Innovative Environments: The Interplay of People, Politics, Resource Management, and Restoration.

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This is an updated version of work that formed my Master's Dissertation at Keele University in 2010/2011.

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Acknowledgements

It is a great pleasure to thank those who supported me through the research and writing of this dissertation. I am sincerely grateful to my supervisor Steve Quilley who, despite distance or schedules, answered my questions and guided me along with comforting ease. To my interview participants, Ranil Senanayake, Milo Bekins-Faries, Jean Arnold, Aaron Becker, and the IAFN, I cannot extend enough gratitude. Thank you for allowing me to analyze the IAFN as a case study. Without the time and effort offered through your interviews I am certain I would not have been able to complete this research.

For my niece and nephew.
May there be healthy, green spaces and vibrant places
in which you can grow and learn.
All my love.

Abstract

Conventional resource management methods are increasingly being criticized as incapable of addressing the complexity of the social-ecological systems within which they work. Techniques in adaptive management are more often being recognized as the appropriate manner for working within complex systems. Looking at global North-South dimensions, this paper will mainly address forestry as a social-institutional system and will analyze the development of Analog Forestry, an alternative method of land management, and how it grew and spread. The analysis is made through a framework of social innovation and highlights the importance of creative ingenuity, power dynamics, social capital, networks, and social memory.

List of Acronyms

AF	Analog Forestry
IAFN	International Analog Forestry Network
FBC	Falls Brook Centre
NSRC	Neo-Synthesis Research Centre
ITP	Industrial Tree Plantation
NTFP/R	Non-Timber Forest Product/Resource
FGP	Forest Garden Product
EU	European Union
UN	United Nations
SUF	Special Use Forest
BSM	Benefit-Sharing Mechanism
VCF	Vietnam Conservation Fund
WB	World Bank

Aims

This research paper seeks to explore processes of social innovation within the domain of resource management, specifically looking at forest management, environmental degradation and poverty alleviation. The system that is investigated is the culture and practice of forest management. Forest management is considered the art, science, and technology of managing tree, woodland, and forest resources. It is a multidisciplinary field that can be based in economics, conservation or a combination of the two. Management can encompass, but is not limited to silviculture, aesthetics, environmental services, recreation, game, fish, non-timber forest products (NTFPs) and resources, and wood products. In this way, it is a social-institutional system that includes other sets of nested systems. The current crisis confronting forest management across the globe is a perceived economic, ecological and management crisis. It deals with the depletion of forest resources and degradation of lands and environmental services, while the people who depend on forests for their livelihood are marginalized. This paper employs a case study on the International Analog Forestry Network (IAFN) and the social-ecological system of Analog Forestry (AF). The case study aims to elaborate on the processes of social innovation associated with the scaling up and out the IAFN and the AF methodology in forest management and restoration.

There was one main question asked throughout the completion of this research project:

- What were the social, political and economic conditions that existed to create the context in which the International Analog Forestry Network was formed?

The objective will be to analyze the formation of the IAFN through the framework of social innovation. In doing so, the history of the AF system is addressed, and the practical aspects of the system are examined. In examining the diversification and scaling-out of the AF system a closer analysis of the formation of the IAFN will bring the social, political, economic and environmental contexts that shaped the formation of the IAFN to light. Through a simultaneous illumination of the historical context of the social-institutional system of forest management that reaches across the world, this paper will examine whether the expansion of the AF system and the formation of the IAFN was a response to deficiencies within that historical context. The historical context of this social-institutional system is thus understood as a context that has contributed to the social-ecological challenges, which AF seeks to address.

Methodology

Research for this paper that drew on the personal experiences, memories, and interpretations of various members of the IAFN gathered through email correspondence[1] and included phone interviews, when possible. Connecting with members of the IAFN was important in collecting information from the experts of the AF field. The interviewees were selected for their involvement with the IAFN, length of time practicing the AF technique, and AF expertise. Many of the interviewees are involved with the AF system in more than one capacity. The participants represent the international make-up of the IAFN, and demonstrate North-South dynamics within the network. The four participants are the founder Dr. Ranil Senanayake (Sri Lanka), chairman Milo Bekins Faries (Costa Rica), vice-chair Aaron Becker (Vietnam/Philippines) and board member Jean Arnold (Canada).

[1] Email correspondence was the preferred method of communication for the participants to fit their busy and travelling schedules. Email also eliminated the scheduling difficulties that are encountered when planning from different countries across the globe. Email correspondence fit well with the budget of this research project as the cost of telephone interviews could have restricted the amount of time the self-funded researcher was able to schedule for interviews and therefore limit the amount of information collected. The interview participants reside in Canada, Vietnam/Philippines, Costa Rica and Sri Lanka and two sets of interviews were performed with each participant.

Documentary research was conducted from the theoretical foundations presented in previous work on Panarchy, resilience theory, complex systems theories and social innovation. This was primarily sourced from The Resilience Alliance, SiG@Waterloo, The MacArthur Foundation and SiGMars. These three centres focus their research on the three aforementioned concepts and host work and research from the leading scholars in the field. Information on the AF system and the IAFN was gathered from the IAFN website and documentation it provides, as well as through Falls Brook Centre in New Brunswick, Canada and through recommended documentation by interview participants.

Introduction

> Scientific resource management has its roots in the utilitarian and exploitative worldview, which assumes that humans have dominion over nature. In the historical process of converting the world's life-support systems into mere commodities, resource management science was geared for the efficient utilization of resources as if they were limitless (Berkes & Folke, 1998, p. 1).

The global context at the beginning of the 21st Century is a combination of socio-ecological problems that can be found in what is called a 'perfect storm' scenario. This scenario represents the interconnection between climate change, fossil fuel supplies, food shortages and economic crises. The concept is decades old and the reality is more recently tangible. Contrary to views presented by complex systems thinkers, it is conventional disciplines and reductionist approaches that struggle to recognize the intersections and interdisciplinary connections that are illuminated in perfect storm scenarios (Westley and Antadze, 2009, p. 8).

In addition to a simplified perception of the causes and consequences of social-ecological and economic problems, the economic system driven by industrialized nations has increased pollution, whilst demanding high profitability and abundant ecological resources. In turn, these demands lead to the over-exploitation and exportation of ecological resources in the developing world. "The exclusion of large parts of the world's population from basic economic and ecological services increases the vulnerability of the whole to perfect storms and hard losses of resilience" (Westley and Antadze, 2009, p. 8). The conventional resource management methods in forestry and agriculture that are founded on a disciplinary-based science approach perpetuate North-South power dynamics and exclude vulnerable populations from full participating. This is the type of exclusion that contributes to hard losses of resilience.

The complex socio-ecological challenges facing modern society require innovative solutions. Social Innovation is increasingly being expressed as the means

by which individuals, groups and communities are combating social, political, and economic challenges in an effort to build resilience. In regards to forest management and community resilience, alternatives to conventional practices are constantly being introduced. However, the question remains, which alternatives stick?

The technique of Analog Forestry (AF) is especially interesting to highlight as it takes into account the restoration of biodiversity on degraded lands, while providing economic benefits and products to the practitioners. In this regard, the AF system not only provides economic benefits to its practitioners, but it is moving away from environmentally detrimental practices to regenerate the lands that have been damaged by the effects of mainstream forest management.

Sri Lankan ecologist, Ranil Senanayake, first introduced the term Analog Forestry in 1977 (2011c). His ideas in adapting agricultural systems to local contexts have since been adopted by individuals and organizations across the world. At the United Nations (UN) sponsored Open-ended Intergovernmental Meeting of Scientific Experts on Biological Diversity in Mexico City in 1994, AF was accepted and recognized as a methodology that integrated the protection of biodiversity within the context of land management. The AF system has continued to diversify through the development of a system of government approved crop certification, known as Forest Garden Products (Both Ends, 2006). As practitioners of AF continued to sprout up in different locations across the globe the International Analog Forestry Network (International Analog Forestry Network, 2011) was formalized to facilitate knowledge mobilization, and to share information and experience between individuals, groups, and organizations learning or practicing the AF technique (International Analog Forestry Network, 2011). The AF methodology and formalization of the IAFN are studied closer in a case study to get a more detailed look at the processes of social innovation when connected to social-ecological systems and resource management.

Theory

Theoretical Approach

Social innovation is an integrative approach to overcoming social challenges. Social networks, capital and memory are important tools that assist social innovations. Social innovation as a theoretical framework accounts for the interconnections of social, economic, environmental and political systems in forest management. The theoretical foundations of social innovation come from the theory of Panarchy. Panarchy is an interdisciplinary approach to analyzing resilience in complex systems by focusing on adaptive cycles at various time and space scales. The following section will explore the theoretical foundations of social innovation in the theory of Panarchy and then move on to providing a deeper understanding of the processes of social innovation.

