Two Approaches to Ecosystem-based Management in British Columbia

by

Dionne Bunsha

M.Sc. (Development Studies), London School of Economics, 2000
B.Com., University of Mumbai, 1993

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Degree:	**Master of Resource Management**
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Examining Committee:	
Chair:	**Soudeh Jamshidian** PhD Student

Ken Lertzman
Senior Supervisor
Professor

Evelyn Pinkerton
Supervisor
Professor

Date Defended/Approved: November 26, 2012

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Abstract

My research examines two approaches to ecosystem-based management (EBM) in coastal British Columbia (B.C.) – Clayoquot Sound on the west coast of Vancouver Island and the Great Bear Rainforest (GBR) in the central and north coast of B.C. The first paper is an evaluation of the implementation of the Clayoquot Sound Scientific Panel's (CSSP) recommendations, which introduced EBM in Clayoquot Sound. The second paper focuses on community-based monitoring by the Coastal Guardian Watchmen Network (CGWN) in the GBR and how they could incorporate lessons from other case studies around the world. The CGWN is a network of stewards from ten First Nations communities in the GBR, who monitor their natural and cultural resources. Together, these two papers provide insights into new approaches to conservation that are collaborative and holistic, incorporating local knowledge and concerns.

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List of Acronyms

AAC	Annual Allowable Cut
ATIX	Association of the Indigenous Land of the Xingu
BC	British Columbia
BEC	Biogeoclimatic units/zones
CBAM	Community-Based Adaptive Management
CBM	Community-Based Monitoring
CDEP	Community Development and Employment Project
CGWN	Coastal Guardian Watchmen Network
CFN	Coastal First Nations
CLUD	Clayoquot Land Use Decision
CRB	Central Regions Board
CSSP	Scientific Panel for Sustainable Forest Practices in Clayoquot Sound
CSTPC	Clayoquot Sound Technical Planning Committee
CWH	Coastal Western Hemlock
DFO	Department of Fisheries and Oceans
EBM	Ecosystem-Based Management
ENGO	Environmental Non-Governmental Organization
FEMAT	Forest Ecosystem Management and Assessment Team
FLMMA	Fiji Locally Managed Marine Areas
FN	First Nation
FSC	Forest Stewardship Certification
GBR	Great Bear Rainforest
GIS	Geographic Information Systems
GLIFWC	Great Lakes Indian Fish and Wildlife Commission
HTO	Hunters and Trappers Organization
ILMO	Indigenous Land Management Organization
IMA	Interim Measures Agreement
IMEA	Interim Measures Extension Agreement
ISA	Instituto Socioambiental
LMMA	Locally Managed Marine Area
LOMA	Large Ocean Management Area

MAPP	Marine Planning Process for the Pacific North Coast
MAT	Mean Annual Temperature
MH	Mountain Hemlock
MoU	Memorandum of Understanding
NAILSMA	North Australian Indigenous Land and Sea Management Alliance
NGO	Non-Governmental Organization
NTC	Nuu-cha-nulth Tribal Council
NWMB	Nunavut Wildlife Management Board
PIX	Xingu Indigenous Park
PLA	Participatory Learning and Action
PNCIMA	Pacific North Coast Integrated Management Area
TFL	Tree Farm Licence

Chapter 1.

Implementation of the Clayoquot Sound Scientific Panel Recommendations

Abstract

In 1995, the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound (CSSP) made recommendations to resolve conflicts over logging of old growth forests. In order to contribute to an evaluation of the implementation of the CSSP recommendations and current challenges in resource management in Clayoquot Sound, I interviewed 40 local residents, stakeholders and experts. Participants felt that the CSSP led to a paradigm shift in logging practices that are precautionary and incorporated First Nations (FNs) values. It indirectly led to FNs having a greater voice in how the forests in their territory were harvested when forestry companies did not want to operate under the new regulations and sold their tenure to Iisaak Forest Resources, a FN-owned company. The CSSP recommendations addressed concerns about ecological conservation within the area, but it did not have a mandate to address social and economic issues. Implementing the CSSP recommendations led to a decline in forestry jobs, and economic development in Clayoquot is still a challenge. To ensure proper implementation of the recommendations, the Provincial government needs to re-install a co-management institution, and provide funding and support to enable monitoring and adaptive management. Conservation financing could help resolve the conflict over conservation of unlogged areas and create sustainable economic opportunities.

Keywords: Clayoquot Sound, Scientific Panel, Forestry, British Columbia, Ecosystem-based Management, Co-management.

Introduction

> *My dad, when we were looking for suitable tree to make a canoe, told me that one has to be very careful when finding the proper tree. I was not allowed to cut a tree before making sure that there was no eagle's nest within a distance of 100 meters. Or, that there was no wolf's den, or a salmon stream. It was against the law for us to disturb the creatures that the Creator has put here for us. If we did, then it would be the Creator himself who would punish your whole family. That is why it is important to be aware of all of our surroundings. Those are the teachings of my father and grandfather. (Joe Martin, master carver, Tla-o-qui-aht First Nation, Clayoquot Sound, interview, October, 2010)*

Clayoquot Sound, on the west coast of Vancouver Island in British Columbia (B.C.), Canada (Figure 1.1), is biologically diverse, with large stretches of coastal temperate rainforests and productive marine ecosystems. It is a complex landscape with an archipelago of islands and steep, mountainous mainland watersheds. Around 73%-83% of Clayoquot's forests are still considered old growth[1] (Clayoquot Sound Technical Planning Committee, 2006a; Tripp et al., 2012; Leversee, D., personal communication, February, 2011), compared to 35% for the rest of Vancouver Island (Leversee, D., personal communication, February, 2011).

Clayoquot Sound was the center of the 'War in the Woods', a term that refers to conflicts between the forest industry and local residents and environmentalists in different parts of B.C. from the Stein Valley to Haida Gwaii and the North and Central Coast in the 1980s and 1990s (Wilson, 1998). Canada's largest civil rights protests against the logging of old growth forests took place in Clayoquot Sound in the summer of 1993, in which more than 800 people were arrested (Magnusson & Shaw, 2002). Blockades to protect one of the last remaining old growth forests on Vancouver Island captured international attention when environmental groups launched a market

[1] Old growth forests are forests in which gap dynamics dominate (Wells et al., 1998). The transition from mature stands to old growth be defined as the phase in development where the mortality of canopy dominants begins to influence forest structure and understory microclimate. The old-growth stage is characterized by the accumulated results of this process over time, for example, canopy gaps, large dead trees in various states of decay, a productive understory layer and so on (Wells et al., 1998). An old growth forest stand is usually at least 180-220 years old with moderate to high canopy closure; a multilayered, multispecies canopy dominated by large overstory trees; high incidence of large trees, some with broken tops and other indications of old and decaying wood (decadence); numerous large snags; and heavy accumulations of wood, including large logs on the ground (FEMAT, 1993).

campaign in Europe for consumer boycotts of timber from B.C. The Nuu-chah-nulth First Nation (FN) communities in Clayoquot Sound also fought against excessive logging and successfully won a case in 1985 to protect Meares Island from logging (MacMillan Bloedel Ltd. Vs. Mullin et al., 1985). In an effort to stop the protests in 1993 and resolve the conflicts over logging of old growth forests, the Province of British Columbia established the Scientific Panel for Sustainable Forest Practices in Clayoquot Sound (CSSP) in 1995 (CSSP Report 3, 1995). The CSSP was an independent, science-based panel, comprised of scientific experts and First Nations elders, that was appointed to make recommendations for sustainable forestry practices in Clayoquot Sound that would, in the words of the then Premier of B.C., Mike Harcourt, be “the best in the world” (CSSP Report 3, 1995). It was a landmark in Canadian environmental history (Magnusson & Shaw, 2002).

The idea for the CSSP was inspired by other science-based approaches to sustainable resource use such as the Northwest Forest plan initiated in the U.S. Pacific Northwest in an attempt to resolve conflicts between the logging industry and conservationists in the 1980’s (Magnusson & Shaw, 2002; CSSP members, interviews, July, 2010). Scientists appointed by the Clinton administration to be part of the Forest Ecosystem Management and Assessment Team (FEMAT) developed the Northwest Forest Plan to manage forests for wildlife and watershed integrity while allowing for regulated timber harvesting (DellaSala & Williams, 2006; Thomas et al., 2006; Spies et al., 2006; Reeves et al., 2006; Molina et al., 2006; Charnley, 2006; Noon et al., 2006; Raphael, 2006). The plan laid out scientific and more sustainable ways to manage federal forest land in the range of the Northern Spotted Owl, an endangered species that became the icon for the movement for the protection of its habitat in old growth temperate rainforests (DellaSala & Williams, 2006; Thomas et al., 2006; Noon et al., 2006; Spies et al., 2006; Reeves et al., 2006; Molina et al., 2006). Nearly 10 million hectares of forests in Washington, Oregon and California would be managed under a regime of “ecosystem management” with varying levels of protection for riparian zones, key watersheds and rare species across a network of reserves (DellaSala & Williams, 2006; Thomas et al., 2006; Spies et al., 2006; Reeves et al., 2006; Molina et al., 2006). Dr. Jerry Franklin, one of the scientists who envisioned the NW Forest Plan, was appointed to the CSSP.

Three First Nations, the Hesquiaht, Ahousaht, and Tla-o-qui-aht, have their traditional territories in Clayoquot Sound. They are part of the a larger, culturally linked group of 15 First Nations called the Nuu-chah-nulth along the west coast of Vancouver Island with a common political platform called the Nuu-chah-nulth Tribal Council. Today, there are around 1,600 Nuu-chah-nulth residents in Clayoquot Sound (population estimates vary), of the total population of around 4,861 (Ecotrust, 2011; Francis et al, 2010; Table 1.1).

Conflicts over logging practices in Clayoquot Sound emerged in the 1980s (for a timeline of land management in Clayoquot Sound, see Table 1.2). In 1984, local residents from the Friends of Clayoquot Sound, the Ahousaht, and Tla-o-qui-aht First Nations fought a public campaign and court case in the Supreme Court of Canada against the forestry corporation MacMillan Bloedel to protect Meares Island from being logged by the company (MacMillan Bloedel Ltd. Vs. Mullin 1985). It resulted in a court injunction that brought logging on Meares Island to a stop until Nuu-chah-nulth land claims are settled (MacMillan Bloedel Ltd. Vs. Mullin, 1985; Magnusson & Shaw, 2002; Iisaak Forest Resources Ltd website, 2012a). Meares Island has been proclaimed a Tribal Park by the Tla-o-qui-aht and Ahousaht First Nations (MacMillan Bloedel Ltd. Vs. Mullin, 1985; Magnusson & Shaw, 2002; Iisaak Forest Resources Ltd website, 2012a). Later, the historic blockades in the summer of 1993 by local environmental non-government organizations (ENGOs) against the B.C. government's Clayoquot Land Use Decision (CLUD) focused international attention on the conflicts over logging old growth forests in Clayoquot Sound and resulted in consumer boycotts of B.C. logging companies (Magnusson & Shaw, 2002).

