tanzania's 2006 State of Environment Report, the government aimed to show the inextricable linkages between poverty and environmental degradation. The report states, "Environmental management is complex, multi-sectoral and cross-sectoral; it requires a holistic approach and multi-level operation" (SoER, 2006, p.16). Throughout these policies, the Tanzanian government leads the public to believe that efforts are being made to better understand local and indigenous knowledge systems and their applications within the management of coastal resources. There are also a number of policies, legislations and plans that have been put in place over the past few decades regarding the use of coastal resource management. While this is encouraging discourse, the Tanzanian government intentionally resists making connections between coastal resource management, poverty, and disaster risk reduction. Furthermore, power inequalities are not mentioned within these policies, as it would not be in the government's best interests to shed light on these issues. As a result, those living in coastal communities have remained in conditions of extreme poverty and continue to be vulnerable to natural disasters and environmental degradation. For example, the Human

Poverty Index (HPI) decreased from 32.90 in 2006 to 30.00 in 2007 (African Development Bank Group, 2013). Additionally, the amount of carbon dioxide emissions per capita have increased from 0.13 tons in 2006 to 0.19 tons in 2012 (African Development Bank Group, 2013).

The Systems Thinking Approach

What is Systems Thinking?

Recognizing the limitations of reductionism, systems thinking emerged as a framework used to understand a problem in the context of the entire system it is functioning within. This paradigm emphasizes understanding interrelationships, in contrast to focusing solely on isolated parts. Environmental and social problems are seen as complex and fluid, resulting in constant re-evaluation and integration of various external factors. In working to contextualize and reframe our understanding of natural disasters, poverty and environmental degradation in rural coastal Tanzania, systems thinking provides a way to holistically contextualize these issues and to reveal power inequalities.

At its genesis, the core principles of systems thinking were drawn from organismic biology. Lawrence Henderson, a key systems biochemist, understood a system in terms of its literal Greek definition 'to place together'. He emphasized the importance of understanding a system, whether it be a

living organism or a much larger social construct, in the context of a greater whole. Likewise, biologist Joseph Woodger helped lay the foundation of the idea that living systems are multi-leveled and exist under specific organizational codes, a key systems principle (Capra and Luisi, 2014). While organismic biologists laid the groundwork for systems thinking, it was adapted to psychology and ecology, and eventually gained great footing within quantum physics.

The emergence of quantum physics challenged Newton's theory that all materials could be distinctly broken down into individual parts, causing physicists' general perceptions of reality to be fundamentally challenged. While reductionism is still dominant today, many of its theoretical underpinnings have been proven wrong. Quantum physicists proved that nothing can exist in total isolation or be distinctly broken down. With this notion, key principles in quantum theory sparked the emergence of systems thinking as a studied discipline. As a result of understanding the dynamics of what occurs at a subatomic level, physics formed the foundation of systems thinking. Today, it has been widely adopted and modified for any number of disciplines and applications. It is also important to note that many attribute to Jay Forrester, a computer engineer and professor at MIT, to developing systems dynamics methodology. While this framework narrates more of the 'hard' systems

approach, which is not emphasized here, he still laid important foundations for how systems thinking is applied (Senge and Sterman, 1990).

According to Capra and Luisi (2014), "the systems view of life is an ecological view that is grounded, ultimately, in spiritual awareness. Connectedness, relationship and community are fundamental concepts of ecology; and connectedness, relationship and belonging are the essence of spiritual experience" (p. 70). Peter Senge echoes this definition by encouraging individuals to examine the interrelationships and patterns of change within the larger whole, rather than only observing singular static 'things' (Froschauer, 2015). When we simultaneously examine individual parts in relation to the complex interrelationships between other parts, we can have a better understanding of how the entire system works as a whole. Additionally, Bawden (1991) views systems thinking as a framework that escapes the trap of dichotomization. At its core, he states, it challenges the notion that two ideas can be separate opposing views. Instead, it bridges seemingly contradictory concepts together, as well as creating a dual focus that examines both individual and larger parts simultaneously.