Systems Science

An explanation of why conventional industrial, scientific approaches to forest management can be regarded as insufficient in their capacity to address the complexity of forest systems and their associated nested systems can be attributed to a change in perspectives on systems. The main change in systems thinking comes from a bifurcation in the meaning of stability within a system. Traditionally, systems' thinking has been based around the conception that there is one equilibrium steady state in a system. However, the dynamic nature of systems and the interaction between various systems has led to a conception that instead there can be multiple equilibria in a given system. Lance Gunderson and C.S. 'Buzz' Holling's (2002) explanations of stability and resilience explains the basis for the theory of Panarchy upon which social innovation is built.

Gunderson and Holling (2002) term the idea of stability near one equilibrium steady state 'engineering resilience'. This concept is prominent where theories

envision simplified and untouched ecosystems. Their focus is on one equilibrium steady state with two assumptions. Firstly, that there is global stability, and secondly, that it is sufficient to represent only the fast, local variables and ignore the slowly changing, broad variables in a given system (p. 28-29). The dominant idea over the last century follows that ecological mechanics are balanced in an equilibrium state (Walker and Salt, 2006, p. 30). This equilibrium steady state is visible in maximum sustained yield-type resource management or almost any scenario of single resource optimization for short-term maximization. This is presumably the conception of stability that accompanies scientific forestry or mainstream resource management.

The opposing conception of stability is termed by Gunderson and Holling (2002) as 'ecosystem resilience.' Ecosystem resilience focuses on the *existence* of function, in that components have a function as part of a whole, as opposed to the *efficiency* of function, which is the focus of engineering resilience. This means that simplification for the purposes of efficiency, which is seen in reductionist approaches and short-term maximization, is not the primary objective in ecosystem resilience. Instead understanding and working with dynamic complexity is the goal. Ecosystem resilience tends to be based in resource ecology at the scale of ecosystems and landscapes. Through an inductive approach, it looks at the management of disturbances at multiple scales, while recognizing 'flips' from one operating state to another (p. 29). The flip, or moment of change, is characterized by certain "instabilities [that] can flip a system into another regime of behavior" (p. 28). Following these characterizations, ecosystem resilience is a concept based in the existence of stability as distant from any equilibrium steady state.

Where stability is distant from any equilibrium steady state the concept itself becomes synonymous with resilience. Resilience is then characterized by the amount of disturbance that can be sustained before the system surpasses a threshold and flips into a new regime where it no longer retains the same control and structure, and consequentially takes on a new identity (Walker and Salt, 2006, p. 32). Within this concept the preferred method of management is adaptive, not

rigid. As all systems have to take on shocks and disturbances to remain healthy, the appropriate management system aids in the adaptation of the system to shocks.

The acceptance of complex systems' models and approaches based on conceptions of Panarchy signifies a shift away from the conventional paradigm based in principles of command and control human dynamics for the optimization of certain resources and services. The culture and practice of large-scale forestry operations remains guided by "reductionist logic, where one specific policy measure is used to address one specific problem" (Rametsteiner and Weiss, 2006, p. 692). Many of the large-scale forestry operations are still dominated by the conventional disciplinary-based scientific techniques and command and control dynamics that distance vulnerable populations from participation and ultimately lead to biodiversity loss, degradation and deforestation. Ecosystem resilience recognizes the interconnections and interdisciplinary nature of systems. It thus recommends that resource management adopt more holistic practices of ecosystem management and integrate the participation of vulnerable populations.

The AF system recognizes the interconnections between various ecological systems, as well as the interconnections between social, economic, political and ecological systems. It is an adaptive method of resource management that uses local knowledge in combination with conventional science to learn continuously, stay efficient and also to localize the technique to fit the culture and ecosystems in which it is practiced (Arnold, 2011b). In these ways the AF system is challenges command and control dynamics found in large-scale forest resource management. AF strengthens forest ecosystem resilience, while also working to build forest community and economic resilience.

Background to Social Innovation

With growing concern around the human implications of ecological challenges much academic attention has been geared towards social and ecological resilience and ecosystem management. Many authors write that the "largely sectoral, expert-centred" (Biggs et al., 2010, p. 1) resource management approaches and institutions

in Western societies are in need of transformational change as they struggle to address the interconnecting dynamics between resources and services in different systems. In this regard ecosystem management is the favored form of resource management as it is a complex, adaptive approach that addresses the connections between species, both plants and animals, and environmental services.

It is argued that the appropriate ecosystem management regimes are those that adopt a complex systems perspective (Biggs et al., 2010; Gunderson and Holling, 2002; Folke et al., 2005). This means moving from conventional, single resource approaches that are based on one steady state to instead look at the dynamic role of different resources and ecosystem services interacting on multiple scales (Folke et al. 2005, 443). Such complex approaches of ecosystem resilience look at the capacity of a system to change in response to certain conditions, and focus on the dynamic nature of systems, feedback learning, and the need for systems to innovate.

Understanding Panarchy

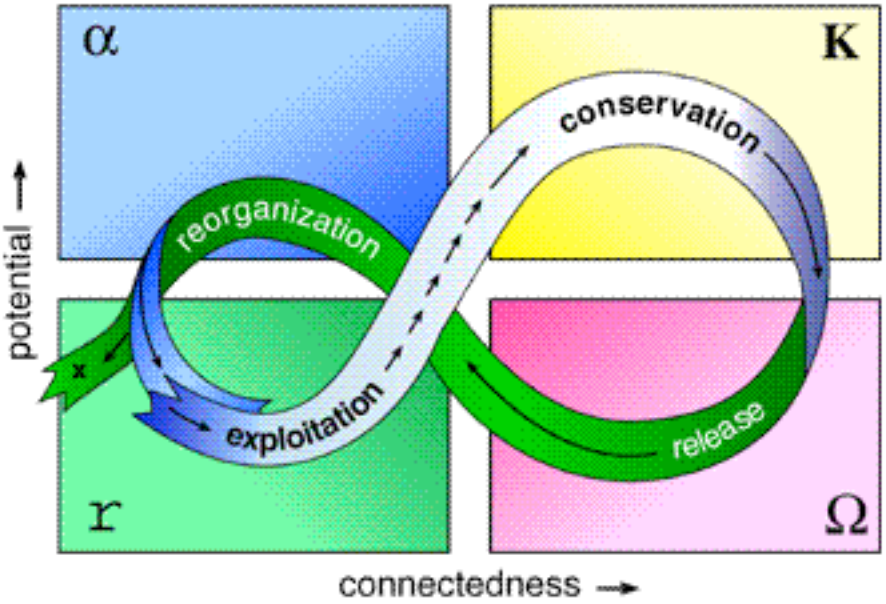
Lance Gunderson and C.S. Holling released the book *Panarchy: Understanding Transformations in Human and Natural Systems* in 2002. Essentially Panarchy "shows how fast and slow, small and big events and processes can transform ecosystems and organisms through evolution, or transform humans and their societies through transformational learning or the chance for learning" (Holling, 2004, p. 1). The theory of Panarchy looks at the structure and dynamics of complex systems to discover the organization and operation of ecosystems. It then turns to highlight similar cyclical patterns and processes in human systems. This unique theory considers interactions across various scales between different systems, all the while recognizing that ecological systems form the foundation for other systems, like human systems.

While Holling and Gunderson maintain that there are certain distinctions between ecological and human systems, Folke et al. (2005) manage the

interconnection of the two systems by looking at the capacity of change in social-ecological systems. A social-ecological system implies the interdependence of human/social and ecological systems (Berkes et al., 1998) and the term thus reflects the linkages between the two systems. These linkages can be seen through the impacts of ecological system changes on a social system. Change can also manifest through the myth and culture of a society that is relative to the land and ecology and can be seen in the way that this myth and culture influences ways of living. "Given the strong interactions that exist between people and ecosystems, there is growing consensus that ecosystems are best understood and managed as coupled social-ecological systems" (Biggs et al., 2010, p. 2). There is a growing trend in acknowledging the interconnections between the human and ecological systems.

Since its release, Panarchy has been influencing and changing resource and ecosystem management by bringing attention specifically to the aspect of resilience in systems (Norberg and Cumming, 2008). Ecosystem resilience is a major component in the theory of Panarchy in which the adaptive cycle is used for its analysis. Gunderson and Holling (2002) use an infinity loop heuristic tool to represent the four ecosystem functions of exploitation, conservation, release and reorganization that delineate the various stages in the adaptive cycle (See Figure 1). The heuristic diagram is best understood when monitoring a single scale or system. Its purpose is to aid in understanding "the dynamics that drive both continuity and change" (Westley and Antadze, 2009, p. 13). While the adaptive cycle heuristic emerged from an examination of ecosystem processes, it has since been applied to human and economic systems.

Figure 1
The adaptive cycle as represented through an infinity loop (Holling, 2004, p. 3).
This diagram provides a heuristic for understanding the four system functions and the flow of activity between them.