The Government of B.C. broke the stalemate over logging old growth forests by announcing the formation of the CSSP, which had 19 experts, including four Nuu-chah-nulth elders. The Panel's mandate was "to review current forest management standards in Clayoquot Sound and make recommendations for changes and improvements…to develop world-class standards for sustainable forest management by combining traditional and scientific knowledge" (CSSP Report 1, 1995). It made recommendations for changes to forest practices and planning based on the principles of ecosystem-based management (EBM), all of which were accepted by the Government of B.C. in 1995 and enacted into law in 2008 (for a summary of the CSSP recommendations, see Table 1.3).

The CSSP's recommendations resulted in an extensive watershed planning process involving several stakeholders. The Clayoquot Sound Technical Planning Committee (CSTPC), comprising representatives from government, First Nations and stakeholders, was formed to work with the Central Region Board (CRB), a co-management board, to formulate 15 watershed plans. The watershed plans brought about radical changes in the way forest management was planned and carried out. They pioneered the application of EBM to forestry in Canada. The Scientific Panel used the Nuu-chah-nulth principle of '*Hishuk-ish-ts'awalk*' (*everything is one*) to express the Panel's holistic approach of ecosystem management, emphasizing strong connections within and among ecosystems (CSSP Report 1, 1995). The impact of the CSSP recommendations extended far beyond Clayoquot Sound. It inspired other experiments in EBM and collaborative, science-based planning in other places such as the Great Bear Rainforest in the central and north coast of B.C.

Fifteen years after the B.C. Government and First Nations accepted the Panel's report, some of the recommendations have not been fully implemented (Beasley et al., unpublished manuscript; Technical experts and forestry industry representatives, interviews, October, 2010). The Clayoquot Sound watershed plans were completed in 2006 and became legally binding in 2008 (Figure 1.2). Some aspects of the recommendations on reserves and species protections are yet to be implemented (Beasley et al., unpublished manuscript). A monitoring and adaptive management program, essential to understanding how the implementation of the watershed plans is affecting the ecosystem, is one of the last pieces left for full implementation.

The socio-economic situation in Clayoquot Sound is different from what it was 17 years ago when the panel's report was prepared, and new resource management issues have emerged (Ecotrust, 2011). First Nations are concerned about the decline of employment in fishing and logging. In addition, conservation issues such as fish farms and the protection of the 'unlogged' watersheds are dilemmas within the community (First Nations representatives, local residents and scientists, interviews, October, 2010). A new marine planning initiative is also underway led by the West Coast Vancouver Island Aquatic Management Board, and provides an opportunity to integrate marine and terrestrial planning. There is a need to respond to changes in the local economy and new issues like climate change.

In this paper, I review implementation issues related to the CSSP recommendations and their impacts. Specifically, I seek to understand stakeholder and community viewpoints on the implementation of the CSSP's recommendations from a variety of perspectives, including First Nations, non-indigenous residents, forest industry representatives, scientists, environmental activists and government officials. The interviewees are mainly community members or people who have worked in resource management and planning in Clayoquot Sound. The interviewees have an intimate knowledge of this place, its history and politics and are most affected by the impacts of the EBM practices recommended by the CSSP. I focused on three broad questions: 1) what are the impacts of the implementation of the CSSP recommendations on the environment and on communities in Clayoquot Sound? 2) What are the limitations of the CSSP recommendations? Did they adequately address the issues raised in the public protests? 3) What are the challenges ahead for EBM in Clayoquot Sound? Beasley et al. (unpublished manuscript) complements this paper by examining technical documents to assess various issues relating to implementation, monitoring and impact of the CSSP recommendations.

Methods

The Study System

Ecological System

Clayoquot Sound encompasses 262,600 ha of land and 87,400 ha of water on the west coast of Vancouver Island (Holt & Utzig, 2007; Tripp et al., 2012). Several diverse ecosystem types exist here including rainforests, lakes, rivers and streams, alpine peaks, open ocean, rocky coastal shores, long sand beaches, estuaries and mudflats. With around 74% of Vancouver Island already logged, Clayoquot is one of the few remaining places on Vancouver Island that has a large area of unlogged old growth temperate rainforest. Clayoquot Sound has a significant portion (15%) of the old-growth forests remaining on Vancouver Island, although it has only around 7% of forestland on Vancouver Island (Moore, 2001; Tripp et al., 2012; Leversee, D., personal communication, February, 2011). Only 22 of Vancouver Island's 282 major (over 3,000 hectares) rainforest watersheds are unlogged. Of the 22 unlogged watersheds on

Vancouver Island, eight don't have permanent protection. Six of these 8 unprotected intact watersheds are in Clayoquot Sound (Sierra Club BC, 2011).

Coastal temperate rainforests are among the most rare and diverse ecosystems, covering only 0.2% of the earth's surface (Schoonmaker et al., 1997; DellaSala, 2010; Wilson et al., 2005). They store more organic matter than any other forest type, including tropical forests (Schoonmaker et al., 1997; DellaSala, 2010; Keith et al., 2009; Waring & Franklin, 1979; Harmon et al., 1986; MacKinnon, 2003). Despite a substantial logging history, the west coast of Canada and southeast Alaska have the most extensive examples of undeveloped and semi-natural temperate rainforest remaining globally (Lertzman et al., 2002; Kellogg, 1992; MacKinnon & Vold, 1998). Temperate rainforests are wet and rarely burn (Schoonmaker et al., 1997; Gavin et al., 2003a; Lertzman et al., 2001; MacKinnon, 2003). Natural disturbances are infrequent and fires are very rare: in Clayoquot Sound most areas have not had a fire in more than 1,000-2,000 years and many locations have not burned for the last 6,000 years (Gavin et al., 2003a). Such remarkably long fire-free intervals have rarely been documented in any forest type worldwide (Gavin et al., 2003a; Lertzman et al., 2002). These long fire-free intervals result in a forest landscape dominated by very old forests. In British Columbia, terrestrial ecosystems are classified with the biogeoclimatic ecosystem classification system (Meidinger & Pojar, 1991). There are seven BEC subzones in Clayoquot Sound are, mostly in the Coastal Western Hemlock (CWH) zone, with Mountain Hemlock (MH) at higher elevations (Ecotrust, 2011). Most of the CWH is in the vm1, vm2, and vh1 sub-zones and variants (Ecotrust, 2011).

The CSSP recognized the interconnectedness of land and ocean ecosystems in temperate rainforests such as Clayoquot. They suggested that the water bodies and immediately adjacent terrestrial environment should be treated as a single system, termed the 'hydroriparian ecosystem' (CSSP Report 5, 1995). The aquatic and riparian components of the hydroriparian ecosystem influence each other strongly (CSSP Report 5, 1995). The hydroriparian system is connected to the ocean through physical processes of water, wood, sediment, nutrient and particulate matter export (CSSP Report 5, 1995). The ocean is connected to the stream through migration of salmon, which are a keystone species that enable the transfer of nutrients in these ecosystems (CSSP Report 5, 1995). All salmonids depend on the freshwater environment for

reproduction, and most depend on the ocean environment for their growth (CSSP Report 5, 1995).

Clayoquot Sound has several unlogged watersheds, ecosystems that have remained unmodified by industrial development. Unlogged watersheds are very rare globally (Lertzman & Mackinnon, *in press*). Few places in the world have large river systems that still interact with their associated floodplains and upland ecosystems with minimal impact of human activities (Lertzman & Mackinnon, *in press*). One of the most contentious environmental issues in Clayoquot Sound today is the ENGO campaign to protect unlogged watersheds in Clayoquot Sound (Forestry industry, ENGO and FN representatives, interviews, October, 2010; ENGO representatives, interviews, June, 2012). There are 17 unlogged watersheds (over 1,000 hectares) in Clayoquot, of which four are fully protected in parks. Other unlogged areas are partially protected in provincial parks: a third of Clayoquot River Valley, a quarter of Flores Island, and about half of Vargas Island (Mychajlowycz, M., 2010b). Unlogged Meares Island is still under a 1985 court injunction prohibiting logging and other development, pending treaty settlement (Mychajlowycz, M., 2010b). There are several unlogged areas smaller than 1,000 hectares (Figure 1.4).

Social System

The non-First Nation communities in Clayoquot Sound are Tofino and Ucluelet (Clayoquot Biosphere Trust website, 2012). Tofino is a town of around 1,700 permanent residents, that is a big tourist hub, and whose population increases to around 20,000 in the summer with the temporary influx of tourists and tourism workers (Clayoquot Biosphere Trust website, 2012). Ucluelet also attracts many tourists and has several people working in the Pacific Rim National Park Reserve (Clayoquot Biosphere Trust website, 2012). Several of its residents were employed in the forest industry, and it is making the transition from a resource-based economy to a service sector-based economy. Most of the community and development services for Clayoquot that encompasses the Tofino area to the north, Bamfield area to the south and the Alberni Valley in the middle are in Port Alberni where the Alberni-Clayoquot Regional District is located. As a regional authority, it works collaboratively with provincial ministries, municipal governments and First Nations (Clayoquot Biosphere Trust website, 2012).

Three First Nations communities (Tla-o-qui-aht, Ahousaht and Hesquiaht) are located within Clayoquot Sound, and two (Ucluelet and Toquaht) are situated close to its periphery. These five Nations are collectively known as the Central Region First Nations (because they are located in the central part of the west coast of Vancouver Island). In 1994, these five First Nations allied to sign the Interim Measures Agreement (IMA) with the B.C. government for interim claims to define the terms of co-management of land and resource use and operations during treaty negotiations (Hoberg & Morawski, 1997; Arbour et al. (eds), 2008).

The IMA resulted in the formation of a co-management board called the Central Region Board (CRB) with an equal number of representatives from First Nations and the B.C. government (Hoberg & Morawski, 1997; Arbour et al., 2008). The CRB dealt with resource management and land use planning in the Clayoquot Sound region. It was a final stop for reviewing projects and plans that pertained to any of the Central Region First Nation territories. The B.C. government had the right to make the final decision, based on the CRB's recommendations. The IMA was extended twice in April 1996 and March 2000 to become the Interim Measures Extension Agreement (IMEA): A Bridge to Treaty on March 28, 2000. In 2009, the IMEA lapsed and the B.C. government did not re-extend it because it was meant as 'a bridge to treaty', an interim body, until the Nations settled treaties. After two of the Nations, Toquaht and Ucluelet (aka Yu-cluth-aht), signed the Maa-nulth Treaty, the B.C. government decided to withdraw from the IMEA and, as a result, the CRB was disbanded (B.C. government website, 2012; B.C. government representative, interview, October, 2010).

There are five First Nations settlements and two main towns in and around Clayoquot Sound (Table 1.4). When the 1993 protests occurred, there was a lot of tension between the town of Tofino (where most of the environmentalists lived) and Ucluelet (where most people worked in forestry). Ucluelet residents were afraid that their jobs in the forestry industry were under threat. Now, the tensions have eased considerably. First Nations communities face several challenges with access to employment, housing, health facilities, education facilities, affordable transport and other infrastructure (Ecotrust, 2011). The economies of the Clayoquot communities have been relatively depressed (Ecotrust, 2011). Unemployment rates are between 13% and 27%, (Ecotrust, 2011) (Table 1.5). In Tofino, tourism is the main driver of the economy, while

in Ucluelet, tourism is growing and many people work in fish processing and government jobs with Parks Canada.