Philosopher C.D. Broad coined the term 'emergent properties' – defining the system features that only emerge at a specific point of complexity, which don't exist when looking at individual parts (Capra and Luisi, 2014).

Additionally, many authors emphasize how we should view ourselves as an implicit part of the system we are working to understand, as there is no way to objectively observe the system without somehow interacting with it. Flood (2010) states, "Systemic thinking is a mode of thinking that keeps people in touch with the wholeness of our existence. It helps to keep in mind that human thought is not capable of knowing the whole, but it is capable of knowing that we don't know" (p.282). With such widespread applications of systems thinking, it is clear that each model tends to emphasize different aspects of the systems thinking framework, as well as incorporating unique features. Yet, many models also tend to emphasize the same essential characteristics.

Key System Components

I utilize Capra and Luisi's (2014) framework of systems thinking to outline and define the key components of a system. Inherent within these system elements are the principles of quantum physics that ultimately informed this way of thinking. The following (see table 1) outlines these components:

Table 1: Key System Components

Source: Capra and Luisi (2014)

COMPONENT	DEFINITION
FROM PARTS TO THE WHOLE	In contrast to the Newtonian understanding that all material can be divided into individual parts, quantum theory tells us the opposite. All living things are nested within a larger system – and therefore couldn't possibly be understood in isolation. The system itself inevitably has certain properties that are not present within any single part.

INHERENT MULTI-DISCIPLINARITY	All systems have the same core characteristics and are therefore implicit in most, if not all, academic disciplines. With this in mind, the systems view can be applied to further understand a wide array of living systems across many disciplines.
FROM OBJECTS TO RELATIONSHIPS	Based on the principle of quantum entanglement, one atom is always inherently affecting another – and thus always affecting and being affected by it. From this perspective, there are no parts – only networks of relationships. Thus, a systems approach emphasizes a change from looking at individual objects to looking at everything as a web of relationships.
FROM MEASURING TO MAPPING	Rather than focusing on measuring and obtaining definitive results, Capra and Luisi (2014) suggest a shift towards mapping. By working to map these complex interrelationships, specific patterns and networks will arise – and provide a more accurate understanding of the system as a whole. Understanding these larger patterns of organization are essential to applying systems science.
FROM QUANTITIES TO QUALITIES	Systems are not based on distinct quantities – but rather qualities. When working from a systems approach, there is a deeper understanding of the qualities of relationships and networks – rather than an emphasis on determining a certain quantity.
FROM STRUCTURES TO PROCESSES	Individual structures inherently exist within a larger context, and thus should be understood through all of these underlying processes.
FROM OBJECTIVE TO EPISTEMIC SCIENCE	Rather than viewing ourselves as vehicles for executing perfect objective science – we need to understand that we are implicitly subjective and are always influencing our surroundings. Systems science instead suggests focusing on “epistemology – the understanding of the process of knowing” (Capra and Luisi, 2014, p.77) as the lens in which we should view and observe phenomena.
FROM CARTESIAN CERTAINTY TO APPROXIMATE KNOWLEDGE	Finally, the systems approach accentuates the idea of letting go of our universal goal to define knowledge with complete certainty. All concepts and theories that we come up with are, inevitably, limited – and thus, our understanding of everything is limited. When adopting the systems approach,

we have to recognize these limits and understand that all of our knowledge is approximate.
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Strengths and Weaknesses of Systems Thinking

Utilizing systems thinking requires “thinking in terms of non-continuity, uncertainty, inseparability and unpredictability...” (Fazey, 2010, p.7). These notions, therefore, emphasize the importance of assessing one’s personal association with the system. This removes individuals from thinking of themselves as separate, and instead situates them within the system. Inextricably, the individual becomes important in remediating the issues of environmental degradation and poverty, and understands the intimate connection between social and environmental systems. “Compared to those who do not think systemically, systems thinkers are also more likely to have beliefs associated with broader entities that have moral worth, such as ecosystems and living organisms, and they are more likely to be able to understand and deal with complex problems” (Fazey, 2010, p.7).