For an ecosystem such as a forest, think of the century- or centuries-long cycle of succession and growth from pioneer species (r) to climax species (K) followed by major disturbances such as fire, storm, or pest (Ω). Such disturbances occur as wealth accumulates and the system becomes gradually less resilient, i.e., more vulnerable. As a consequence, a disturbance is created to release accumulated nutrients and biomass and reorganize them into the start of a new cycle (α). That reorganization can then exploit the novelty that accumulates but is resisted or lies latent during the forward loop (Holling, 2004, p.3).

As visible in the infinity loop, the adaptive cycle alternates between long periods of slow accumulation of wealth and resources and shorter periods that create opportunities for the release of those accumulated resources and wealth. In the infinity loop, the 'back loop' is where the *release* and *reorganization* phases take place and introduce non-routine change, like a forest fire. Back loop activity can be considerably uncertain and characteristically happens in shorter periods at a faster pace. Contrarily, the 'front loop' is where the slow and deliberate change takes place in the *exploitation* and *conservation* phases. It is generally a disturbance, shock, or crisis that precipitates movement into the release stage. In the adaptive cycle these

seemingly negative disturbances are instead viewed as opportunities to create change and to strengthen resilience.

In *Panarchy* the adaptive cycle takes empirical evidence of adaptive ecological systems and maps it onto human and economic systems. However, there is one aspect that must be highlighted in regards to transferring the principles of the adaptive cycle from ecological systems to human systems. Human systems have three unique components. Humans possess cognitive abilities that allow their social systems to respond to the present, past, and future, which allow humans to potentially stabilize the boom and bust cycles found in the adaptive cycle (Gunderson and Holling, 2002, 55). They can create and access knowledge. Human systems also contain communication and have access to technology (Holling, 2001, 401). These unique human system components provide certain benefits like feedback learning and networking, which facilitate innovation and strengthen resilience.

Innovation itself is the novelty generated at any time throughout the adaptive cycle and it is used to overcome the challenges that confront a system. Differing from invention, innovation not only refers to the creation of new ideas, programs, and products, but also refers to the processes of their dissemination and adoption (Biggs et al., 2010, p. 3). Social innovation is focused on the 'human' and 'social' capacities to create new ideas, products, processes and programs that strengthen resilience.

Within forestry, innovation takes place on different levels; methodologically, mechanically or technologically, individually by the manager or generally through policy. Nevertheless, "the context and conditions under which forestry is operating are in many respects not supportive of innovations" (Rametsteiner and Weiss, 2006, p. 695). This unsupportive, inflexible characterization of the social-institutional system of large-scale forest management reveals low system resilience and suggests that it could be heading towards a rigidity trap. This may reflect the decline that has surfaced in the industry already. There appears to be less people working full-time

in forestry and less people making the majority of their income from forests (Ramesteiner and Weiss, 2006, p. 695).

In this regard, the future resilience of forestry may depend on the willingness of forest holders and managers to accept changes and introduce innovation into their practice (Ramesteiner and Weiss, 2006, p. 702). The rigidity of conventional forestry and its economic decline illustrate the importance of moving away from reductionist approaches to the incorporation of complex systems approaches that are adaptive and support ecosystem management, as opposed to single resource management. This rigidity is also reflective of the barriers caused by the established institutions and power structures that can impede processes of social innovation.

AF is an example of one such ecosystem management approach. It supports economic development through the restoration of biodiversity, in a manner that aims to provide products, goods, and services from various aspects and resources of the forest system.

Social Innovation

> A strength of the social-innovation framework is that it is founded on a complex systems view, and it not only describes processes of change, but also emphasizes the factors and leverage points that may foster the emergence of transformative change (Biggs et al, 2010, p. 2).

Social Innovation allows changes to take place within a system by addressing the social, economic, and ecological needs that increase resilience. However, a social innovation that is disruptive will bring about transformational change. Transformational change is the goal of any social innovation, in that it pushes the system to flip from one regime into another.

Following the interpretation of Frances Westley and Nina Antadze (2009), social innovation is defined as the creation of change through the introduction of novelty or new ideas in the form of processes, products or programs that provide solutions to various political, economic and ecological challenges (p. 4; Moore and Westley, 2011, p. 2). It is also applied to the processes of adopting ideas that prove

to be useful in meeting social needs (Biggs et al., 2010, 3) and these processes are considered stronger when they re-engage vulnerable populations. This is due to the conception that truly addressing social needs and solving social challenges means re-engaging vulnerable populations in economic, social and cultural institutions as active participants and contributors (Westley and Antadze, 2009, p. 8). The case study of the IAFN provided in this paper highlights the process of social innovation and the importance of re-engaging vulnerable populations as participants and contributors.

As outlined in the infinity loop heuristic the following paragraph describes the process of a social innovation in a human context. The process may begin when a vulnerable populations raises concerns about social challenges. However, they usually do not have the funds or resources to overcome those challenges themselves and so they may seek assistance from government, consultants, or non-governmental organizations to address said problem. The process of addressing those concerns usually follows a pattern in which research and assessments are made around the issue and a variety of solutions are tested. Innovations abound at this stage and a combination of participation, timing and resources see the adequate solution reach a tipping point and become the type of innovation that changes those original social scenarios or creates transformative change (Westley and Antadze, 2009, p. 8). This process can be looked at as a pattern and applied to most scenarios in which one group of 'more privileged' actors' works to create solutions to vocalized challenges faced by vulnerable populations.

Solving the problem and successfully transforming the system within which it exists, means accepting that the solution will have to involve a constant process of change and adaptation, an infinite loop (Westley et al. 2007, p. 99). In this sense success is not an end point in social innovation. The process does not stop at success it only pauses. Success is the time when the innovator or organization can regroup, reflect, learn and re-evaluate strategies and next steps (Westley et al., 2007, p. 207). In this sense, success is determined through feedback learning and leveraged on social memory.

Transformative Change

What is known as a broad social innovation is one that impacts what governs people's conduct by affecting the fundamental distribution of power and resources. In this way it may "change basic beliefs that define the system or the laws and routines which govern it" (Westley and Antadze, 2009, p. 7). This type of broad impact is achieved through cross-scale interaction, whereby the changes, processes, products or programs introduced have to cross multiple social boundaries to reach more and different people and organizations. These social boundaries, people, and organizations are nested across scales, from local to regional to national to global, and are linked in various social networks (Westley and Antadze, 2009, p. 7). Much like the cross-scale dynamics of ecological systems, "in social systems, individuals, groups, organizations, and institutions (such as economies, cultural systems and legal systems) go through the adaptive cycle at different rhythms" (Westley et al., 2007, p. 206). This is why cross-scale interactions help to bring about broad social innovations that have the capacity for transformation.

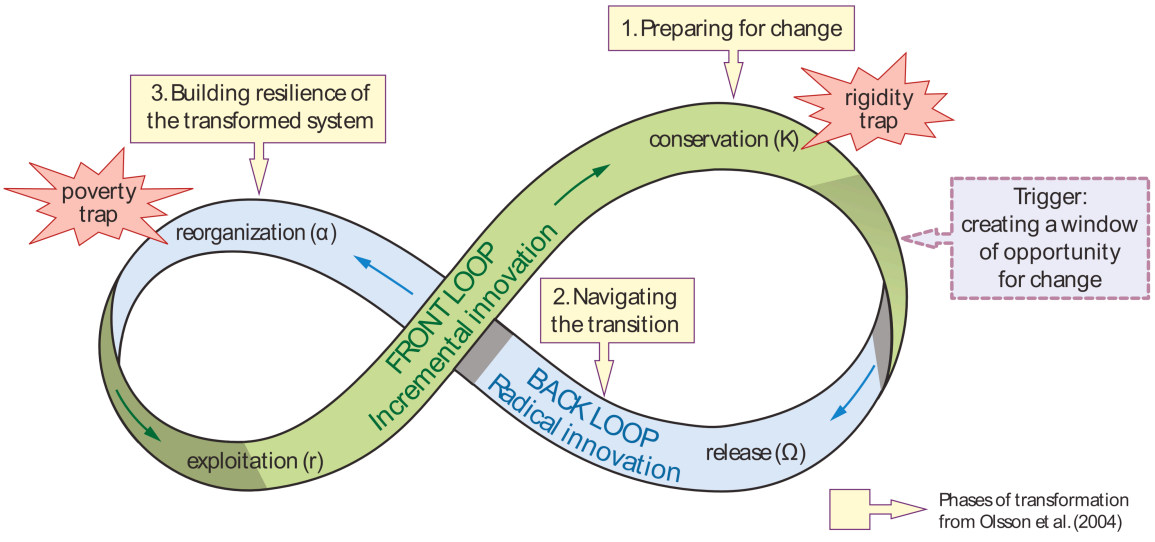
There are two ways in which a social innovation can grow, by scaling-out or scaling-up. When scaling-out takes place the replication and diffusion of an innovation spans across social boundaries and leads to its saturation. When scaling-up takes place the innovation is moved into a broader system where transformation is created by linking opportunities and resources across scales (Moore and Westley, 2011, p. 3). Success in social innovation merely increases opportunities and encourages the group or organization to continue scaling-up, as the innovation makes way for new opportunities for change.