After the CSSP released its reports in 1995, the amount of logging each year dropped substantially because industry had to deal with new restrictions on clearcutting and industrial logging (Figure 1.3). The amount of timber logged each year had been declining even before the CSSP was formed, from over 900,000 m^3 in 1989 to less than 456,000 m^3 in 1993 (Figure 1.3), due to a number of factors including blockades, markets, unresolved land use conflicts, uncertainty (Mychajlowycz, M., 2010b; CSSP member, interview, September, 2012). Forestry jobs declined substantially in the mid-1990s during the period of the protests and after the CSSP recommendations (Butt & Macmillan, 2009). Residents left Ucluelet, the center of the logging industry in Clayoquot Sound, and the population declined by 6% between 1996 and 2001 (Statistics Canada, 2009), partly though not entirely due to changes in forest management that the CSSP heralded (Butt & Macmillan, 2009). From 2001 to 2006, jobs in logging declined by 78%, and in the last census only 15 people reported being employed in 'forestry and logging' (Butt & Macmillan, 2009).

At the time of the 1993 protests, MacMillan Bloedel and International Forest Products were the largest tenure holders in Clayoquot Sound. Logging companies were apprehensive about the uncertainty surrounding the watershed plans and the restrictions that the new CSSP recommended logging practices would impose on forestry. In 1998, Weyerhaeuser Ltd. (the company that bought MacMillan Bloedel) and the First Nations-owned Ma-Mook Development Corporation signed a partnership to form a new forest company called Iisaak Natural Resources Ltd (Iisaak Forest Resources Ltd. website, 2011). When Weyerhaueser decided to wind up its operations in B.C. in 2005, the Central Region Nations First Nations bought out Weyerhaueser's share in Iisaak Forest Resources Ltd., and gained complete ownership of the company and of the two Tree

Farm Licences (TFLs)[2] in Clayoquot Sound (Iisaak Forest Resources Ltd. website, 2012). Iisaak was the first Tree Farm License in British Columbia to be certified to Forest Stewardship Council (FSC) standards (Iisaak Forest Resources Ltd. website, 2012). However, in 2012, Iisaak has decided to temporarily halt the renewal of its FSC certification, as it can no longer afford the costs associated with certification (ENGO representative, interview, June, 2012).

Iisaak manages TFL 57, TFL 54 and six smaller Timber Licenses, which together contain 91,200 ha, or roughly 35% of the land area of Clayoquot Sound (Tripp et al., 2012), of which 15-20% is operable for forestry over a 100 year rotation (Iisaak Forest Resources Ltd. representative, interview, October, 2010). Other major forest sector licensees operating in Clayoquot Sound are MaMook Natural Resources Ltd., Island Timberlands (private forest land around Kennedy Lakes), International Forest Products Ltd. (Interfor) and B.C. Timber Sales (Tripp et al., 2012).

Research Methods

I began this research when Ecotrust Canada, an international environmental non-governmental organization (ENGO), wanted to engage community members, scientists and CSSP members in a review and discussion around the impacts of the CSSP recommendations 17 years after the Panel completed its work. Ecotrust's goal in this research was to use it to initiate discussion amongst Clayoquot residents and mobilize community action for the implementation of monitoring and adaptive management in Clayoquot Sound. In this paper, I review community perceptions and needs regarding EBM in Clayoquot Sound. A companion paper (Beasley et al., unpublished manuscript) supplements this article and reviews the technical literature to ascertain implementation of CSSP recommendations.

[2] Tree Farm Licence (TFL): An agreement entered into between a company and the B.C. government under Part 3, Division 5 of the Forest Act which grants the rights to harvest timber on Crown (government) land on a sustained yield basis. A tree farm licence has a term of 25 years and conveys the company nearly exclusive right to manage forests and to harvest an allowable annual cut (AAC) of Crown timber from the licence area. The company is required to provide a management plan for the establishment, management, and harvesting of timber in a described area (Crown and private land) on a sustained or perpetual yield basis (Ministry of Forests, Lands and Natural Resource Operations website, 2012).

Sampling

In order to evaluate the impacts of the recommendations and their effectiveness in achieving their two broad goals of forest sustainability and participatory resource management, I interviewed 40 people associated in some way with forestry, EBM implementation, or communities in Clayoquot Sound (Table 1.6). They were members of First Nations communities in Clayoquot Sound, environmental activists, logging company representatives, local business owners, scientists and technical experts. Since there are five First Nations communities, the number of FN interviewees is large compared to other groups. There are only three interviewees classified as “non-First Nation residents” because I was unable to fit them into any defined category. However, many of the scientists, ENGO representatives, consultants and forestry industry representatives are also non-First Nation residents. ‘Forestry industry representatives’ refers to non-First Nations engineers and consultants. It does not include First Nations interviewees who are associated with Iisaak Forest Resources, but were classified as First Nations interviewees. Since interviewees wear many hats, classifying them into one category proved difficult, but I chose to do so based on their primary work and/or the reason why I was contacting them. The FN interviewees were in leadership roles or people involved in forestry. They had differing perspectives on how logging should be conducted on their traditional lands.

The interviewees were identified by a partial snowball sampling method (Yin, 1994). Along with my partners at Ecotrust, I created a list of stakeholders who had been involved in environmental and resource management issues in Clayoquot Sound and added a few more names, when they were highly recommended, as relevant people to interview. I identified interviewees based on the positions they held and their experience and involvement in land management in Clayoquot Sound.

Data Collection / Interviews

In-depth, semi-structured interviews (Yin, 1994) were the appropriate method for understanding how implementation is affecting people and how they perceive the impacts of the CSSP recommendations. The semi-structured interview method is a very effective tool that allows a researcher to fully explore, over the course of a lengthy discussion or multiple contacts, how participants apply and integrate multiple criteria in

their assessments of a program's performance. It also allows participants to reflect and voice their perspective about issues that they may not be consulted about in their daily work. The spontaneous nature of the semi-structured interview enables the researcher to pose counterpoints or clarify views and information offered in order to gain a deeper understanding about the interviewee's perceptions.

Even though the CSSP recommended the setting up of a monitoring and adaptive management committee to evaluate the effectiveness of the watershed plans, no monitoring system has yet been set up. In the absence of data from monitoring, I relied on a wide array of local perceptions, experience and knowledge to review the last 17 years of ecosystem-based planning and its outcomes. I also did a literature review of reports and planning documents over the years to evaluate how the recommendations were translated into planning and then action on the ground.

My questions were focused around three main themes:

1. How have the CSSP recommendations been implemented?
    - Did they adequately address the ecological and social issues that Clayoquot was confronted with at that time?
    - How much was implemented? What still needs to be implemented?
    - What were the impacts of implementation of CSSP recommendations on the ecology, economic, social, political life in Clayoquot Sound?
    - Are there issues that the CSSP recommendations should have addressed but did not?
    - Have First Nation issues been adequately addressed, and have First Nations gained a greater voice?
    - How has the declaration of Clayoquot Sound as a biosphere reserve changed the area?
2. What were the limitations of the Scientific Panel's recommendations and how can they be overcome?
3. What are the ecosystem management challenges for the future in Clayoquot Sound?
    - Are the CSSP recommendations still relevant today? And for the future?
    - What are the ecological and social challenges for the future?
    - How can marine and terrestrial planning be linked?

Literature Review

In addition to participant interviews, I collected and reviewed data in the form of reports, books and journal articles on land management in Clayoquot Sound and ecosystem management in British Columbia. These literature sources provide both a means of triangulation and a detailed study of land management in Clayoquot Sound.

Triangulation

Since all interview data reflect the motivations and biases of the interviewee, and because an analyst's interpretation of this data reflects his or her own motivations and biases, methodical "triangulation" is necessary to try and make the data as objective as possible (Stake, 1995; Yin, 1994; Berg, 1989). Triangulation requires corroboration of an account by two other sources for acceptable confidence in one's findings. While analyzing the interview data, I achieved triangulation by comparing participant accounts and my understanding of them with (1) other participants' accounts; (2) technical reports, journal articles and books written on these subjects; and (3) the knowledge of other experienced researchers and practitioners – especially Dr. Ken Lertzman, Dr. Evelyn Pinkerton, Dr. Barbara Beasley, Mike Davis (from Ecotrust) and Satnam Manhas (from Ecotrust) with whom I discussed, clarified and sought further information about the findings.

Review Process

A selection of experts reviewed drafts of this paper: three scientists, four Ecotrust representatives and one Iisaak Forest Resources Ltd. representative. This review process has provided a valuable check on my interpretations.

Data Presentation

The results of the interview data are summarized into main points that arose during the interviews. Where necessary, I have also put the interview responses into context with some background information that we came across while reviewing literature that would help in understanding the issue being discussed. The main viewpoints and concerns that different stakeholders mentioned are summarized in Table 1.7.

Results

1. Impacts of the implementation of the Clayoquot Sound Scientific Panel recommendations

The impacts of the CSSP that were identified by interviewees can be classified in eight categories:

Logging Practices

Since the mandate of the CSSP was to recommend how to log sustainably, most of the impacts of its recommendations have been changes in silvicultural practices. For instance, the units for spatial planning shifted from administrative units to watershed units, so that planning could be based on ecological boundaries. With the new precautionary approach to logging, the AAC in 2009 had dropped to 1/3rd of what it had been in 1995 (Table 1.3). A silvicultural system termed "variable retention"[3] replaced clearcut logging[4]. In 2009, the average rate of variable retention practiced by Iisaak Forest Resources Ltd., the only logging company operating in Clayoquot Sound, was around 45-50%, with retention varying between 15-80% (Iisaak Forest Resources Ltd. representative, interview, October, 2010). Most respondents (representing different stakeholder groups) felt that the CSSP recommendations were ecologically sound and that variable retention was better for forests than clearcutting. While some First Nations representatives were satisfied with the 'lighter touch logging', others said that their elders felt it was the 'bare minimum' and are still concerned about the manner in which logging is carried out. Some First Nations representatives described variable retention as 'smaller clear cuts', and said they would prefer more careful logging practices.

[3] Variable Retention: Variable retention is a silvicultural system created by the CSSP in which only a portion of the cut block is cut and the rest is retained in order to preserve forest structural elements that are essential to retaining biodiversity and other environmental values in the forest. The percentage to be cut and the location of reserved patches are determined taking various environmental factors into consideration. The variable-retention silvicultural system recommended by the Panel provides for the permanent retention of forest "structures" or habitat elements (e.g., large decadent trees, or groups of trees, snags, and downed wood) from the original stand that provide habitat for forest biota. It is intended to reflect natural disturbance patterns and our understanding of natural disturbance and recovery processes (Beese et al., 2003; Mitchell and Beese, 2002; CSSP Report 5, 2005).

[4] Clearcut logging: is a silvicultural system in which most or all trees in a defined area are cut down over a short period of time and replaced with an even-aged cohort of young trees.

Interviewees from all stakeholder groups felt that riparian areas have been well protected due to the Scientific Panel recommendations.