Yet, systems thinking has a multitude of weaknesses, as well. Some state how it cannot always be used as a model to accurately predict what will happen, or to perfectly include every system factor. When dealing with messy social situations, systems thinking will inevitably propose a more simplified view of reality and thus not accurately predict what will happen. (Featherston and Doolan, 2012). Yet, for many, systems theory is not about better predicting, but

about better understanding the system. In doing so, inter-variable relationships can be brought to light and certain aspects of the system can be better contextualized. The point is not to create a perfect model, but to instead get a better picture of that model, and then recognize that the remaining variables may never be fully mapped out or understood. There is a varying degree of complexity and approximate knowledge embedded within each and every system.

The Resilience Thinking Approach

What is Resilience Thinking?

Resilience is defined as “the ability of a system to absorb disturbance and re-organize while undergoing change so as to still retain essentially the same function, structure, identity and feedback” (Walker et.al. 2004, p.2; Rotarangi and Russel 2009; Miller et.al. 2010; Berkes 2007). Stemming from systems thinking and ecology, resilience thinking has conventionally focused on the amount of disturbance a system can experience before it surpasses a key threshold that results in a fundamental shift in the system’s characteristics and identity (Rotarangi and Russel 2009; Berkes 2007). Crucial elements of resilience thinking include feedback loops (Fazey, 2010), scale, thresholds and

the notion that systems are always adapting and changing (Berkes, 2007), thus proving its intimate roots with systems theory. Resilience thinking advocates for a holistic approach to solving social and environmental problems which ultimately works to incorporate a variety of disciplines and perspectives. Since its origins, however, there has been an increased emphasis on the linkages between ecosystems and social systems. Rather than viewing ecosystems as 'pristine', it is becoming clear that they have co-evolved with specific cultures and social systems over time, resulting in a bi-directional relationship between environmental conditions and social systems (Rotarangi and Russel, 2009).

Key Resilience Components

While individual models have variations of key resilience features, most models tend to highlight similar components. The most common elements include:

The adaptive cycle and adaptive capacity: The adaptive cycle describes two paths, or feedback loops, that are commonly present within a system. The first loop simply represents positive growth within a system, while the second loop represents disruption and system collapse. Essentially, one path represents slow, incremental change and the second explores how the system responds to dramatic shocks. In theory, a strong and resilient system will respond to a

disruption by being able to return to its original state, while a less resilient system will transform or decline (Slootweg and Jones, 2011). Adaptive capacity reflects a systems' overall resilience by examining its heterogeneity. Ecological systems, with high adaptive capacity, have higher levels of biodiversity. Similarly, social systems with high adaptive capacity have a number of institutions and networks that allow for knowledge sharing, diverse options for problem solving and a more balanced dispersion of power (Slootweg and Jones, 2011). With such diversity, systems are able to reorganize themselves to adapt to change and ultimately maintain its core function and identity. Adaptive capacity can also reflect how the actors within a system are able to manage resilience and influence how the system responds to disturbance (Berkes, 2007).

Panarchy: Originating from C.S. Holling and Lance H. Gunderson, panarchy "emphasize[s] the unpredictability of interactions between ecosystem components in contrast to a commonly held deterministic worldview which regards ecosystems as ultimately predictable and controllable" (Slootweg and Jones, 2011, p.265). It recognizes that interactions will occur between various temporal and spatial scales, resulting in any number of variables through the system being changed.

Social-ecological systems and thresholds: Social-ecological systems consist of both environmental and social systems that depend on one another and are intimately entangled. Although specific parts can be identified, it is impossible to separate the social and environmental components when applying them to specific analytical situations. Within these social-ecological systems, various thresholds exist that determine the overall system state. Each system has alternate states depending on which thresholds are crossed (Slootweg and Jones, 2011, Fazey 2010).