Consider the diagram in Figure 2, which illustrates the dynamics of innovation in a given system. As is shown, there are two categories of innovation, incremental innovation and radical innovation. Incremental innovation consists of "improvements to existing ideas, products, or processes" (Biggs et al., 2010, p. 3). It boasts high success rates and low levels of uncertainty regarding outcomes. Conversely, radical innovation is the "development and adoption of new

combinations of ideas, products or processes that challenge or disrupt the broader institutional framework, whether it is social, cultural, political, or economic" (Biggs et al., 2010, p.3). With a radical innovation the chances of success are generally difficult to estimate and are accompanied by considerable opposition to the dominant ideas of the innovation. The heuristic tool suggests that both styles of innovation are necessary to accomplish change in an adaptive cycle. As highlighted in Panarchy, incremental and radical innovations represent slow and fast movements on various scales.

As is shown in the diagram, the front loop is where incremental innovation takes place that will strengthen the current system. The back loop is precipitated by a disturbance and creates an opportunity for radical innovation (Biggs et al. 2010, p. 3). While both incremental and radical innovations take place, it is the latter generally leads to a transformational change in the system. Although radical innovation is the desired type of innovation in achieving systems change, most innovation is incremental.

Figure 2
The adaptive cycle as represented through an infinity loop (Biggs et al., 2010, 4) highlighting the dynamic course of innovation.



Actors

The success of a social innovation largely depends on the strength of visionary leadership and the capacity for an individual innovator, group or organization to make the necessary connections with others and allow the innovation to have a broad impact. A clear and concise vision allows for a common focus to emerge between actors. "Leaders provide key functions for adaptive governance through trust, sense-making, managing conflict, linking actors, initiating partners between actor groups, compiling and generating knowledge, and mobilizing broad support for change" (Folke et al., 2005, p. 451). Alongside leaders, key individuals aid in the communication of the vision and ideas.

The roles that individuals perform vary in function and importance. While individual functions are important in achieving a durable social innovation, it is the connections between actors that generate an energy that is important in building momentum in the process of a social innovation. Momentum and network connections will carry an innovation across scales. "This energy is stirred by sharing a common idea and a common sense of purpose" (Westley et al., 2007, p. 131). Momentum carries an innovation across scales by transcending social or institutional boundaries and moving through networks of people and organizations that share similar interests or a 'common sense of purpose'. Cross-scale and cross-system conditions can create the right timing that will give the innovation, idea, product or process the chance to 'stick' (Westley et al., 2007, p. 207). In this way, the manner in which individual actors interact with each other determines the performance of the process of innovation (Rametsteiner and Weiss, 2006, p. 693). The connections generated through social networks and social capital are important in the dissemination, development, and adoption of any social innovation.

In the book *Getting to Maybe,* Frances Westley et al. (2007) outline the importance of working with 'powerful strangers' within the system that the social innovation is working to change. They postulate that one of the necessary and somewhat challenging tasks in bringing a social innovation to fruition involves gathering the power and resources that will lead to transformation. This is

considered a challenging task because it is power that determines the control of resources, an ability to maintain the status quo, and to make change, through the allocation of 'time, energy, money and social connections' (p. 95). This in short means that transformative social innovations also involve changing certain power relationships in an effort to redistribute power.

Westley et al. (2007) write about interacting with 'powerful strangers' in the context of processes of social innovation writing that as an innovation scales up and out the innovator will undoubtedly and eventually meet someone who holds a position of power within the system that the innovator hopes to change. This is a powerful stranger. Westley et al. argue that for a redistribution of power to take place, a degree of co-learning needs to take place between what will be the radical change and the powers that maintain the status quo. Acceptance of the innovation in the established institutions and organizations that already absorb most resources, allows the transformation to be "established in its own right" (2007, p. 95). As the established institutions absorb most available resources, it is beneficial to a social innovation to redefine what makes up the resources that are being released in the system. In this way, resources may include things that are already a part of the system, but they may also include the resources that can be created in relationship amongst themselves and others (2007, p. 136). Social networks and the connections between actors, leaders, and powerful strangers help to enable power and resources for change.

Capital, Networks, and Memory

The ability for a social innovation to scale up and out is dependent upon building connections because all complex systems are based on relationships. In ecosystems, it is the interactions between different organisms and abiotic entities that create ecosystem services and make up the ecological systems that are visible and tangible to the humans that live in and alongside them. This is to say that a whole ecosystem is built on the connections between the organisms and abiotic entities involved in

the ecosystem, the functions they perform and how they interact with other organisms, structures, and processes in the system and other inter-related systems (Norberg et al., 2008, p. 48). In social scenarios, the social connections that we make are essential in determining what we get done in groups and as individuals. In this regard, social capital acts as the glue for adaptive capacity and collaboration (Folke et al., 2005, p. 452). Social capital refers to the linkages within and between individuals through social networks and is the product of investing in social relationships.

Social networks are simply one form of social organization in which individuals or organizations are connected to one another by some form of interdependency. Networking language refers to the individuals in a network as 'nodes' and the relationships that connect those nodes as 'ties'. In general, social networks are important in their ability to enable adaptive responses by linking different actors and creating opportunities for new interactions, and learning experiences, all of which are important in dealing with uncertainty and change (Folke et al., 2005, p. 455). Therefore, within the adaptive cycle, social networks "play a key role in the dissemination of social innovations and sustainable change, thus increasing the overall resilience of human-ecological systems" (Moore and Westley, 2011, p. 1).

There are two types of network ties, which can affect the structure of a social network and its capacity to disseminate information and quickly mobilize actors. These are bonding links, which are considered strong ties and bridging links, which are considered weak ties. (Moore and Westley, 2011, p.3) Bonding links are the strong or direct links, such as familial ties or friendship. They usually take place within the network and absorb benefits into the network. Bridging links, however, extend outside of the network to and from people who provide a diverse set of resources. In regards to social problem solving it is the weak ties or bridging links that allow the introduction of new ideas into a small social circle. Bridging links "span social gaps to mobilize cooperation among diverse stakeholders who cannot solve the problems by themselves" (Brown, 1992, p.1). In this way although bonding

links are necessary in building trust, bridging links are important in the process of scaling-out.

There are many different types of social networks, which are determined by the various reasons for their formation. Collaboration networks materialize when a network forms out of a group of individuals or organizations with the purpose of a common effort. “Collaboration networks can provide an arena where social capital is enhanced and where concerns are reformulated to generate innovation and nurture renewal in times of organization” (Folke et al., 2005, p. 451). The IAFN is a network built on collaboration in which all of the members are connected in the common cause of restoring ecosystems and biodiversity, as well as strengthening human well-being through research, knowledge exchange and the implementation of the AF system (International Analog Forestry Network, 2011, en/international). The inter-organizational collaboration in the case of the IAFN creates a more adaptive style of management that is open to feedbacks and learning by providing accessible information and opportunities for practitioners to share knowledge and experiences.

The collaborative network style, as seen in the IAFN, is beneficial for storing social memories (Olsson et al., 2007, p. 10) and accumulated experience, which can be drawn upon in strategic planning and times of crisis. Hahn et al. (2008) describe social memory as important in the process of adaptive management for many reasons, but primarily because it allows for past experiences to influence future policy. Social memory is a significant part of the cultural capital in societies, as it provides analysis of social capital (p. 139). Essentially, social memory allows for reflection on experience and when drawn upon can provide new solutions to ‘old’ problems. As human systems have the unique ability to predict future scenarios, social memory can aid in the creation of new policies to deal with issues by learning from past mistakes. In this way, social memory in conjunction with social learning allows for flexible and adaptive responses. Both flexibility and adaptability are important in times of ‘crisis, renewal, and reorganization’ (Hahn et al., 2008, p. 140). The key to utilizing such memory is allowing innovation to work alongside it.

Case Study

Profile of a Social Innovator

The following section briefly outlines one main actor involved in the formation of the IAFN and the creation of the AF system. Some of the different types of actors involved in the process of social innovation include: social innovators, social entrepreneurs, knowledge brokers, networkers and facilitators, visionaries, knowledge carriers and retainers, interpreters, sense makers, and inspirers (Folke et al., 2003, p. 368). Although the following profile is connected with one influential actor in the IAFN, it must be noted that it is possible for an actor/individual to hold the characteristics of many of the different types of actors and to amplify those specific characteristics at a certain time to fulfill a role that is needed. It is also important to note that a diversity of actors involved in the process is necessary.