Parks and Reserves

The area in parks and reserves increased from 18% to 33% of Clayoquot land base with the implementation of the Clayoquot Sound Land Use Decision (Iisaak Forest Resources Ltd. representative, interview, October, 2010). The watershed plans arising from the CSSP added a network of reserves, resulting in a cumulative total of about 61% of Clayoquot's forested land base in parks or reserves, 29% harvestable in special management zones, and 10% in generable harvestable area (CSTPC Progress Report, 2006a). Analyses by Iisaak have indicated that, in the short term, approximately 85% of remaining old growth in Clayoquot will be protected from harvest, and in the long term, a similar percentage of forested land base will be protected (Iisaak Forest Resources Ltd. representative, interview, October, 2010).

An Iisaak representative pointed out the need to implement the Panel's recommendation on connectivity between watersheds units. He suggested it as a "top up" to accommodate any potential connectivity shortfalls in the reserve network.

> *The licensees (Iisaak and other forestry companies) need to work with the Clayoquot Technical Planning Committee (CSTPC) to establish these linkages and connectivity and determine in which areas these would best be applied. This emphasizes the need for a properly funded and functioning CSTPC or delegation of their responsibilities with adequate funding.*
>
> *(Iisaak representative, interview, October, 2010)*

Environmental activists felt that the reserves are very fragmented, and located in unproductive areas that wouldn't have been logged anyway like rock or bog forests (ENGO representative, interview, October, 2010).

First Nations Role in Decision-Making

The CSSP acknowledged the value of local, experiential knowledge by appointing First Nations elders on the Panel and designating a Nuu-chah-nulth representative, Dr. Richard Atleo, as co-chair along with Dr. Fred Bunnell, a forest scientist with a specialty in wildlife. This respect for local knowledge permeated not only the recommendations of the Panel but also the processes that led to its implementation, and resulted in greater First Nations empowerment. First Nations representatives were

part of the technical planning committee (CSTPC) appointed to implement the recommendations and formulate watershed plans.

First Nations interviewees felt that making cultural surveys in cut blocks mandatory before any logging plans are carried out was a major step towards respecting their knowledge and culture. Approximately 103,044 hectares of the Clayoquot Sound watershed planning area has been identified by the Nuu-chah-nulth First Nations as having 'cultural significance', where no development activities can be carried out without their prior approval (CSTPC Progress Report, 2006a). Detailed inventories of culturally important species and resources were conducted. Many FN respondents felt that processes that developed around the time of the CSSP or before or after, like the formation of the Central Region Board (CRB) and Iisaak Forest Resources Ltd. also helped with First Nations gaining control over land use planning and local harvesting practices.

Formation of Iisaak Forest Resources Ltd.

An indirect impact was the formation of Iisaak Forest Resources Ltd., a pioneering First Nations owned logging company in Canada. Most of the First Nations representatives interviewed were proud of the existence of Iisaak Forest Resources Ltd. as a First Nations owned logging company and wanted to support it and see it prosper. However, most First Nations interviewees also felt that their Nations have not gained much from the existence of the company either through the creation of jobs or through revenue. In 2010, Iisaak provided roughly 12 full-time forest milling jobs and roughly 30 seasonal jobs to the Clayoquot First Nations residents (Ecotrust, 2011). This quote from one FN representative summarizes the sentiments expressed by most FN interviewees: "*We have a wealth of resources, yet we are unable to touch any of it. Every year, I see $17 million of wood go out of our territory and not a cent comes back to our community*." (First Nations representative, interview, October, 2011).

FN representatives were in a peculiar dilemma because they wanted to support Iisaak and ensure that it succeeds, but some FN residents didn't feel that the company fully lived up to FN values of sustainability and respect for nature. Their sentiments can be summed up by this quote from a First Nations representative:

> *Because we are part owners of the company, we have to walk the fine line between supporting them (Iisaak's management) and reprimanding them and trying to fix the problem. They want to take our trees, pay us nothing for it and leave. We are supporting them, but tell them that over the next five years, we want to work on a solution that will reflect our laws of stewardship, using different means - carbon credits, lower rate of retention, tenure reform, protection of sacred sites that fall within the tree farm license. (FN representative, interview, October, 2011)*

The management staff in Iisaak changed in 2012 and it is expected that the new management will bring about changes aimed at better stewardship of forest values (ENGO representative, interview, June, 2012).

Several non-FN experts felt that Iisaak has done well despite several factors working against it. Not only was it a pioneering FN forestry initiative, it took on a challenge to work within constraints and implement the CSSP recommendations, which large forestry corporations were not willing to do and hence pulled out of Clayoquot Sound. The interviewees felt that at the time of its early years, Iisaak weathered a recession in B.C.'s forestry industry during the early stages of its inception and managed to survive. Iisaak is the first and one of a very small number of forestry companies that has managed to adhere to FSC standards, and the interviewees felt this was a major achievement.

Development of Inventories and Local Capacity

Implementation of the CSSP recommendations required the creation of inventories and watershed plans that involved substantial research and technical expertise, and developed local capacity (Forestry industry representatives, ENGO representatives and technical experts, interviews, October, 2010). The presence of several research and monitoring projects and organizations like the Biosphere Project, the Long Beach Model Forest Project and the Weyerhauser Adaptive Management project, initiated by local scientists, helped build local expertise (Technical experts and scientists, interviews, October, 2010). While these projects no longer exist, their legacy remains in the people who worked in them and in other local institutions such as the Clayoquot Sound Biosphere Trust, the Tofino Botanical Gardens, Ecotrust and the Raincoast Education Society (Scientists and technical experts, interviews, October, 2010). Several scientists and technical experts felt that the existence of these projects in the past has made Clayoquot one of the few places in B.C. that has the institutional

memory, local human resources and social capital (based on the community's experience of collaboration for conservation goals) to implement ecosystem based management.

Economic Impact

After the CSSP recommendations were accepted, the major forestry companies pulled out of Clayoquot and this led to a large loss of jobs, both directly and indirectly related to forestry (Forestry contractor, interview, October, 2010). However, some FN representatives felt that this did not affect their communities substantially as very few of their members were employed in these jobs. In fact, much before the CSSP was formed, the member Nations of the Nuu-chah-nulth Tribal Council (NTC) asked the B.C. government to address the declining employment of First Nations in the forest sector, and the damage poor logging practices were causing to fisheries and other resources (Iisaak Forest Resources Ltd. website, 2012). The number of forestry related jobs fell even before the CSSP recommendations were implemented from 2,520 in 1993 to 840 in 1995, due to several factors such as restrictions on how the available land base could be harvested due to the Clayoquot Land Use Decision (CLUD) and a reduced amount of land base that was available for harvest (Iisaak Forest Resources Ltd. representative, interview, October, 2010).

Many people associated with the logging industry resented the idea of the EBM, and felt that it prevented them from carrying out their work and earning a living as they had in the past. This is reflected in the quote below from a respondent working in the forest industry (2010).

> *The concept of EBM has failed. Who wants to take the recommendations elsewhere? If it's just a model in a glass bowl, then what's the value to society? There's still the park mentality. We've got this sacrificial lamb here (in Clayoquot). As long as we can keep doing it in these unique places then we can keep the status quo around the world…Why should Clayoquot be a petri-dish for the rest of the world? (Forestry industry representative, interview, October, 2010)*

This quote highlights the resentment that local people associated with forestry have towards conservationists who view Clayoquot as a unique place with several old growth forests that need to be protected.

As tourism grew in Clayoquot Sound, tensions emerged in local politics between the logging town of Ucluelet, where people were losing jobs, and the growing number of entrepreneurs and self-employed in Tofino (Local technical experts and logging industry representatives, interview, October, 2010). Several people interviewed who were employed by the logging industry in Ucluelet felt that low-paying tourism jobs will never compensate for the employment opportunities they lost in the logging economy (Logging industry representatives, interview, October, 2010).

Creation of the Clayoquot Sound Biosphere Trust

The idea of applying for Clayoquot Sound to be designated a 'Biosphere Reserve' stemmed from the Biosphere Trust project, a mountain to ocean research initiative started by local scientists. The CSSP recommendations helped push forward the idea (Scientist, interview, September, 2010). UNESCO Biosphere Reserves seek to balance sustainable development and conservation (Clayoquot Sound Biosphere Trust website, 2012). All reserves have legally protected core areas (which give long-term protection to landscapes and ecosystems), buffer zones (where some resource extraction can take place, as long as it does not undermine the objectives of the core areas), and transition zones or zones of cooperation (where people work together to use the area's resources in a sustainable manner) (Clayoquot Sound Biosphere Trust website, 2012).

In January 2000, Clayoquot Sound was designated as a UNESCO Biosphere Reserve (Clayoquot Sound Biosphere Trust website, 2012). The federal government made a $12 million grant to the communities through the creation of the Clayoquot Biosphere Trust, to manage this endowment fund and uphold the spirit and intent of the Biosphere Reserve designation (Clayoquot Sound Biosphere Trust website, 2012). The trust gives small grants to local NGOs for research and community development (Clayoquot Sound Biosphere Trust website, 2012). Most people interviewed felt that the Biosphere designation has not meant much to the community or conservation, but has helped to attract tourists. Some environmentalists interviewed felt the designation gives the false impression that the entire region is protected, when, in fact, it is not.

Influence on National and International Ecosystem Planning

Clayoquot Sound pioneered EBM along the coast of B.C., and its planning and forestry practices have inspired other places in B.C. and the world to adopt similar land use planning initiatives (Scientists, interviews, October, 2010). Conservation finance initiatives, First Nations agreements and ecological practices that emerged in the north and central coast of B.C. drew from Clayoquot's experiences in ecosystem management (Scientists, interviews, October, 2010). It influenced forestry industry practices (Scientists, interviews, October, 2010). Soon after the recommendations were announced, Macmillan Bloedel decided to voluntarily change to variable retention logging throughout Vancouver Island (Scientists, interviews, October, 2010).

The land use plans in the Great Bear Rainforest of B.C. built on the foundations laid by the CSSP, creating reserves, adopting variable retention and multiple scale ecosystem planning (ENGO representatives and scientists, interviews, October, 2010). Their plans were participatory, holistic, and were based on risk analysis, taking into account cumulative impacts as well as human well-being (ENGO representatives and scientists, interviews, October, 2010).

2. Limitations of the Scientific Panel

Did not address the conflict over logging of old growth forests

Most environmentalists interviewed felt that though the CSSP changed the way logging was done, its mandate was limited, and did not allow the Panel to address the issue that was at the heart of the protests – whether old growth forests in Clayoquot Sound should be logged at all. The CSSP's mandate was limited to specifying how forestry should be done. Some environmentalists and a few First Nations members who were interviewed felt that the Panel was used to break the 1993 protests. The conflict underlying the 1993 protests has not been addressed and continues to manifest itself in local political spheres with environmentalists still protesting against plans to cut in unlogged watersheds and forestry contractors unhappy with restrictions on logging (ENGO representatives, forest industry representatives and local technical experts, interviews, October, 2010).