Resilience: Incorporating the above notions of the adaptive cycle, adaptive capacity, panarchy, social-ecological systems, and thresholds – various theories assert models for improving resilience within a system. Walker et.al. (2004) states that there are four aspects of resilience: (1) latitude, (2) resistance, (3) precariousness and (4) panarchy, which has already been discussed. Latitude refers to the capacity for the system to 'stretch' before it loses its ability to re-organize and recover from an outside disturbance. Resistance refers to how much the system resists change when experiencing a shock, or how easy or hard it is for the system to be altered. Precariousness defines where the system is in terms of reaching its maximum threshold – that, if crossed, would permanently alter its function and identity. By identifying these four aspects of resilience, one can understand how to collectively improve these

elements and the overall strength of the system. Berkes (2007) has defined four characteristics that, if adopted, would improve a system's overall resilience. They include: (1) learning to live with change and uncertainty, (2) nurturing various types of ecological, social and political diversity for increasing options and reducing risks, (3) increasing the range of knowledge for learning and problem solving, and (4) creating opportunities for self-organization including strengthening of local institutions and building cross-scale linkages and problem solving networks.

Strengths and Weaknesses of Resilience Thinking

Resilience thinking is a useful concept that can be modified and applied to any number of concepts. By internalizing key principles of resilience thinking, individuals are able to embrace uncertainty and critically analyze real-world problems with a different set of key skills than reductionist thinkers. Individuals are able to question how they learn and be innovative in how they apply that knowledge (Fazey, 2010). Resilience thinking is able to capture the complexity of social-ecological systems and incorporate a more progressive approach to problem-solving, than traditional reductionist methodologies. It is a useful conceptual tool that "can help bridge different epistemological perspectives, assist people to think differently about how they view and interact with social-

ecological systems, and influence how they perceive the world more generally” (Fazey, 2010, p.17).

It does, however, have its limitations and challenges. In context, key elements of resilience thinking can prove difficult to apply. When dealing with uncertainty, for example, it is difficult for decision-makers, as well as policymakers, to cope with and effectively incorporate this notion into their daily operations as it is undefined and vague (Berkes, 2007). Furthermore, while resilience thinking emphasizes the importance of combining different types of knowledge, as well as incorporating both science and indigenous forms of knowledge, it has proved difficult to implement. With extreme power imbalances between these two ways of thinking, it can be difficult to resolve these issues and then implement them (Berkes, 2007).

Furthermore, resilience thinking tends to ignore issues of power and management related to indigenous and local knowledge. As Rotarangi and Russel (2009) state, “...social-ecological resilience has so far mostly been discussed in the absence of critical cultural dimensions and holistic concepts which define indigenous communities (e.g., culturally specific local dynamics, connections to place, language and social relationships)” (p.211).

The Systems-Resilience Approach

Understanding Problem-Solving from Systems and Resilience Perspectives

In comparing systems and resilience thinking, clear differences in problem-solving strategies emerge. When approaching a problem, a systems thinker would rely on mapping out a model of the essential system components and highlight inherent assumptions made within the model to see if they are systematically flawed. This framework is fundamentally rooted in a constructivist paradigm, which seeks to understand the wide variety of beliefs, values and ontologies that exist in the world (Miller, et.al, 2010).

For example, in the area of the Pangani River Basin, common management issues often revolve around declines in mangrove forests and fish and shrimp resources. As mangrove cover continues to lessen, those living in coastal villages are becoming increasingly susceptible to the impacts of natural disasters. A systems thinker would aim to draw connections between a number of factors in order to better understand what could be causing the mangrove degradation and consequently causing communities to be more susceptible to natural disasters. This could include variables such as the history of Pangani, local culture, political dynamics, health, and education. By incorporating this holistic approach and questioning the inherent foundations of the current

narrative, a more critical approach to understanding the problem and potential solutions can be encouraged.