The characteristics of a social innovator are found in a person, who sees a problem that they are compelled to solve. They create, carry, and share their vision. A social innovator is the type of person who will pull together or create new organizations, groups, and networks to facilitate collaboration and innovation generation in order to solve perceived social challenges. The social innovator is a driver of the process of social innovation and characteristically follows a process of learning by doing to find a solution, strategy, or innovation that 'sticks' (Westley et al., 2007). Driving the process of social innovation begins with gaining an in-depth understanding of the issue to determine the best way to address the problem at hand. This leads to purposeful action. By gaining an understanding of the situation and system that is causing strife and discontent, the social innovator is better equipped to determine "what scope of change is needed, and in so doing, they encounter the entrenched powers that benefit from and hold in place the existing system – the very system they want to change" (Westley et al., 2007, p. 25). This enables meetings with 'powerful strangers', which in turn can create influential social connections, which

can then lead to encounters and experiences that help to release critical resources (Westley et al., 2007, p. 25). Social innovators highlight the connections between the systems as a whole and the social problem that they hope to solve. They then begin a process of feedback learning or 'learning by doing', experimenting with different strategies and linking important actors together in the process.

Ranil Senanayake

Ranil Senanayake is the founder of AF. When asked his role in the formation of the IAFN, Senanayake self-identified as a facilitator (2011d). After looking at the different types of actors involved in social innovation, it is clear to see that Senanayake encompasses the characteristics of various actors. He is a visionary leader, a knowledge broker, a networker, and a facilitator. This profile seeks to highlight how the combination of the above character traits make Ranil Senanayake is a social innovator.

Senanayake saw that the current approach to large-scale forestry had detrimental impacts on the environment, specifically that it could lead to "a global disaster in terms of biodiversity conservation and climate equilibrium" (2011b). His discontentment with this scenario led him to gain a clear understanding of current forestry methods in monoculture and tree extraction from natural forests in Sri Lanka, all the while taking note of similar techniques and processes taking place on a global scale. Senanayake started the non-governmental organization the Neo-Synthesis Research Centre and was able to develop the AF method through a pilot project in the late 1970s. AF was developed based on a local Sri Lankan practice of forest gardening, which was refined through the application of ecological science and offered a solution that could be adopted and adapted in different locations of the globe to the mitigate against the perceived potential loss of biodiversity (Senanayake, 2011e). Senanayake's vision and passion led him to build connections with other innovators, knowledge brokers, and social entrepreneurs. These connections allowed the AF system to scale-out and encompass an international

network of individuals and organizations that carry an interest in and practice the AF technique across the globe. Strong and visionary leadership and the capacity to build on social capital is thus directly linked to the success of a social innovation.

Historical Context

> "It's impossible to understand a system without considering its history, as well as its social and political contexts"
> (Berkes et al, 2003, p. 8).

Forestry issues are as diverse and complex as forest systems themselves. Like the different types of forests, forestry issues span across scales, both temporal, regarding growth cycles, and spatial, from the North to the South, from rural and indigenous communities to urban cosmopolitan centers, and everything in between. Concern for natural forests, the resources they provide, the environmental services they support, and their management emerged when their scarcity increased (Mather, 2000, p. 26). This concern became most visible in the 1980s and is reinforced with the idea of sustainability, introduced in 1992 at the Rio Summit. Deforestation, degradation, and forest loss have since dominated the drive for sustainable resource management practices.

The North-South Dimension

The North-South dimension is a geo-political delineation used to describe resource allocation and socio-economic differences. However, referring the to 'global' North-South is arguably more representative of vulnerable populations that are effected by forest management policies, processes, and practices at local, national and international levels. These vulnerable populations exist in different capacities in the North and South, take different forms, are connected to different economic and

resource management systems, but are nonetheless part of the same predicament that is being addressed in this paper regarding forest resources and resilience.

For example, the declining forest industry in Canada has created a vulnerable population in those communities that were dependent upon pulp and paper mills and logging as their primary industry, source of employment and income. As other countries have begun to replace Canada in the market of tree and forest resources many forest-based economies and communities are left vulnerable and closer to poverty, as the industry is in decline. In the South, in Sri Lanka for example, vulnerable communities are more likely to be dependent upon the actual living forest for their livelihood, food and fuel resources, the drivers behind the subsistence ethic. However, in these communities it is common to deforest to make way for agricultural land despite dependency, as well as to log timber illegally to fill a niche in the international market. These descriptions mark a mere portion of the complexities that encompass forest management across the globe, highlighting that the issues cross-scales and that the vulnerable communities worldwide deal with similar problems and challenges. This paper will show how some people are working successfully to overcome these losses of resilience in forest communities in both the North and South through adaptive strategies, networking, innovation and cooperation.

What is being expressed through delineations of the global North and global South in this context are core-periphery relationships, in which the global South is proximate to the periphery and the global North make up the core. Vulnerable populations are mostly located along the periphery, thus considered the global South, and so are those that experience the negative social, economic and environmental effects of certain forest management policies, practices and processes.

The global North-South delineation alongside core-periphery relations reflects the patterns of timber extraction and the movement of timber and wood products around the world. The global North-South dimension emerged from colonization, reinforced core-periphery relationships, and defines the demands of consumption and production in the current international economic system.

For the core (North) to continue to provide its consumers with increasing quantities of goods, it continues to seek new resources from peripheral regions (South). The historic core/periphery relationship in the forestry sector can be seen in the colonial plantation system and through the presence of foreign-based and trans-national corporations.

Globalization facilitates economic and political interactions between nations, organizations, and individuals from different parts of the global North and South. Amidst the context of the globalization of natural resources, conventional forestry, and industrial farming techniques have been criticized for their inability to effectively address the dynamic complexity of natural resource issues and systems. While this research paper looks at the formation of the IAFN, it is important to look back at the historical contexts that have formed the current situation in which the AF system and the IAFN exist today, as the conventional and alternative methods, although brought about by the same history represent to different, overlapping spheres in the system. The AF system was developed as an alternative in forestry, a method in silviculture and agroforestry, as well as a technique in biodiversity restoration on degraded lands. AF originated in Sri Lanka and is largely implemented in regions with tropical forests. However, the AF system recognizes the relationship between the global North and South and now with the IAFN as an international entity, is working to build bridges in forest management and restoration in the global North and South.

Forest Transitions

Alexander Mather (2000) uses the concept of forest transitions to explain the North-South dimensions tied to the social-institutional system of forestry. The concept of forest transitions follows that economic development influences the contraction and expansion of forest cover. The 2011 *State of the World's Forests* report showed that rates of deforestation and forest loss from natural causes remain high, even though forest loss has slowed down in recent years. It reported that most deforestation and

forest loss takes place in tropical regions, while afforestation and forest gain take place in temperate and boreal zones and within emerging economies (p. 3).

This data strengthens Mather's case on forest transitions in that within a pre-industrial forest the products are diverse and the forest is generally a common resource. In an industrial forest the primary objective is wood production and is generally under private control. In a post-industrial forest, conservation and recreation become greater priorities and so weaken wood production management (2000, p. 27). Each stage of industrialization and development thus has different impacts on the forest cover. This breakdown of the forest transition serves to highlight the North-South dimension in which there is an increasing role of industrial forests in the global South, while a post-industrial forest paradigm has been established in the global North (Mather, 2000, p. 25). This coincides with *State of the World's Forest 2011* data. Deforestation thus occurs to make way for agriculture, industrialization, and economic development in the global South, while the already established global North experiences an increase in forest area through reforestation, afforestation and conservation.

Despite the dependency of rural communities on "the biodiversity, ecological processes, and ecosystem services provided by tropical and sub-tropical forests, it is precisely these areas where forest cover is fast disappearing" (Nagendra, 2007, p. 15218). Large tracts of tropical forest are cleared daily to make space for agricultural ventures because the clearance of forest allows for the creation of new and private goods. Forest clearance is necessary in these cases as private goods like cattle pasture and crop cultivation are not originally found within forests (Humphreys, 2006, p. 19). Monocropping is generally the preferred method of planting to maximize the yield of the most economically valuable product. However, this practice degrades the land and decreases biodiversity. "The destruction of forests results in biodiversity loss, both directly by killing individual species of fauna and flora and indirectly through habitat loss. It causes soil erosion, the degradation of watersheds, the loss of places of local cultural and spiritual significance, and the destruction of other public goods" (Humphreys, 2006, p.21). However, reforestation, afforestation and plantation forests are contributing to increases in forest areas

across the globe, although the ecological benefit and levels of biodiversity found in plantations remains a topic of debate.