Restricted within the constraints of the Clayoquot Land Use Decision

Environmentalists felt that the CSSP's mandate was restricted because it had to go by the zoning decisions laid out by the B.C. government in the Clayoquot Sound Land Use Decision (CLUD), and it had no power to change them or specify areas where logging should not be carried out (for example, in the unlogged watersheds). The Land Use Decision allows other activities like mining, real estate development or road construction, which the CSSP had no mandate to review and specify where such activities could be allowed and where it is unadvisable (ENGO representatives, interviews, October, 2010).

Some scientists and environmental activists felt that the CSSP was a partial attempt at EBM. They felt that since the recommendations did not examine cumulative impacts, they lack an ecosystem-based approach. Several ENGO representatives felt that the CSSP did not look at the importance of Clayoquot's old growth forests in the larger context of Vancouver Island. They said that since most of Vancouver Island has been logged, Clayoquot Sound has tremendous conservation value as one of the last remaining places with large swathes of old growth forest (ENGO representatives, interviews, October, 2010).

3. Recent Developments and Challenges

Monitoring and Adaptive Management

Implementing ecosystem based management needs a system of monitoring and adaptive management. Though adaptive management was recommended by the CSSP, it has not yet been implemented due to the lack of funding. Almost all interviewees felt that monitoring is needed to understand what has been implemented and whether it has been effective in meeting the objectives. A FN representative said that his community had Guardians monitoring their traditional territory while doing stream cleaning, cultural survey and trail building (FN representative, interview, October, 2010). The Clayoquot Biosphere Trust (CBT) is making efforts to set up a community-driven monitoring system (CBT representative, interview, June, 2012). Although the watershed plans have been passed as law, the B.C. government has not allocated adequate funds to implement monitoring and adaptive management (Forestry industry representatives and scientists,

interviews, October, 2010). A B.C. government representative felt that the government should be investing more into Clayoquot:

> *The government hasn't done anything towards implementing monitoring and adaptive management in Clayoquot. We never wrapped all the watershed plans together into a regional plan. The Province is not providing resources to finish the implementation. It has other priorities and is focusing on other regions.*
>
> *We didn't fully implement the watershed plans mostly because we haven't provided the resources, but partly due to politics. After elections, governments kept changing and they had different priorities, both within FNs and the B.C. government. When the Liberals first came in they had a mandate on how the province should participate in treaty with FN and that really soured relationships with FN. We had spent a few years building up trust. Every time these things happen, it sets you back.*
>
> *(B.C. Government representative, interview, October, 2010)*

Co-management

The Central Region Board, comprising ten community representatives (both FN and non-FN), played an important role in reviewing development plans and making recommendations to the B.C. government. The scrapping of the Board in 2009 has left a void in participatory decision-making. Most interviewees felt that the community needs a co-management board in order to facilitate collaborative decision-making amongst governments, with participation from stakeholders. A First Nations representative (2010) explained the importance of the CRB:

> *The CRB was a big part of our strength, in making our voice heard. If it was still in place, we would all be able to sit together and have a discussion on the issues that affect us today. They supported us, made a lot of things happen. It was really good at intervening with government and telling them what we need. It was able to find funding if we needed it. They were there to help the Nations stand up. The CRB was an inside track to the government.*
>
> *(First Nations representative, interview, October, 2010)*

Interviewees almost unanimously agreed that the B.C. government should re-constitute the CRB, as it is essential for effective implementation of Clayoquot's watershed plans. A B.C. government explained why the CRB was dissolved:

> *We already have three of five Nations are in some sort of treaty process. So the way that some folks in the Province look at it is that we no longer need a bridge to treaty. Each Nation will now be responsible for its own decisions as per the terms of those treaties. There are discussions about the possibility of creating some sort of management board and I don't know how many Nations will be involved. This is a period of great uncertainty within the government so there are*

many issues and allocation of duties that are yet to be resolved.
(B.C. Government representative, interview, October, 2010)

However, some interviewees felt that the treaty was just an excuse for ending the CRB (FN representatives, interviews, October, 2010). The interviewees pointed out that the B.C. government had started to whittle down the power of the CRB even before the Maa-nulth treaty was signed (FN representatives, interview, October, 2010). Funding for staff was cut and meetings were infrequent. Most interviewees said they did not understand why the government decided to dismantle a well functioning co-management board (FN representatives, interview, October, 2010). Despite the treaty being signed, the B.C. government did not decide to pull out of the West Coast Aquatic Management Board, a co-management board for aquatic ecosystems on the west coast of Vancouver Island. This board is still functioning and actively involved in several aquatic and marine planning initiatives.

Human Well-Being

Some First Nations representatives pointed out that social development in their communities is their biggest challenge. Employment rates are low and facilities such as health care, education and housing are inadequate (Ecotrust, 2011). To make matters worse, a loss of commercial fishing opportunities has greatly diminished the economic prospects for First Nations communities (FN representatives, interviews, October, 2010). Many people are migrating out of their communities and losing their connection to the land, resulting in the loss of oral knowledge and tradition (FN representatives, interviews, October, 2010). In 2009, a B.C. Supreme Court judgment (Ahousaht & others v. Canada, 2009) confirmed the aboriginal right to harvest and sell any species of fish from their traditional territories. The Ehattesaht, Mowachaht/Muchalaht, Hesquiaht, Ahousaht, and Tla-o-qui-aht bands had filed a lawsuit against the federal and provincial governments in 2003, arguing Canada's fisheries regime infringes their right to fish on a commercial basis and largely excludes them from the commercial fishery (Ahousaht & others v. Canada, 2009). However, the government has not yet implemented this judgment (FN representatives, interviews, October, 2010). Most FN representatives felt that declining economic opportunities is the most pressing issue facing their communities (FN representatives, interviews, October, 2010), as elaborated in the quote below.

> *Today, our situation is different from 15 years ago when the CSSP made its recommendations. At that time, we had 150 boats that took out 350 people out fishing. Now, there are just six people doing commercial fishing. The fishing licenses are so expensive, they are beyond our reach. We are starving in our own wealth. That makes us like beggars in our own land.*
>
> *(First Nation representative, interview, October, 2011)*

Some interesting new ventures have been housing, community gardens and kitchens. First Nations are also interested in looking into the possibilities of carbon credits as an alternative source of revenue to logging the unlogged watersheds (FN representatives, interviews, October, 2010). However, logging industry representatives are wary of the idea, as elaborated in the quote that follows.

> *I have a problem with sitting back and taking dirty money. It doesn't ensure that people tied to their land base and are producing a sustainable product. I would rather see the buyers of carbon credits clean up their business instead of sending the money off to Clayoquot Sound and have people sit at home here.*
>
> *(Forestry industry representative, interview, October, 2010)*

Logging of Unlogged Watersheds

The fate of the undeveloped watersheds was an important issue that the CSSP was only able to partially address. The CSSP could only suggest how forest management practices could be made sustainable in zones where the government had allowed forestry, including unlogged watersheds. The panel asserted the ecological significance of these watersheds (CSSP report 5, 1995), and recommended that there be a moratorium on the development of these areas until it had been demonstrated that their other recommendations could be implemented effectively elsewhere in Clayoquot Sound.

Iisaak Forest Resources Ltd.'s plans to log Flores Island stirred a controversy within the Clayoquot community. Iisaak had been surveying and building roads in an undeveloped watershed on Flores Island in 2011. The Ahousaht First Nation gave a referral letter to Iisaak Forest Resources Ltd. supporting its logging plans in Beddingfield, Bedwell and Flores Island (Press Release, Iisaak Forest Resources Ltd. website, 2011). Friends of Clayoquot Sound, the local ENGO that spearheaded the 1993 protests, said that Iisaak Forest Resources Ltd. is breaking a Memorandum of Understanding signed with ENGOs (Greenpeace International, Greenpeace Canada, Natural Resources Defense Council, Sierra Club of B.C. and Western Canada

Wilderness Committee) in 1999, in which Iisaak Forest Resources Ltd. agreed that it would not log in the unlogged watersheds, and it would adopt an independent, internationally recognized certification program by the Forest Stewardship Council (FSC) (MoU, 1999). In exchange, the environmental groups agreed to endorse Iisaak Forest Resources Ltd. as a model of ecologically sustainable forestry, assist its institutional development and help the company to market its products (MoU, 1999). However, Iisaak said that it remains committed to the MoU, which does not state that it will not log in unlogged watersheds. It pointed out that the MoU states that Iisaak will not log in 'eehmiis' (undeveloped areas that are, in the Nuu-chah-nulth language "very, very precious") (MoU, 1999). Iisaak said that it is complying with that agreement by not logging in '*eehmiis'* identified in the watershed plans (Press Release, Iisaak Forest Resources Ltd. website, 2012b).

There were several shades of opinion about this issue within First Nations communities. Some were outright against logging old growth forests, while other First Nation representatives said they were in a dilemma. Although they did not want to log old growth forests, they felt they were forced into a corner because as co-owners of Iisaak Forest Resources Ltd., they have to pay back the $4 million loan that they took to buy TFL 54. This concern was well-articulated by a FN leader:

> *It is a really complex problem and it worries me that we don't have more skilled people to help us handle this. There has to be a better way of taking care of business. Every year Iisaak is knocking on our door, and asking for around $250,000 to run the company. And every year, the people have been giving money to Iisaak to make it happen for them. It is just getting to a point where I am wondering why are we doing this? We are pumping out millions of dollars and haven't got a cent in return. And then they say we are going to own a TFL. Yes, with four other Nations. It doesn't make sense to me. The logic is that once we own the TFL, we don't have to do what industry wants and maybe we can look at preserving the forest through carbon credits.*
>
> *(First Nation representative, interview, October, 2011)*

Conservation Finance

In order to prevent the logging of unlogged watersheds, the Clayoquot Conservation Alliance (comprising seven ENGOs) has been working on a conservation financing agreement with the First Nations, similar to the Great Bear Rainforest agreement (ENGO representative, interview, June, 2012). The ENGOs have been trying to raise funding from philanthropists, foundations and government that would help pay

off Iisaak's debt and would also provide funds for sustainable economic development (ENGO representative, interview, June, 2012). This could help resolve Iisaak's dilemma regarding the need to conduct logging operations in previously unlogged Flores Island in order to pay off its debt.

ENGOs and a few supportive FN representatives believe that conservation finance would address the dilemmas of conserving unlogged watersheds and of the community's need for sustainable development, which were two main limitations of the CSSP recommendations (ENGO and FN representatives, interviews, June, 2012). The ENGOs plan to negotiate separate agreements with each FN community (ENGO representative, interview, June 2012). The agreements propose the creation of conservancies for the unlogged watersheds (called '*eehmis'* areas) which would protect First Nations social, ceremonial, cultural uses as well as ecological and recreational values (ENGO representative, interview, June, 2012). Low-impact commercial activities, like tourism and non-timber forest products, would be allowed and could benefit First Nations (ENGO representative, interview, June, 2012). Higher impact commercial activities, like logging, mining, hydroelectric power generation (except run-of-river for local use, not connected to grid), are not permitted in conservancies (ENGO representative, interview, June, 2012). While some forestry representatives were opposed to the idea of conservation financing (Forestry industry representatives, interviews, October, 2010), most FN communities were open to the prospect as a more sustainable economic path. But, some FN respondents were apprehensive about how it would work and whether it would curtail their autonomy (FN representatives, interviews, March, 2011).