Similar to systems thinking, resilience thinkers would view knowledge as being tentative and always evolving. Additionally this framework works to incorporate broader social-ecological frameworks by highlighting the various complex interactions between social and ecological systems. For example, within the context of Pangani, resilience thinkers would examine how lack of access to education could be contributing to environmental degradation. Furthermore, resilience thinkers would reflect on the source of their knowledge in order to reflect on how their assumptions are inherently integrated into their problem-solving methods. The resilience framework, however, is slightly more rooted in a positivist epistemology, where objective definitions and measurements are emphasized (Miller, et.al, 2010). Therefore, a resilience thinker would be much more focused on understanding the specific thresholds, level of panarchy, and adaptive capacity within Pangani's various social-ecological frameworks, and less concerned with embracing the overall complexity of the system.

In contrast, systems thinkers are commonly more actor-oriented and would therefore start with exploring local knowledge to understand how locals

are experiencing the issues at hand. This provides the foundation for the rest of the model and inevitably incorporates actors from the community, the region, the country, internationally, and so on (Miller, et.al, 2010). Additionally, it is important to note that it is not essential for systems thinkers that each and every variable be defined. Embedded within the systems framework is an understanding that there will always be variables, relationships between those variables, as well as emergent properties, that may never be predicted or understood. There will always be a degree of unknown complexity, and an acceptance that all knowledge is approximate and inevitably incomplete.

A resilience thinker, however, begins by building from the existing knowledge base and looks at the larger picture before delving into one specific context. This, however, leaves open the possibility that the 'current knowledge base' does not accurately reflect marginalized population that can't contribute to the mainstream literature.

The Systems-Resilience Approach

I propose combining these two conceptual frameworks in order to best accentuate their strengths and abate their weaknesses. Within this approach, there are three key elements: (1) multi-directionality, (2) approximation, and (3) inherent power. At its foundation, the Systems-Resilience Approach

emphasizes utilizing a tri-focal approach that works to gain insight from the local lens, as well as the national and international lenses. With all three knowledge bases being formed simultaneously, a more accurate picture can come together to congregate the various perspectives, actors, and their inherent understandings and beliefs throughout the entire system. As a result, one can better understand how each part could influence another, and thus better theorize different constructions of the problem.

By first looking from the national and international scale, we start by utilizing a resilience-based approach and examine the problem from the current mainstream development narrative. In recognizing that this framing de-emphasizes the role of power within environmental degradation and poverty, and instead places natural disasters as something neutral and static, one can better understand the capacity for power to be incorporated. Furthermore, by learning how these actors view these problems, their motivations can be highlighted and a better understanding of how these issues are being remediated or exacerbated can be brought to light.

Conversely, a more actor-oriented systems approach is also utilized to view the issue from the local perspective. It is useful to highlight how the community feels within the system and to understand the local nuances and

daily actions that could be improving or exacerbating the problem. A complete historical, political, and cultural context is defined to understand not only the issues of environmental degradation and poverty, but the root power dynamics that are inextricably present within these issues. In this sense, a comprehensive connection can be made between various spatial and temporal scales. As a result, there is widespread recognition that various components of the system are interacting and affecting one another in a variety of ways. In order to improve social and environmental conditions, then, it is necessary to work at multiple scales, with multiple actors, and with recognition and respect for the specific contextual characteristics within each community.

This falls in sharp contrast to the reductionist understanding of how the environment and human interactions are linked. True vulnerability to natural disasters does not solely lie in the conditions of environmental degradation and poverty, but also in the systemic factors that are strategically placing these individuals in such a vulnerable place. Although it may be difficult to engage with and challenge those in power, it is important to at least recognize how these power inequalities are contributing to the exacerbation of poverty, environmental degradation and vulnerability to natural disasters. With this recognition alone, space could be created to allow for power to be addressed at the local level and for more nuanced and effective solutions to be offered.

Within each part of the Systems-Resilience Approach, power has to be at the core. As Rotarangi and Russel (2009) state, "If resilience is to be relevant to societies in which people have a long term relationship with land and resources, but have been disempowered by a dominant society, then a new tangent is required, and possibly more culturally oriented methodologies" (p.212). A fine balance needs to be achieved that works to strike a balance between the dominant discourse that removes power from the conversation, and the knowledge and cultural experiences of those who experience these dynamics on a daily basis.