A Brief History of the Conventional Forestry Method

In writing about the sustainable development and the trade of tropical timber Jeffrey Vincent (1992) suggests that, "international timber prices reflect the commercial value of tropical wood -- not the diverse values of tropical forests as sources of biological diversity" (p. 1651). This is reflective of the industry and market whereby "the major context of forest policy is conservation and protection with industrial wood as the product" (Steppler, 1987, p. 18). However, Mather (2000) suggests "the forest is increasingly valued as an environment, rather than simply as a source of wood" (p. 27). There are two explanations for Mather's point, that in the West public perceptions are changing and that forest transitions are taking place. In either case, the emerging prevalence of valuing diverse forest products is also reflective of how conventional forestry methods seem disconnected from complex systems thinking and broad or ecological valuation schemes. To make up for the lack of flexibility and the need to account for non-timber forest products (NTFPs) and resources and the impact forests have on ecosystem services, there has been an expansion in methods of forestry and many alternatives have emerged. These include methods such as selective harvesting, agroforestry, permaculture, sustainable forestry and AF.

After the Enlightenment era, science and rational thinking dominated resource management. Forestry grew out of the 18th century German quantifying age and the science of tree resources. It is this scientific background that has constructed much of the current management practices and policies that exist today. Scientific forestry was introduced by the West and focused on mathematics and science to quantify a maximum sustainable yield of mostly timber and to increase production and economic benefit.

The forest sciences were based on standing volume-regeneration, which provided continuous production. Methods were devised to estimate the mass of wood and "plans for cutting and replanting were developed in order to maximize yield while maintaining a constant level of productivity" (Ciancio and Nocentini, 2000, p. 48). Tree plantations have since become a staple segment of conventional forest management. So much so that "highly managed forests, such as timber plantations in North America and oil-palm plantations in South East Asia, have also replaced many natural forests and now cover 1.9 million km^2 worldwide" (Foley et al., 2005, p. 571). Not coincidentally, the first large-scale rubber plantations were in Sri Lanka where the AF system was developed. The purpose of what are known as Industrial Tree Plantations (ITPs) has traditionally been "to produce, as quickly as possible and at competitive prices, high volumes per hectare of typically one product" (Gerber, 2011, p. 166). ITPs became more common alongside the Green Revolution of the 1960s, as plantations allowed forests to be cleared to make way for agricultural land, while partitioning areas for timber production.

The plantation forestry that had been exported to the colonies was not always the preferred method of management by local inhabitants. The colonial appropriation of forest timber plantations destroyed some traditional management regimes and set off widespread peasant uprising in South Asia (Gerber, 2011, p. 167; Humphreys, 2006, p. 7). The loss of resources, fuel and fodder, and ecosystem services led to deforestation and the contentious behaviour of peasants. The main causes of most ITP conflicts are related to the "large-scale occupation of state land customarily used by local inhabitants" (Gerber, 2011, p. 173). Touching on issues of land tenure and poverty, the establishment of ITPs takes place with consequence to local proprietors and indigenous peoples, so that the subsistence ethic is apparent and leads to deforestation and forest degradation (Gerber, 2011, p. 170). As in the South Asian example, the vulnerable populations first express their malcontent with the system through protest and uprising. When they are unable to achieve transformative change through those measures they fall into a cycle that perpetuates unsustainable resource use and environmental degradation. The

history and politics of plantations highlight the social dynamics and global North-South power dynamics that are involved in forest management.

Other negative implications of ITPs include lowering net biodiversity, removing ecological goods and services, and the introduction of pesticides and agrochemicals that accumulate in water and organisms. Recognizing the prevalence of plantation forestry in the industry and in converting the forests of the globe into constantly productive woodland gardens means that it is imperative to address the importance of biodiversity, which decreases as ITPs increase. Although plantations can serve as one way to recover forest land, they cannot fully substitute the levels of biodiversity found in natural forests or their function as carbon reservoirs (Palo and Vanhaned, 2000, p.3). High levels of biodiversity are not only beneficial ecologically, but they can also be beneficial to economic activity. Biodiversity leads to diverse provision of NTFPs and resources, opportunities for eco-tourism, integrated pest management, pharmaceuticals, bioremediation, and ecosystem functions and services (Lovejoy, 1994). High levels of biodiversity thus provide many economic and social benefits.

Impacts of the Green Revolution

The Green Revolution that took place around the 1960s was financed by and received its managers from "the Ford and Rockefeller Foundations, the Development Advisory Service, the World Bank and USAID" (Cleaver, 1972, p. 177). It developed from the expert research exploring ways to enhance the productivity of those major agricultural crops and animal production in developing countries, mostly in the tropics. It generally focused on the monoculture production of major agricultural crops and in doing so set aside land for forest plantations, which allowed natural forests to be cleared for use as agricultural land. The Green Revolution succeeded in increasing crop harvests and grain output in the developing world (Foley et al., 2005, p. 570), which in turn ceased hunger for many.

Alongside the positive aspects, the Green Revolution placed heavy emphasis on the use of mechanized technology, fertilizers and other costly inputs. The method of monoculture cropping was contrary to the more common cultivation of mixed stands, which often included tree species and was practiced by most of the rural poor. These are two examples of negative socio-economic implications that the Green Revolution had on the rural poor, which consequently led to a change in the focus of forestry and agricultural methods.

In many areas, the agricultural method of maximum production differed greatly from traditional practices of the rural poor that diversified yields. This made the technologies promoted through the Green Revolution inapplicable, while the costs of the fertilizers and mechanization were too high and thus inaccessible to the rural poor in developing countries (Nair, 1993, p. 7). As the socio-economic inadequacies of the Green Revolution were recognized by a number of experts and policy-makers, there was a renewed interest in concepts of intercropping and integrated farming systems. However, this interest in no way flipped the dominant management approach. As a consequence of this expert interest, social forestry and other alternatives to the scientific and reductionist methods of economic resource maximization emerged and were tested.

Social forestry initially appeared as a program from the World Bank (WB) in response to the negative effects that the Green Revolution had on the rural poor of the developing world. The goal was to increase food production, while conserving the environment. Concerns of deforestation and environmental degradation had sparked research into approaches of land-use that encouraged 'sustainability of the production base', while encouraging the production of multiple outputs (Nair, 1993, p. 6). Social forestry is "the practice of using trees and/or tree planting specifically to pursue social objectives, usually betterment of the poor through delivery of local benefits to the local people" (Nair, 1993, p. 17). This is significant to the emergence of AF as a method of land management because whilst it is a technique in sustainable resource management, AF as a social-ecological system is concerned with strengthening rural communities socially, as well as economically. AF achieves this partly by offering a solution that employs a synthesis of local knowledge with

scientific process and information. This shows that the AF system constitutes a broad management approach, in that it is a social-ecological system, a method in agroforestry, silviculture and biodiversity restoration, and can be characterized as an approach in social forestry.

Analog Forestry

A background understanding of the practical aspects of the AF system is important because it shows the contrast to conventional methods of forestry and agriculture. This helps to show how the AF system is an alternative to the conventional practices of logging, clearcutting, monocropping and that as a social innovation it actively works to address the social, economic, political and ecological contexts that lead to deforestation and biodiversity loss. In examining the diversification and scaling-out of the AF system, a deeper understanding is gained about the importance of the formation of the IAFN.

AF History

The AF system functions first as practice in biodiversity restoration by restoring the biological and ecological diversity of landscapes that have been degraded due to exhaustive agricultural practices and deforestation. While AF is a system of silviculture, it is also a method in agroforestry. Agroforestry is a land management system that produces both commercial forest products and agricultural produce (Steppler and Nair, 1987). As a social-ecological system, AF works to build healthy, vibrant tree-dominated ecosystems that will support human systems, specifically strengthening rural communities in a sustainable manner through the provision of marketable products (International Analog Forestry Network, 2011, \en\analog_forestry). It achieves this by combining the values of local forest biodiversity with marketable organic crop cultivation (Both Ends, 2006).

In the practice of AF a degree of modern scientific data is necessary, while information and indicators of ecosystem health and biodiversity must also be derived from traditional local knowledge (Senanayake, 2008, p. 7). In this way, the AF technique emphasizes the importance of traditional knowledge in local land management. One challenge to the implementation of agroforestry is ensuring the practitioner has a full understanding of the various dimensions of the forest, the farm, and the animals involved (Steppler, 1987, p. 19). AF tackles this challenge by incorporating the local and cultural knowledge of the area where AF is being implemented alongside scientific data. This is also one capacity in which the AF system includes the direct participation of vulnerable populations and rural forest farmers and it ensures that there are many local expert practitioners.

The AF system transcends national scales and is practiced in different locations across the globe. Each location has its own social and resource history, ecological understanding and biological diversity. In this way the AF system as discussed here speaks to the general methodology as opposed to focusing on one specific location where it is practiced. AF is not a fixed formula. It seeks to restore ecosystems according to the harmony of each site and thus functions from a synthesis of ecological science and traditional knowledge (Arnold, 2011b). This is contrary to the homogenized approach used in conventional forestry methods, models and monocultures.