Integration of Marine and Terrestrial Ecosystem Planning

Most interviewees felt that integrated ecosystem planning would be beneficial to the protection of Clayoquot Sound's interlinked ecosystems. The Biosphere Trust is working towards developing a monitoring project for Clayoquot. The West Coast Vancouver Island Aquatic Management Board, a forum for communities, stakeholders and governments, is in the process of developing marine use plans and a monitoring system for Clayoquot Sound (West Coast Aquatic website, 2012). These two initiatives

provide an opportunity for integrated resource planning and monitoring to ensure that the terrestrial-marine linkages and cumulative impacts are considered.

Discussion

My interviews reflect the conflicts in values and cultures that still exist within the Clayoquot communities over old growth conservation and FN self-determination. The community remains polarized over the issue of old growth logging. This was at the heart of the protests in the summer of 1993. The possibility of conservation financing could help reconcile the conflicts between forest conservation and harvesting. Most interviewees felt that the B.C. Government's decision to dissolve the CRB and the CSTPC has slowed down implementation and decision-making in the area. They felt that these institutions should be re-constituted in some form in order to ensure that different groups within the community have a voice and are able to collaborate in decision-making. Despite some constraints, the CSSP's recommendations resulted in paradigm shifts in land management and logging practices. The Panel's recommendations introduced variable retention, a lighter touch, ecosystem-based silvicultural system that seeks to retain forest structure, habitat and biodiversity in managed forests (Beese et al., 2003; Mitchell & Beese, 2002; CSSP Report 5, 2005). The CSSP ensured additional reserves to protect hydroriparian ecosystems, sensitive soils and unstable slopes, biodiversity (species at risk, forest interior conditions in late successional forest, ecosystem representation, and linkages among watersheds), scenic and recreational values and First Nations cultural values (CSSP Report 5, 2005; Beasley et al., unpublished manuscript). The initial economic impact resulted in job losses, but the forestry companies were cutting jobs even before the protests began (Iisaak Forest Resources Ltd website, 2012a).

CSSP's recommendations and the resulting watershed plans were a landmark attempt at EBM in British Columbia that inspired co-management agreements and science-driven land use planning agreements in the Great Bear Rainforest (Scientists and ENGO representatives, interviews, October, 2010). Constrained by a limited mandate from the government, the CSSP tried to ensure as much protection for ecological values as possible. Implementation of the unfinished pieces of the CSSP's

vision needs the support of the B.C. government (B.C. government representative, interviews, October, 2010). If it turns its attention to Clayoquot, the government of B.C. could apply several elements of EBM that it has implemented in the GBR to Clayoquot Sound.

The conflicts in Clayoquot and the IMA signed by the Nuu-chah-nulth FN inspired a broader process of EBM in the Great Bear Rainforest. In the GBR, conservation financing played a key role in the agreements reached between FNs, B.C. government, ENGOs and a coalition of logging companies (Price et al., 2010; Armstrong, 2009; McGee et al., 2010). The GBR agreements provide greater control for FN over resource management in their territories, invoke a precautionary approach to land use planning and are intended to provide for creating sustainable economic opportunities and the human well being of people living in the region (Price et al., 2010; Armstrong, 2009; Tjornbo et al., 2010; Shaw, 2004; McGee et al., 2010).

The processes in the GBR and Clayoquot are linked; events and people involved in Clayoquot shaped the outcome of the GBR agreement (Tjornbo et al., 2010). The exchange of learning and evolution between the two areas could continue, with Clayoquot picking elements of the GBR and other places that could provide ideas on how to move forward with the challenges (discussed below) it currently faces. Some of these issues are likely to be addressed in a conservation finance proposal that the ENGOS involved in the GBR have proposed for Clayoquot. Others will have to be taken up by the B.C. government and FNs.

Co-management

The CRB resulted in greater empowerment of FN communities and collaborative decision-making in resource management (Goetze, 2005). According to Goetze's (2005) findings, the CRB provided the FNs with the structure and processes of an 'empowered' co-management regime. It led to collaborative decision-making between FN and local municipalities and helped residents feel like they had a collective say in decisions affecting them (Goetze, 2005). The disbanding of the Central Region Board (CRB) created a void in the decision-making process and left communities without a voice or a forum within which they can collaborate (FN representative, interviews, October, 2010).

While the B.C. government has disengaged from co-management in Clayoquot, it is actively involved in co-management in the GBR. In the GBR, around 27 FN were able to form a coalition and negotiate a 'government-to-government' arrangement for shared decision-making in relation to land use planning and resource management (Price et al., 2010; Armstrong, 2009; Tjornbo et al., 2010; Shaw, 2004). This changed the power dynamic in favour of First Nations, as they were then considered equal partners with the government of British Columbia and not merely another 'stakeholder' in the planning process. The goal of the 'government-to-government' agreement was to ensure that lands and resources are managed in accordance with First Nations laws, knowledge and values through the land and resource management planning (LRMP) process (Armstrong, 2009; McGee et al., 2010). A forum representing all major interests (including resource development, conservation, tourism, government, and First Nations) used interest-based negotiations to reach a consensus agreement on recommendations for the LRMP (McGee et al., 2010). The government-to-government Land and Resource Forums are the primary vehicle are the means through which the government of B.C. and FNs make recommendations on laws, policies, land use plans and forest practices (Smith et al., 2007). A Technical Committee and an EBM Working Group advise the Land and Resource Forums (Smith et al., 2007).

If the B.C. government is engaging in an elaborate co-management process in the GBR, it could re-instate co-management in Clayoquot as well. It would be easier to coordinate as such a system was already in place and it involves fewer First Nations and stakeholders than in the GBR. Though not perfect, the CRB was a very effective co-management arrangement for the Clayoquot region (Goetze, 2005). Its absence has left a void in resource management (B.C. government, FN, EGNO and industry representatives, interviews, October, 2010). Even though two of Clayoquot-Ucluelet area FN have already signed treaties (Toquaht and Ucluelet), it could be possible to re-constitute a co-management arrangement like the CRB, if the B.C. government has the will to do it. The fact that some Nations have signed treaties should not hinder co-management. A co-management arrangement in Clayoquot would facilitate dialogue, collaborative decision-making, co-ordination between governments and implementation of watershed plans. The presence of a co-management board would also help facilitate

and implement the proposed conservation finance agreement that ENGOs are trying to negotiate.

Institutionalizing co-management boards and giving them planning and decision-making powers (a higher order of institutionalization and co-management rights) helps governments decentralize power and enables communities and governments to resolve conflicts (Pinkerton, 2009; Pinkerton & Weinstein, 1995; Pinkerton, 1993). Co-management is an effective way of resolving conflicts and enabling democratic decision-making (Pinkerton, 2009; Pinkerton & Weinstein, 1995; Pinkerton, 1993). Pinkerton (2009) and Pinkerton and Weinstein (1995) lay out a framework listing the full suite of co-management rights – starting with data collection and monitoring to determining harvest to policy-making that may be useful for communities while negotiating co-management agreements (Table 1.8).

Monitoring and Adaptive Management

The CSSP envisioned their recommendations being implemented as part of an adaptive management process (CSSP Report 5, 2005). But there has been very little monitoring in Clayoquot. This is one of the major missing pieces in the implementation of paradigm shift that the recommendations ushered in. Moreover, the adaptive management framework for Clayoquot Sound should consider ecosystem management issues like climate change that the Panel did not address, but later became concerns within the Clayoquot community. A climate change adaptation and mitigation strategy should be part of monitoring and adaptive management.

In order to fill the void left by the B.C. government's failure to implement monitoring and adaptive management, local environmental groups have been trying to establish a monitoring system in Clayoquot. They have been drawing inspiration from the example of the Babine Watershed Monitoring Trust (BWMT). The BWMT is a group of five neutral trustees that coordinates monitoring projects in the watershed according to the legally-binding Babine Watershed Trust Agreement 2005 (Price and Daust, 2009; Babine Watershed Monitoring Trust website, 2012). The BWM Trust was formed through a collaborative process involving community groups, businesses and provincial government agencies (Price and Daust, 2009). Representatives of these organizations

met regularly during 2004, with support from MSRM, WLAP, Pacific Inland Resources and Babine River Foundation, to develop the governance structure for monitoring in the Babine watershed. (Price & Daust, 2009). The trust works within a modest budget funded by donations from the Babine River Foundation, an organisation representing the three angling lodges on the Babine, that charge anglers an 'eco fee' which goes towards funding the Trust's monitoring work (Price, K., personal communication, November, 2012). The trust has a results-driven monitoring framework that separates values from knowledge, links monitoring to planning, provides an independent, transparent, and efficient procedure for prioritizing monitoring and provides decision support by highlighting strategies that are unlikely to achieve objectives (Price & Daust, 2009).

Assessments of monitoring in the Northwest Forest Plan warn aggregation of local monitoring efforts is not a substitute for a designed regional monitoring plan (Spies & Martin, 2006). Spies & Martin (2006) suggest that regional-scale questions require a regional-scale monitoring program (Spies & Martin, 2006). Based on their experiences with implementing the Northwest Forest Plan monitoring system, Spies & Martin (2006) offer suggestions for executing an effective monitoring plan. Government agencies should invest substantial resources to ensure that monitoring will be conducted at broad scales (Spies & Martin, 2006). A combination of local monitoring projects is not a substitute for a designed regional monitoring plan (Spies & Martin, 2006). A cost-effective, broad scale indicator of biological diversity can be obtained by monitoring vegetation structure and composition, measured with satellite imagery and inventory plots (Spies & Martin, 2006). Habitat approaches may not necessarily cover some species, such as threatened and endangered species (Spies & Martin, 2006). These species may require population monitoring (Spies & Martin, 2006). A monitoring system requires research support to develop and test metrics and biodiversity models (Spies & Martin, 2006). In the FEMAT areas, links monitoring and decision-making (adaptive management) are still being forged (Spies & Martin, 2006).

While local participation in monitoring EBM in Clayoquot is important, the B.C. government must honour its commitment to implementing the CSSP recommendations (which were later enacted into law through the watershed plans) by funding and supporting a regional monitoring and adaptive management system in collaboration with local residents.

Conservation Finance

The CSSP recommendations and the watershed planning to implement the recommendations did not address the most contentious question driving the 1993 protests - whether old growth should be logged in Clayoquot at all. Although the MoU between ENGOs and Iisaak Forest Resources Ltd. attempted to address this, the manner in which both parties interpret the understanding sometimes varies (Iisaak Forest Resources website, 2012, Friends of Clayoquot Sound website, 2012). Conservation financing proposed by ENGOs, similar to the deal in the Great Bear Rainforest, may reconcile the conflict, promote sustainable economic opportunities and preserve old growth forests in Clayoquot. A big part of the unfinished agenda in Clayoquot Sound is the need to create diverse and sustainable employment opportunities. Until better economic alternatives exist, the pressure to develop the unlogged watersheds will persist. Economic initiatives that could work towards a conservation-based economy need to be explored such as shellfish cultivation. Clayoquot could learn from EBM in the Great Bear Rainforest where sustainable economic development and human well being are part of EBM implementation. FN communities in Clayoquot are exploring ways in which they can benefit more from the tourism industry such as entry fees.