Within this approach, there are three key elements that should always be embedded with each portion of any proposed intervention or policy. They are as follows:

- (1) Multi-directionality: Always aim to examine a problem from a multitude of perspectives, considering different times scales, different spatial scales, and different actors. Furthermore, ensure that there are no simple cause and effect relations. Instead, challenge oneself to see each and every relationship as multi-directional.
- (2) Approximation: Recognize that the goal of this framework is not to delineate every single variable explicitly, but instead to get an approximate picture of

the larger whole. Continuously challenge your assumptions, critically analyze where your knowledge is coming from and contemplate what other actors could be incorporated. Yet, at the same time, realize when these exercises are exhausted within the boundaries of the specific context.

(3) Inherent Power: Always incorporate power dynamics throughout the framework, as power is often the core cause of social and environmental issues. By recognizing inherent power dynamics within social-ecological frameworks, the current development discourse can be challenged and power can be re-embedded into the development conversation.

In order to best understand how these concepts could be operationalized within the field, the following outlines three case studies within the context of rural coastal Tanzania and then applies them to the Systems-Resilience Approach.

Case Study 1: Tourism in Bagamoyo

Many coastal communities in Tanzania are currently suffering from conditions of severe environmental degradation that simultaneously contribute to conditions of poverty and susceptibility to natural disasters. Efforts to develop a tourism sector within these coastal communities tends to exacerbate these issues while simultaneously inserting Western notions of development and neoliberal globalization into local value systems and cultures. This often

clashes with environmental restoration efforts and leaves the community somewhat powerless. In 2009, the Tanzania Coastal Management Partnership (TCMP), in conjunction with USAID conducted a study of Bagamoyo District. After its analysis, TCMP and USAID decided that it would be beneficial to develop Bagamoyo's tourism sector as a means to "meld environmental conservation, sustainable use of resources and poverty alleviation" (USAID, 2009, p.33). While this may seem promising, it is important to contextualize this initiative within a more holistic context and to examine embedded power dynamics.

One specific example entails Bagamoyo's coastal No-Take-Zones. A Central Coordinating Committee (CCC) comprised of local village members designated four offshore no-take-zones in order to allow for fish stocks to be replenished (USAID, 2009). Unfortunately, in practice, it is near impossible for the CCC to enforce the rules of the No-Take-Zones as they can only inspect the zones twice a week and do not own the boat used for enforcement (ibid). As a result, the regulations of these zones cannot be properly enforced. Furthermore, 20% of the fees go to the District Council, while the remaining 80% has to be split up amongst seven villages and the CCC, leaving an insignificant sum to be put towards poverty alleviation and coastal resilience

(ibid). With the potential increase in tourism, the pressures put on these zones will only increase and enforcement will only prove to be more difficult.

TCMP recommends utilizing these no-take zones for snorkeling and diving, but recognizes that the CCC and local villagers don't have the ability to invest in the necessary infrastructure required to make these areas a popular tourist destination. Instead, they recommend private sector investment as the only feasible route (ibid). This, however, could take away the power and agency from the local villages and instead make them subject to Westernized models of tourism and development. It is likely that these local communities will not reap many of the benefits of this tourist destination. Such intervention effectively aims to justify Western involvement with promises of poverty alleviation and environmental conservation - while, in the end, disregarding the needs of local communities and potentially placing them in the same or worse-off position than before.

As a development actor aiming to apply the Systems-Resilience Approach in the context of tourism in Bagamoyo, one can think through a series of questions (see table 2). It is important to note that table 2 only offers a few theoretical questions, with recognition that many more would be developed and entertained in the field. With these questions in mind, one can better understand how this model may be put in place in the field.