AF addresses the ecological and social weaknesses of conventional disciplinary-based scientific forestry and agriculture. These large-scale methods that optimize production through monoculture plantation and technological, as well as chemical inputs, have shown great weakness in addressing 'social issues' while contributing to biodiversity loss and environmental degradation. As seen through the Green Revolution, the agricultural techniques introduced increased product output to the effect of safeguarding against famine. However, without addressing the complexity of the situations that lead to famine and poverty, the Green Revolution inadequately addressed the contributing social issues. In this regard, AF is a response to a concern for global biodiversity loss instigated by current large-

scale forest management approaches that decrease forest diversity by favoring single species plantations (Senanayake, 2011b).

In essence, the AF system is fundamentally different from conventional methods of forestry in 4 ways: a) AF seeks to create tree-dominated ecosystems, which mimic the "architectural structure and ecological functions of the mature local ecosystem" (Senanayake, 2011b; International Analog Forestry Network, 2011); b) AF follows a complex, diverse and uneven-aged tree planting system and practices the selective harvesting of timber and non-timber forest products and resources; c) AF deliberately involves rural communities, farmers, and people engaged in restoration to use species that will provide marketable products (Arnold, 2011a); and d) the AF design can be suited to fit a farmer's specific needs in a variety of ways. Some examples include the selective harvesting of wood products, provision of an assortment of agricultural goods, ecotourism, and carbon productions (Bekins-Faries, 2011a). It is in these ways that AF engages vulnerable populations and instigates transformation by addressing the interconnection of ecological systems with social, as well as economic systems.

Scaling up and Out

By 1987, Senanayake and the NRSC developed a certification scheme to match the Sri Lankan AF circumstances and in 2005 had built upon it to develop international standards. Although the original Forest Garden Products (FGPs) were developed specifically for the Sri Lankan case they provided a foundation on which to create the international standards, which have an accredited certifying agency and have trained inspectors to use the standards.

The original FGP certification sought to open greater markets for the forest farmer's goods while providing a means of evaluating the evolving analog forest practices. The products and goods came from certified Forest Gardens, which were originally "developed to rehabilitate Sri Lanka's landscape, build its soil fertility, boost annual incomes, enhance and diversify subsistence-level crop production and

strengthen appropriate traditional land management practices undermined by decades of extractive natural resource policies" (Becker and Goldman, p. 73). The focus on land and ecosystem rehabilitation was a result of conventional and 'colonial' forest and agriculture techniques. Sri Lanka had been devastated by deforestation, seen the introduction of high-input monoculture crops, and suffered low agricultural yields. The introduction of Forest Gardens provided the rural poor with a viable alternative to "destructive high-input agricultural practices and encroachment on protected forest areas" (Becker and Goldman, p. 73).

The standard for FGP states that the forest habitats must be managed under a strict organic production basis. This means that the application of pesticides, fungicides, herbicides and artificial fertilizer is prohibited. This organic production base helps to quickly build up ecosystem biomass on the degraded lands (F.G.P. Inspection and Certification (Pvt). Ltd., 2011). Certified FGPs are collected exclusively from the forest habitats nurtured by the AF technique. In this way, consumers of certified FGPs "contribute to a change in the lifestyles of tropical subsistence farmers and help reverse the trends in tropical rainforest habitat destruction" (F.G.P. Inspection and Certification (Pvt). Ltd., 2011). The IAFN monitors the certification standards. 2005 was the year that marked the approval of the revised certification standards that make up the international standards that are still evolving. The change was made to encompass a larger base and reflect the growth of the AF system. Currently the international certification standards are working on meeting equivalency norms that will bring the standards up to date with the European Union (EU) norms. To do so economic, social and environmental criteria has to be met (Bekins-Faries, 2011c).

From 1987 to 2005 many changes and evolutions took place within the AF system. Advancing from humble beginnings as research plots and projects for an ecologically friendly method of agroforestry and biodiversity restoration, the AF system became an internationally recognized methodology within the context of land management for the protection of biodiversity in 1994. This took place at the UN sponsored Open-ended Intergovernmental Meeting of Scientific Experts on Biological Diversity. At this time AF was being practiced in Sri Lanka, Canada, Costa

Rica, Ecuador, and Peru. There was obvious momentum between actors at this stage because it was within a year the main organizations formed the IAFN and thus began the process of formalization.

The International Analog Forestry Network

The IAFN was formalized in 1995 to meet the needs of AF practitioners in knowledge sharing and training, and to account for growth in the number of practitioners and the areas where AF was being implemented. There were five initial parties present in the creation process, which culminated at a conference in Sri Lanka. These organizations were Falls Brook Centre (FBC - Canada), the Neo-Synthesis Research Centre (NRSC - Sri Lanka), Arbofilia (Costa Rica), Fundacíon RainForest Rescue (FURAR - Ecuador), and COICAP (Peru) (International Analog Forestry Network, 2011, /en/history). The network has since grown to include about 36 international member organizations and about fourteen individual members under a mandate to "maintain an exchange of knowledge, experience, and up-to-date information between groups interested in learning, promoting, and applying an AF system in their own area" (International Analog Forestry Network, 2011). Since inception the IAFN has continued scaling out to build programs in AF around the world.

Prior to the 1995 network formation the AF system had been going through processes of research and development, implementation, and growth, essentially moving through the adaptive cycle. In the beginning there was no formal connection between practitioners of the AF system and so some form of governance was needed. The formalization of the network addressed the need for practitioners of the AF system to share knowledge and best practices and provided a way for others who wanted to get involved to do so (Arnold, 2011b). In this way the formalization made the IAFN a referent organization for those who were already practitioners and those who were hoping to learn more. The formation of a referent organization was a necessary step in building system resilience, as it provided an 'internal structure'

and some 'social shaping of boundaries' (Westley and Vredenburg, 1997, p. 381). The referent entity provided a central and foundational point upon which the network nodes or practitioners refer.

The formalization process also helped to establish regulation, future planning, and the systematic mobilization of resources. In creating organizational regulation, there were principles instituted on membership through the creation of criteria and an application process. The formalization process also established some base values of the IAFN and structuralized the allocation of power (Westley and Vredenburg, 1997, p. 381). The base values that were established in becoming a formal referent organization helped to present a clear vision and defined what its members aim to do. In turn this enabled purposeful action to take place between individual members and member organizations in a common effort, which consequentially allows the AF method to scale-out, to be adopted by more practitioners and to have support from the IAFN.

The formalization process also allowed for the mobilization of resources and communication tools like the website, which permits internal and external communications. In this way the IAFN provides a central location to store knowledge, technical information, experience, and the social memory of the network of practitioners. These are all things that an AF practitioner can draw on in a time of need or crisis. They are things that recall social memory and employ co-learning and feedback learning, which strengthen the resilience of AF on many levels; locally for the individual forest farmer finding solutions to issues on the ground, as well as institutionally for the IAFN to be able to have political influence.

Between 1996 and 2005 there was a momentum that followed the creation of the network, which saw workshops, training sessions, and international meetings take place to clarify the goals and future activities of the IAFN. Members were committed to widening the network's impact and "to develop replicable models of sustainable resource management based on traditional methods" (International Analog Forestry Network, 2011, /en/history). In 2005 there were major developments in the certification standards of FGP transferring them from being specific to the Sri Lankan situation to the adoption of an international scope. The

IAFN continues to monitor the international certification standard, which is constantly evolving. At the time of writing this paper, the standards were in a process of making the equivalencies necessary to meet European Union (EU) norms by harmonizing with other organizations. Consequentially this inter-organizational collaboration has contributed to increases in the membership and scaling out of the IAFN (Bekins-Faries, 2011c). The continued training of AF accredited professionals will add to the bank of experience already stored in the IAFN. The ingenuity of the members of the IAFN and the AF practitioners will determine the how the methodology will continue to spread out and up across scales.

The formalization process continues in 2011 as the IAFN moves from infancy to childhood through the creation of an international secretariat, which will see the world centre for the IAFN located in Quepos, Costa Rica. Through this process the IAFN has been legally registered as a non-profit organization. Some of the areas within the IAFN that the secretariat aims to improve include communication, new membership, and translation (Bekins-Faries, 2011c). These improvements have also given the IAFN an edge when interacting with other players in the field. It allows the IAFN to engage with powerful strangers and redistribute necessary resources. The establishment of the secretariat was made possible by a contract of 42 000 euros in which CORDAID.org has partnered with BothEnds to manage the funds (Bekins-Faries, 2011c). This partnership and funding support is important to the power dynamics that are prevalent within the structure of the IAFN along with the North-South dimensions present within the socio-economic situations that AF aims to improve alongside biodiversity restoration.