In the Great Bear Rainforest, ENGOs and forestry companies were able to come to an agreement on a set of principles upon which joint solutions could be developed (Armstrong, 2009; Tjornbo et al., 2010). This led to policies for an adaptive management framework to guide EBM and mechanisms for ongoing stakeholder engagement. In order to address sustainable development needs, a $120 million Coast Opportunities Fund was set up for First Nations economic development and conservation programs endowed by a $60 million private investment (from foundations) and a $60 million public investment (Armstrong, 2009; Price et al., 2010). The governance of EBM is through Land and Resource Forums and ongoing stakeholder collaboration between the province and stakeholders (Armstrong, 2009). If ENGOs were able to work out a conservation finance deal in Clayoquot, it would be much easier than the process in the GBR, since there is only one major forestry company (Iisaak Forest Resources) and it is owned by FNs. The ENGOs are trying to find ways to reach a deal by which they can find financing to pay off Iisaak's debt and set up a fund for developing sustainable

economic opportunities on the condition that there should be no logging in the unlogged (ENGO representatives, interviews, June, 2012).

Conclusion

Clayoquot Sound's journey over the last three decades has been one that many resource dependent communities experience (Shaw, 2002). Residents of Clayoquot confront several conflicts and dilemmas - the urgency to conserve a precious resource, the deprivation of people dependent on the depleted resources, the pressure to continue with or find alternatives to the industrial model of economic development, and battles against powerful corporations that are closely aligned to government.

Conservation financing may provide a solution to resolve Clayoquot's dilemmas over old growth logging. Since Iisaak Forest Resources Ltd. owns about 79% of the logging land base in Clayoquot Sound (Mychajlowycz, 2010a), the negotiations may be easier since there aren't any major multinational corporations exerting pressure on the process. However, FN governments within Clayoquot have differing opinions about the negotiations and their favoured outcomes (FN representatives, interviews, October 2010 and October 2011; ENGO representatives, interviews, June, 2012). Communities along the B.C. coast are struggling to find an alternative to a resource-dependent economy and though there are several experiments, there has been limited success. Economic and ecological sustainability is one of the biggest challenges that small communities such as Clayoquot face. If the proposal is able to plan for viable economic alternatives to developing the unlogged watersheds, it is more likely to be accepted.

The CSSP pioneered radical changes that shifted the paradigm of land management in B.C. towards EBM. The CSSP recommendations changed the way logging was conducted and introduced comprehensive, ecosystem-based, multi-scaled planning – as exemplified by the watershed plans. The CSSP made logging more sustainable in Clayoquot even though it was constrained by its mandate to stick within the land management zones already determined by the B.C. government's CLUD. Implementation of the CSSP recommendations resulted in increased protection of habitats and ecosystem processes and the inclusion of First Nations people, values and

culture in forestry practices. However, the CSSP could not address some of the fundamental issues raised during the War in the Woods, such as protection of old growth forests and unlogged watersheds. In order for Scientific Panels to come up with the most scientific approach, they should be given free rein, not confined within existing government constraints that may not necessarily be based on a scientific approach.

The CSSP paved a new path for forestry in B.C., showing that there were alternative practices to clearcut industrial logging that incorporated FN cultural values and protected environmental values. It was a game changer in B.C., putting pressure on logging companies like Weyerhaeuser to implement variable retention and adaptive management (Bunnell & Dunsworth, 2009). The CSSP brought about favourable long term changes for ecological protection. The outcome was that multinational forestry companies like MacMillan Bloedel (later sold to Weyerhaueser) changed many fundamental aspects of their harvesting practices. Eventually, the big forestry companies wound up operations in Clayoquot Sound and sold their TFLs to Iisaak Forest Resources Ltd. The short-term impact on jobs hurt residents and the local economy, particularly in Ucluelet. While implementing such major transitions, governments should anticipate the economic impacts and plan strategies to alleviate them, such as funds to set up more sustainable economic options. The CSSP tried to stretch the rules within a system of logging in B.C. which is geared towards industrial logging by companies, rather than sustainable forestry that ensures diverse economic employment within communities.

The B.C. government should re-instate co-management in Clayoquot Sound to facilitate effective, participative decision-making and EBM implementation. The CRB and the Clayoquot Sound Technical Planning Committee (CSTPC) were co-management bodies that enabled the planning and implementation of the CSSP's new forestry practices, with community participation. Co-management played a very important role in garnering community inputs and in helping with the transition. When the government disbanded the CRB, it left a big void in decision-making. It was a pioneering institution, and one of the most effective co-management boards in B.C., and should be re-constituted.

Monitoring and adaptive management are essential but missing component to implementation of EBM in Clayoquot. Adaptive management helps gauge whether decisions and actions taken meet the desired goal (Armitage & Plummer, 2010; Gunderson & Holling, 2001; Walker et al., 2004). In Clayoquot, the lack of monitoring has left the community with few means to evaluate the effectiveness of the sustainable forestry practices recommended by the CSSP. In the FEMAT areas too, it was found that NW Forest Plan has been more successful in stopping actions thought to be harmful to conservation than in promoting adaptive management (Thomas et al., 2006). The B.C. government should commit to planning and implementing a monitoring and adaptive management program in Clayoquot, perhaps with inputs from the CSSP so that their vision is properly actualized.

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Tables

Table 1.1: Demographics of the Clayoquot First Nations Communities.

This table is modified from an Ecotrust report (2011) which was compiled from primary data taken from the 1996, 2001, 2006 and 2010 census and INAC data.

Indicators	**Ahousaht**	**Hesquiaht**	**Tla-o-qui-aht**
Total Population (2010)	1974	680	990
Population on reserve (2010)	641	138	336
Population Growth Rates	3.3% (1996-2001) 3.7% (2001-2006) -0.6 % (2006-2010)	-3.2% (1996-2001) 7.5% (2001-2006) 5.1 % (2006-2010)	-1.1% (1996-2001) 4.2% (2001-2006) 0.7% (2006-2010)
Population Age (40yrs or less)	77%	68%	70%
Education Levels	6% - BA or higher 19% - trade or college 10% - high school (2001 census)	9% - BA or higher 18% - trade or college 9% - high school (2006 census)	0% - BA or higher 14% - trade/college 14% - high school (2006 census)

Table 1.2: Keystone Recommendations of the Clayoquot Sound Scientific Panel.

This table outlines the main recommendations of the Clayoquot Sound Scientific Panel report, 1995, as summarized in Moore (2001).

1. Adopt an ecosystem management approach for sustaining all forest values in Clayoquot Sound by planning in large physiographic units and over long time frames. • Abandon the specification of regional target AAC as an input to local planning. • Ecological land units, rather than administrative units, as the basis for planning. • Plan for long time scales to incorporate the cycles of many natural processes, and to ensure that operational plans address post-harvest management: 100 years for large areas, 10 years for smaller areas.
2. Engage communities, experts and First Nations in developing plans. Incorporate scientific information, traditional knowledge and local experience in the planning process. • Collect appropriate baseline information about the full range of biophysical and cultural forest resources and values, and use this information and knowledge to assess ecological responses to change. • Engage the Nuu-Chah-Nulth and other local people in all phases of planning and managing resources. • Appoint a planning committee, with stakeholders, to co-ordinate the planning process.
3. Plan at a "watershed" level to establish "reserves" that protect forest values and "harvestable areas" where forest operations will be conducted. Determine rates of harvest on the "watershed" level. • Develop plans at subregional, watershed, and site levels, and establish internal consistency among these plans • At the watershed level, map and designate reserves in which no harvesting will occur to protect 1) key hydroriparian ecosystems, 2) unstable slopes and sensitive soils, 3) red- and blue-listed species, 4) late successional forest with forest-interior conditions, 5) important cultural values, and 6) areas with high value scenic and recreational resources. • Determine a rate-of-cut based (as specified) on the size of the watershed area. • Within the harvestable areas, determine the size and configuration of cutting units based on consideration of topography, site and stand conditions, adjacent reserve areas, visual landscape management objectives and design principles, and operational constraints. • Riparian and other reserve areas established at the watershed planning level will protect values that require reserve forest. • Fast-track watershed-level planning.
4. Implement new forest practices with a variable retention silvicultural system. Provide protection for riparian and scenic areas. • Introduce the Variable-Retention silvicultural system. • Designate the entire hydroriparian zone as a special management zone, in which particular land management rules or constraints apply, depending on the terrain or features found in the area. • Use landscape design principles in the development of silvicultural plans and development plans for other uses. • Improve on-the-ground performance in construction and maintenance of road drainage structures (ditches, culverts, bridges) to meet the demands of the wet climate.
5. Restore ecosystems through rehabilitating past damage and recreating attributes of old growth in second growth stands. • Restoration plans should initially target: the restoration of hydroriparian zones; large areas which have been clearcut in the past without retention of late successional features (e.g., large, old living trees; snags; and downed logs) through either extended "rotations" or appropriate stand tending. • Innovative approaches to silvicultural practices throughout the stand rotation to promote diverse forest structure and habitats, and to attain structural features of old-growth forests.
6. Monitor, adapt and conduct research • Implement an adaptive management strategy to incorporate new knowledge and experience. • Refine the development of visual landscape guidelines. • Monitor the effects of plans and check against management objectives to facilitate adjustments. • Incorporate into the monitoring program: watershed and coastal integrity, biological diversity, human activities and values, implementation of forest management plans.

Table 1.3: Clayoquot Timeline.

This table outlines the major events and processes in the history of Clayoquot's conflicts over forestry and land use planning (Iisaak Forest Resources Ltd. website, 2012; Magnusson & Shaw, 2002).

Year	Event
1980	***Nuu-chah-nulth Land Claims:*** The fifteen Nuu-chah-nulth First Nations of the west coast of Vancouver Island reclaimed their traditional lands. The Canadian government accepted the land claim for negotiation.
1984-85	***Meares Island Protests and Supreme Court Judgment:*** The Ahousaht and Tla-o-qui-aht First Nations and Friends of Clayoquot Sound, a local environmental group, held boat blockades at Meares Island to protest against MacMillan Bloedel's plans to log the old growth forest on the island. The Ahousaht and Tla-o-qui-aht First Nations filed a case in the Supreme Court of Canada, and were granted an injunction in 1985 against logging on Meares Island pending treaty settlement.
1989-93	***Stalemate Over Land Use Planning:*** Several consultations between the B.C. government and stakeholders to reach an agreement on land use and sustainable development in Clayoquot Sound, like the Clayoquot Sound Sustainable Development Task Force 1989 and the Clayoquot Sound Sustainable Development Strategy Steering Committee 1990, did not make much progress due to disagreements over interim logging. Since two earlier efforts at trying to resolve the conflict over logging in Clayoquot failed, in 1991, the B.C. government instructed the Commission on Resources and Environment (CORE) to develop a comprehensive land use plan for Vancouver Island excluding Clayoquot Sound.
1993	***The Clayoquot Land Use Decision (CLUD):*** The B.C. government unilaterally announced the Clayoquot Land Use Decision (CLUD). While the Land Use Decision increased the protected area in Clayoquot Sound, and captured some significant ecological values, it still allowed for much of the forested area to be logged under a regime of "General Integrated Resource Management" and left most of the undeveloped watersheds subject to industrial development.
1993-95	***Summer Of 1993 Protests and Blockades:*** Several environmentalists were against the CLUD because it was a unilateral decision taken without adequate public involvement, it allowed logging of old growth forests and undeveloped watersheds and the new reserves demarcated had disproportional representation of only a few of the Biogeoclimatic (BEC) zones. This prompted widespread civil disobedience protests, the largest ever in Canada, with over 800 people arrested for blockading logging operations. Greenpeace and other international environmental groups organized consumer boycotts in 20 countries.
1994	***Interim Measures Agreement and Formation of the Central Region Board:*** The Hesquiaht, Ahousaht, Tla-o-qui-aht, Ucluelith, and Toquaht First Nations, entered into an Interim Measures Agreement with the Province of B.C., which granted joint management of traditional territories until the completion of treaty negotiations. As part of the agreement, the Central Region Board (CRB) was created to act as a bridging process while comprehensive treaty negotiations were underway. The Board consisted of representatives from B.C., local and First Nations government and its role was to review and make recommendations on all proposed development plans relating to Clayoquot Sound. This was the first step towards co-management in Clayoquot Sound.