Table 2: The Systems-Resilience Approach Applied to Tourism in Bagamoyo

KEY COMPONENT	QUESTIONS TO CONSIDER
MULTI-DIRECTIONALITY	How can this problem be understood from each actor mentioned in the above case study (i.e. local villages, USAID, the TZ government)? What other perspectives should be incorporated? With tourism operating at the international scale, what sorts of global factors could be perpetuating these issues? How has this problem changed over time, and how can we anticipate it changing into the future? What other factors are influencing issues of tourism and environmental degradation that have not yet been considered?
APPROXIMATION	Have I reached a point of saturation when aiming to incorporate multi-directionality? What assumptions did I make? Where did my knowledge originate from? Do I have a firm grasp on the overall system surrounding tourism and environmental degradation in Bagamoyo?
INHERENT POWER	What power inequalities exist between locals in Bagamoyo and the government, as well as between USAID and TCMP? How do the locals perceive such inequalities? How does the government? What approaches can be utilized to shed light on these perceptions? How can these power dynamics help us better understand and provide better solutions to the issues of poverty, environmental degradation and vulnerability to natural disasters?

Case Study 2: AIDS and resource degradation

Torell et.al, (2006) conducted a study examining the relationship between the prevalence of AIDS and biodiversity conservation in rural coastal Tanzania. Within their study, they examined numerous coastal villages including Bagamoyo and Pangani. The results of the study “conclude that AIDS is contributing to natural resource degradation in the project area and that gender

inequity, migration and lack of livelihood options exacerbates the situation” (Torell, et.al, 2006, p.806). For example, when a family member becomes sick or dies from AIDS, or an AIDS-related illness, the family not only loses a source of income within the household, but also loses the amount of time they have towards generating their own income – as they now have to dedicate time to caring for their family member (Torell, et.al, 2006). Furthermore, when AIDS becomes prevalent in villages, it is more likely that community members will disregard long-term sustainable practices and shift their focus to short-term gains (ibid). As a result, resource extraction tends to become more prevalent as the incidence of AIDS increases. Charcoal-making, for example, may become more commonplace as it is less labor intensive than fishing and produces income more quickly (ibid).

Additionally, it is important to reiterate how mangroves play a crucial role in reducing the impacts of storm surge. With stocks declining, these villages become increasingly more susceptible to the impacts of natural disasters. As their income and time become devoted to taking care of family members with HIV/AIDS, they are left with less assets to fall back on after a natural disaster takes place. At the same time, they are simultaneously being forced to extract resources that increase the negative impacts of natural disasters in the first place.

Once again, in order to understand how the Systems-Resilience Approach could be applied within this scenario, table 3 outlines potential questions to consider when utilizing this approach.

Table 3: The Systems-Resilience Approach in Considering AIDS and Resource Degradation in Rural Coastal Tanzania

KEY COMPONENT	QUESTIONS TO CONSIDER
MULTI-DIRECTIONALITY	What other factors could be contributing to locals engaging in environmentally destructive practices? What other factors are contributing to the high prevalence of HIV/AIDS? What other key actors should be considered? Whose perspectives are being marginalized within this narrative? Am I aware of my own personal experiences that inform how I view this problem/solution?
APPROXIMATION	Have all key perspectives been integrated into the model? Have all potential directionalities of key variables been considered? Is there a general understanding of the system as a whole, while sufficiently contextualizing key variables within the local setting?
INHERENT POWER	What power inequalities perpetuate the prevalence of HIV/AIDS, as well as high rates of environmental degradation? Where do these power inequalities derive from? How do locals understand and operate around these power dynamics? What is the capacity for providing a solution that could effectively reveal these power inequalities and actively deconstruct them?

Case Study 3: Forced eviction in Porokanya

Along the coast of Tanzania lies another small fishing village named Porokanya. This village has been the subject of much debate in recent years as the government has claimed it exists within the national park boundaries of

SANAPA. While there is clear evidence this is not the case, the government has forcefully evicted many villagers living in Porokanya and are attempting to do so in neighboring villages as well.