In an interview with Chairman of the IAFN Milo Bekins-Faries, he expressed that the partnership between CORDAID and BothEnds and the role they are performing by handling the funds are important in bridging 'the North-South divide'. Financial barriers were identified as the principal hindrance for rural farmers to adopt of the AF system. A forest farmer has to put in a significant 'investment of blood, sweat, and tears' to build the forest system that after a couple of years of growth will begin producing the biodiversity that permits an economically viable diversification of the farmer's agricultural product. Milo

articulated that given the social-economic situations of the North and South it was more of an obligation of Northern NGOs to support the South financially, if only by searching for money that could be transferred from North to South through projects or otherwise by granting funds to the IAFN to be distributed accordingly (Bekins-Faries, 2011c). This is an example of the power dynamics and the North-South dimensions within the IAFN and how they contribute to the functioning of the system itself. Although all member organizations commit to expanding the IAFN, and to sharing knowledge and expertise, generally financial resources come from the North. These North-South dynamics represent one way in which AF has scaled up in its processes of social innovation.

Power Dynamics

The formation of the IAFN as a formal, legal entity is beneficial to the AF system as it allows members to enter a space where they are more likely to meet powerful strangers. The power stuctures that exist in the social-institutional system of forestry at present include, but are not limited to: land tenure, public forest resource-use, patterns of consumption, and the economic structures that favour large farms over small-scale ventures. The AF system as a methodology in forest management and restoration, confronts these power dynamics on various scales, while working to redistribute power to the rural poor, who then perform ecosystem restoration and work to increase human well-being by providing marketable products from the forest and creating a vibrant environment.

Elaborating on the aforementioned power structures, which are in themselves connected across scales, means taking a look at how forest management has changed. Before the creation of the modern state, "most of the world's forests were either common property resources or open access regimes. Now most of the world's forests are controlled by a government agency on behalf of the state… which has tended to adopt a utilitarian approach to forests as revenue sources" (Humphreys, 2006, p. 9). In many instances forestry initiatives are thus developed

through government-sponsored projects or by private concessions on state land. These initiatives are commonly developed using methodologies that support monocultures and plantation regimes to maximize wood product profits, while ignoring the value of NTFPs or the ecosystem services a forest maintains. Generally what is ignored are the impacts of these initiatives on the communities that live beside or within these forested areas and their use and relative dependency on the forest resources. "Making state lands available to private or state-owned plantation companies has threatened local livelihoods through the ban on ecosystems that were customarily used as de facto commons and through their subsequent destruction and replacement as monocultures" (Gerber, 2011, p. 170). The AF system works to combat these socially and ecologically destructive scenarios by restoring the degraded and deforested lands, all the while addressing the socio-economic needs of the local communities. AF allows the practitioner, whether it is state forest company or rural farmer to demonstrate environmentally and economically beneficial practice that can be adopted anywhere in the world and will not have the same socially and ecologically detrimental impacts as the conventional utilitarian approach.

AF works to re-engage vulnerable populations by integrating their participation into the management system and allowing them to directly benefit from the marketable goods produced by the forest. However, this type of small-scale, local management is generally resisted by those with power out of fear of revenue loss. In this regard, some political lobbying is needed to convince those in power of the benefits in changing the status quo. This could include reorienting government subsidies away from ITPs and directing them towards community and small-scale forest management (Gerber, 2011, p. 174). The IAFN thus must also work with a somewhat political capacity to integrate the AF methodology into national forest management policies, reforestation initiatives and restoration endeavors.

Chairman Milo Bekins-Faries is confident that the establishment of the international secretariat will aid the political influence of the IAFN in demonstrating "how AF could be used in the governmental policy of any ministry of agriculture"

(Bekins-Faries, 2011c). The political influence of the IAFN thus involves "not changing, but allowing governments to see the value of AF and to use it as the methodology for restoration" (Bekins-Faries, 2011c). As an example, there has been an AF program taking place in Cuba in partnership with FBC since 2008. The project is restoring land in the province of Guantanamo. The IAFN and participating communities collect the necessary economic and environmental data of the program and present it to the government, who then judge the results of the program on the community (socially), for the farmers (economically) and on the land (ecologically) (Bekins-Faries, 2011c).

The Guantanamo project has been successfully integrated into the 'empresa forestal', a state owned forestry company, in Guantanamo and is used as an example to demonstrate the value of the AF system. There are 21 of these state owned forest companies in Cuba. Their forest management control is not determined by provincial delineation, but instead by areas of land. They control approximately 62 percent of the standing forest and have significant influence on reforestation and restoration initiatives (Dirección Nacional Forestal Ministerio de la Agricultura, 2010). As a result of the Guantanamo project the AF methodology is transported to other parts of Cuba to restore degraded lands through the various empresas forestales.

The AF international certification standard is another way that the IAFN is confronting power relationships. The international standard can guide the creation of environmentally sound policies that address the North-South dilemma involved in patterns of production and consumption and target consumerism by directing forest production and consumption away from plantation products. Aaron Becker (2011), Vice Chairman of the IAFN shared a story of a success in the adoption of the AF system and Forest Garden model to meet social-ecological objectives in special use forests (SUFs) in Vietnam.

Becker worked with the WB and the Vietnam Ministry of Agriculture and Rural Development's Forest Protection Department (FDP) on a program called the Vietnam Conservation Fund (VCF). The VCF was focused on protecting SUFs that demonstrate high biodiversity, while creating social safeguards. To do so, VCF

looked at the development of benefit-sharing mechanisms (BSMs) like a collaborative management with the community playing a role in forest protection, while also allowing the community to benefit from resource-use in the SUFs. In this specific case, the AF model of FGPs was applied to three ethnic minority community nurseries and "negotiated the sourcing and development of analog forest NTFPs" (Becker, 2011). The implementation of AF demonstrated SUF protection and the benefits acquired by households in the three communities. Thus, AF was implemented as a social-ecological system because of its dual focus. In this way it was adopted as a strategy to strengthen SUFs ecologically, and also to meet the focus of the VCF program in creating social safeguards by providing marketable products and services.

However, the process of fully adopting the AF method in these communities and transferring it to others was not over yet. Becker recounted that "despite ongoing encroachment of communities into protected areas, Vietnamese law still did not permit/afford communities that type [the AF style of management] of official and pro-active management role in state protected forest land" (2011). Although the AF system through the Forest Garden model provided the capacity to meet the social-ecological focus of the VCF, national law obstructed the process and required the revision of national forest law and use to allow the proximate community members to benefit economically from the forest management and use. A true success story, the VCF worked to draft a new policy, which was later approved by the FPD and endorsed by the Prime Minister. As a result of this AF initiative "BSMs are now permitted on a limited and trial basis in some SUFs in Vietnam" (Becker, 2011).

This success story is representative of incremental changes to the conventional methodology of forest land management. On a local level the policy change can represent a disruptive change in that it allowed a significant change to occur in the land-use of SUFs in Vietnam. However, the social-institutional system of forestry was not disrupted, nor tipped into adopting a new methodology for management practices, nor was the alternative method in forestry adopted and diffused through the forestry management system as a whole. In this regard, this

success story represents one step or stage in the AF system's process of social innovation.

Conclusion

Forest systems are complex and the management regimes that accompany them should reflect this complexity. Adaptive management techniques and ecosystem management are the most appropriate method of resource management to compliment the complex systems or parts of those systems that they attempt to manage. Without being rigid, adaptive management strengthens resilience and can effectively reduce the social, economic, and environmental risks that accompany many reductionist scientific approaches. In this way, integrative scientific approaches that account for local populations and resource-users help to create more resilient social-ecological systems.

Social innovation has the capacity to address social challenges in an integrative way so that the economic, political, and environmental effects and influences are considered alongside the social. The way in which people can materialize their ingenuity helps determine the resilience of the system that they are working within. The AF system was initiated in response to the social, economic, and ecological deficiencies brought about through the historical contexts and existing social-institutional system of forest management. The conventional methods in forest management are perceived to be detrimental and destructive to the environment and would lead to economic challenges, which create social instability and lead to crisis or perfect storm scenario. The AF technique effectively addresses each of these concerns through the restoration of biodiversity on degraded lands and by providing forest farmers with a diverse range of marketable products, which works towards sustaining communities socially and economically.

The formation of the IAFN helped the AF system to scale-out and up, so that it has been adopted by more individuals and organizations and influenced broader change. Formalizing the network was the best option for the actors of the AF system

in solidifying trust and collaboration, providing a foundation for communication and creating a central place to store the social and institutional memory, social capital, practical AF knowledge on implementation. The formation and gradual yet continual formalization of the IAFN has been necessary in strengthening the resilience of the AF system, as it sets up a structure to guide those involved and those who wish to become involved.

The IAFN effectively aids practitioners and social innovators by broadening communication across scales. An abundance of NGOs exist, as seen in the diverse membership of the IAFN, and they are each working on scaling-out and scaling-up to achieve more integrated sustainable economies and livelihoods, which can lead to sustainable communities. The capacity for the network to link to these other 'like-minded' organizations and individuals gives the IAFN more bridging links to draw on in times of crisis, reorganization or renewal. The intersection of their work builds the momentum for change that can aid in transforming the status quo of conventional techniques in forest management and restoration to accommodate social-ecological systems that recognize the linkages between human-social, economic and ecological systems.

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