In the 1960s, Saadani village, which includes Uvinje and Porokanya, grew frustrated with foreigners killing local wildlife and asked the Wildlife Division to set up parameters to promote wildlife conservation (Minority Rights, 2015). As a result, local village members promised to give up over half their land to the Game Reserve, in return for being allowed to perpetually remain on the main land where their villages exist (ibid). The Game Reserve formed the start of SANAPA, which was eventually turned into National Park land and expanded. When the original borders of SANAPA were drawn, the government respected their original agreement with Saadani village and did not include those previously agreed territories on their map. Somehow, down the road, the map was altered to include Uvinje and Porokanya, ultimately stripping these coastal communities of their land (ibid). Despite protests, the boundaries became permanent in 2005. Orozco-Quintero (2014) stated, "The people of Uvinje see it quite simply: it is a trust betrayed, a complete disregard of their roots, identity and stewardship of nature, and ultimately the loss of their home, the annihilation of their existence" (p.2).

It is important to note that there is no news coverage of the government forcibly evicting people from their land in Porokanya in 2014 and there is no real follow up on what has occurred in Uvinje. This lack of information is reflective of the influence of the government and its goal to maintain a positive narrative around SANAPA as a way to ultimately encourage tourism in the area.

Without sufficient land rights, and persistent issues of bad governance, it is clear that these rural coastal communities are being marginalized and ignored. Furthermore, since they inhabit land that is popular for tourists, their interests are not prioritized over the potential for tourism and hunting.

Furthermore, those who survived being forcibly evicted ultimately lost their homes, assets, and in some cases, family and friends. These factors inevitably impact their ability to be resilient against coastal natural disasters. Without any solidarity from the government or sufficient land rights, in addition to constant impact from natural disasters, these coastal communities are systematically kept from being able to rise out of poverty and become more resilient.

In order to better understand how the Systems-Resilience Approach could be utilized in this context, table 4 summarizes potential applications.

Table 4: The Systems-Resilience Approach in regards to Governance and Land Rights within Porokanya

KEY COMPONENT	QUESTIONS TO CONSIDER
MULTI-DIRECTIONALITY	What motivations does the government have to forcefully evacuate villages such as Porokanya and Uvinje? What other factors, outside of tourism, could be influencing these actions? How can the local perspective of these events best be illuminated? What other sorts of spatial scales and time scales need to be incorporated into this model?
APPROXIMATION	Does the model effectively incorporate the necessary components to understand the larger systemic relationships at play? How will one decide when questioning the multi-directionality of this problem has been saturated?
INHERENT POWER	What structural inequalities have allowed such acts to be committed and ignored? How can these stories be told? How can the victims of these forced evictions be empowered? What opportunities, as well as limitations, are present to challenge these power inequalities?

After examining each individual case study, and thinking through potential questions, a Systems-Resilience Model can start to be developed. With this in hand, a development actor is able to gain a more firm and holistic understanding of which issues could be contributing to the perpetuation of poverty, environmental degradation and susceptibility to natural disasters. As a result, a complex and holistic model can be created in order to most effectively determine potential solutions to these issues.

In applying this framework, it is important to note that this method does not specifically provide a solution to these problems, but instead allows one to re-frame and contextualize them from a more holistic and integrative perspective. With this new framing, those utilizing this approach will be able to get a better understanding of the problem, as well as the role of inherent power inequalities. From there, development actors can funnel their resources and time in the most effective ways in order to create long lasting positive change. Without such re-framing, issues of poverty, environmental degradation and susceptibility to natural disasters will only continue to persist.

Conclusion

Although Tanzania may seem fraught with dichotomies, on the surface, the systems-resilience framework encourages seeing these seemingly opposite characteristics in the same vein. In rural coastal Tanzania, the problems of environmental degradation, poverty, and susceptibility to natural disasters have been relentless. Without recognizing the importance of moving away from reductionist tendencies, little headway has been made. The Systems-Resilience Approach offers an alternative way of understanding this problem, as it encourages a more holistic approach that incorporates multi-directionality, approximate knowledge and inherent power dynamics.

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