Year	Event
1995	***CSSP Formed:*** The government faced a dilemma of massive public antipathy to their plan, impending economic crisis arising from the boycotts, and lack of credibility because of their poor process. They decided to break this stalemate by appointing an independent Scientific Panel to review forest practices in Clayoquot Sound--and both government and industry made public statements that they would abide by the recommendations of the panel.
1998	***Iisaak Forest Resources Ltd. Formed:*** Weyerhaeuser Ltd (a company that bought over MacMillan Bloedel) and the First Nations-owned Ma-Mook Development Corporation signed a partnership to form a new forest company called Iisaak Natural Resources Ltd (Iisaak Forest Resources Ltd. website, 2011). When Wayerhaueser decided to wind up its operations in B.C. in 2005, the Central Region Nations First Nations bought over Wayerhaueser's share in Iisaak Forest Resources Ltd., and gained complete ownership of the company and of the two Tree Farm Licences (TFLs) in Clayoquot Sound. (include about Ecotrust involvement)
1999	***Memorandum of Understanding to Protect Unlogged Watersheds:*** In 1996, Friends of Clayoquot Sound (FOCS) and Greenpeace took over Rankin logging camp, protesting logging in unlogged forests (under 2% logged) in Bulson by Macmillan Blodel and "clearcuts with reserves" in Rolling Stone by Interfor. This prompted FN to call a public meeting where they insisted environmentalists and logging companies work things out to stop the "war in the woods". Negotiations began that resulted in the Memorandum of Understanding that was signed in 1999 between Iisaak Natural Resources Ltd. and: Greenpeace Canada, Greenpeace International, Natural Resources Defense Council, Sierra Club of B.C. and Western Canada Wilderness Committee to protect biodiversity and enhance sustainable economic development opportunities.
2000	***Clayoquot Sound UNESCO Biosphere Reserve Established:*** A Biosphere Reserve is an area where communities balance conservation with sustainable economies and social and cultural development.
2001	***Iisaak gets FSC Certification:*** Iisaak became the first Tree Farm License in British Columbia to be certified to Forest Stewardship Council (FSC) standards.
2006	***Completion of Watershed Plans:*** All the 15 watershed plans were endorsed by ministerial order, marking a change from a time when the Scientific Panel recommendations and the processes that followed were adhered to voluntarily to one in which they were legislated and legally binding.
2009	***CRB Disbanded:*** The CRB was meant as an interim bridge to treaty, until the Nations signed treaties. Since two of the Nations (Toquaht and Ucluelet aka Yu-cluth-aht) signed the Maa-nulth Treaty with the B.C. government, the Province decided to withdraw funding disband the board. With this, an important forum for co-ordination and planning was lost.
2010-12	***Conflict Over Flores Island Logging Leads to Conservation Finance Initiative:*** Iisaak Forest Resources Ltd. has been surveying and building roads in preparation to begin forestry operations in an unlogged watershed called Flores Island in 2011. The Ahousaht First Nation had cleared Iisaak's plans to log Flores Island. The incident that has prompted deliberations between Iisaak, FN communities and ENGOs about a proposal for conservation finance in Clayoquot and brought several ENGOs from outside to focus their efforts on Clayoquot Sound.

Table 1.4: Description of main communities in and around Clayoquot Sound.

(Tofino Botanical Gardens Foundation website, 2012; Statistics Canada, 2006 Census; Ecotrust, 2011). All population data are from Statistics Canada, 2006.

Community	Population	Description
Tla-o-qui-aht First Nation	350	Two villages, Hupits'ath/ Opitsaht and Hisaawist'a /Esowista. Opitsaht village is only accessible by water. Children from Opitsaht travel on a school boat to attend elementary school in Tofino or high school in Ucluelet (Tofino Botanical Gardens Foundation website, 2012).
Maaktusiis / Ahousaht First Nation	661	Situated on Flores Island. Ahousaht has its own elementary and high school and is only accessible by boat or float plane (Ecotrust, 2011).
Hesquiaht First Nation	113	Hot Springs Cove is the main year-round village of the Hesquiaht First Nation, though other traditional sites continue to be used throughout the area (Tofino Botanical Gardens Foundation website, 2012).
Ucluelet First Nation	205	Formerly, the centre of Clayoquot's logging industry. Now, people here employed mainly in tourism, services, government work and fish processing.
Tofino	1655	It is the hub of tourism in Clayoquot, and has mainly non-First Nation residents.
Ucluelet	1487	It comprises mainly non-First Nation residents. It was the hub of the forestry industry, before the 1993 protests. Now, the main occupations are in tourism, fish processing and the service sector.

Table 1.5: Employment in the Clayoquot First Nations.

This table shows the economic and employment indicators in three Clayoquot communities where the Scientific Panel recommendations are being implemented.

The table is modified from an Ecotrust report (2011) which was compiled from primary data taken from the 2001 and 2006 census. The brackets indicate the year of the census data. Since 2006 data was not available for one community; the Ecotrust report relied on anecodatal information from the community gathered in 2010 in order to get more updated data. Labour Force Participation describes the percentage of the population aged between 15-65 years who are in the labour force or seeking work. Services include health, education, wholesale & retail trade, transportation, admin support, professional, accommodation and food services arts and recreation etc.

Indicators	**Ahousaht**	**Hesquiaht**	**Tla-o-qui-aht**
Employment Distribution	23% Resource/ Manufacturing/ Construction 23% Services 24% Public administration *(2001 census)* 31% Fishing & fish farms 31% Construction 5% Forestry 28% Band Administration 28% Education 1% Tourism 6% Transportation *(Anecdotal info 2010)*	14% Resource/ Manufacturing/ Construction 21% Services 36% Public Administration *(2006 census)*	27% Resource/ Manufacturing/ Construction 51% Services, (of which 42% Tourism) 21% Public Administration *(2006 census)*
Labour Force Participation	67% (2001 census) 75% (2010 Anecdotal info)	64% (2006 census)	59% (2006 census)
Unemployment Rate	17% (2001 census) 25% (2010 Anecdotal info)	27% (2006 census)	13% (2006 census)
Median Earnings	$18,102 (2001 census)	$14,000 (2010 Anecdotal info)	$14,224 (2006 census)

Table 1.6: Sample Sizes of Stakeholder Interviews.

This table describes the number of people interviewed from each stakeholder group.

Sector	**No. of interviewees**
First Nations	14
Forestry Industry	3
Non-First Nations residents	3
ENGOs	8
Scientists	6
B.C. or Local Government	3
Consultants	3
TOTAL	40

Table 1.7: Summary of Perspectives on CSSP Implementation Reflected in the Interviews.

This table summarizes the broad trends from the interviews conducted by me, classified according to the responses of First Nations and the main stakeholder groups to the major issues in land use planning in Clayoquot Sound.

ISSUE	FIRST NATIONS	INDUSTRY	ENGOs / ACTIVISTS
Protection for Old Growth Forests	• Dilemma and divisions within FNs about whether old growth should be logged and how. Most would not like it to be logged but don't know how Iisaak will sustain. • Differences within FNs whether old growth should be logged and how.	• Watershed Plans provide adequate protection for old growth. Less than 20% of forested land base is available for harvest. • Forestry in unlogged watersheds allowed in Watershed Plans, which were developed through a long community consultation process.	• Watershed Plans should be amended to protect unlogged watersheds. • Scientific Panel did well within its narrow mandate, but could not address the real question that sparked the 1993 protests - to log old growth or not?
Extent to Which Watershed Plans Have Addressed the CSSP recommendations	• Land-Use planning is not holistic – only pertains to forestry but not other economic activities like mining, tourism etc. • Cultural surveys are a necessary precautionary measure.	• Connectivity between watersheds not yet implemented - planning units should be reviewed. • Need for comprehensive monitoring and adaptive management.	• CSSP could not address the issue of protection of intact watersheds. • Watershed reserves protect only from logging, but not from other industrial activities such as mining.
First Nations Role in Decision-Making	• Having elders in CSSP gave FN was essential. • Cultural surveys recognize FN values. • Iisaak - big achievement for FN. • CSTPC gave FN a voice in planning.	• Iisaak's formation was a big achievement for FN control over forestry.	• Cultural surveys are important - necessary stipulation before any cutblock is harvested. • Iisaak - big achievement for FN.
Impact on Socio-Economic Situation	• Unemployment and fishing declines have affected FN communities. • FN not benefiting much from logging. • FN-owned forestry company has not brought in money to FN bands for social problems like poor housing, employment.	• Need to focus on value-added products so that more local employment is generated. e.g. housing, non-timber forest products. • Carbon credits may not contribute towards solving the problem of unemployment.	• Logging is not adding much to local employment. • Conservation finance may resolve the FNs' dilemma over economic development or conservation of old growth forest. • Need more sustainable employment alternatives. e.g. gardens, housing.
Institutions and Policy for Local Decision-Making Institutions	• Central Region Board dissolved, has affected decision-making. • Lack of unity amongst five FN and within each community.	• Re-establish Technical Planning Committee (CSTPC) to enable decision-making. • Need a body to co-ordinate monitoring and adaptive management.	• Central Region Board dissolved - has affected decision-making.

Table 1.8: Hierarchy of Rights in Fisheries Management Decision-Making.

(Pinkerton, 2009)

Type of Management Right	Specific Right
Lower order rights	Data collection Data analysis
Higher order rights	Plan timing and location of fishery Rule-making regarding fishing methods Allocation of fishing opportunity among rights holders Enforcement of fishing rules Defining who has fishing rights
Broader rights affecting other actors and users of marine space	Rule-making regarding fish habitat protection Enforcement of habitat protection rules Coordination of fishing and other competing uses of marine space Returning optimum value to fishermen
Highest level rights	Fisheries policy development Identification of key problems, issues Creating a vision of what fishery is desired, goals of management.

Figures

Figure 1.1: Clayoquot Sound in a North American Perspective.

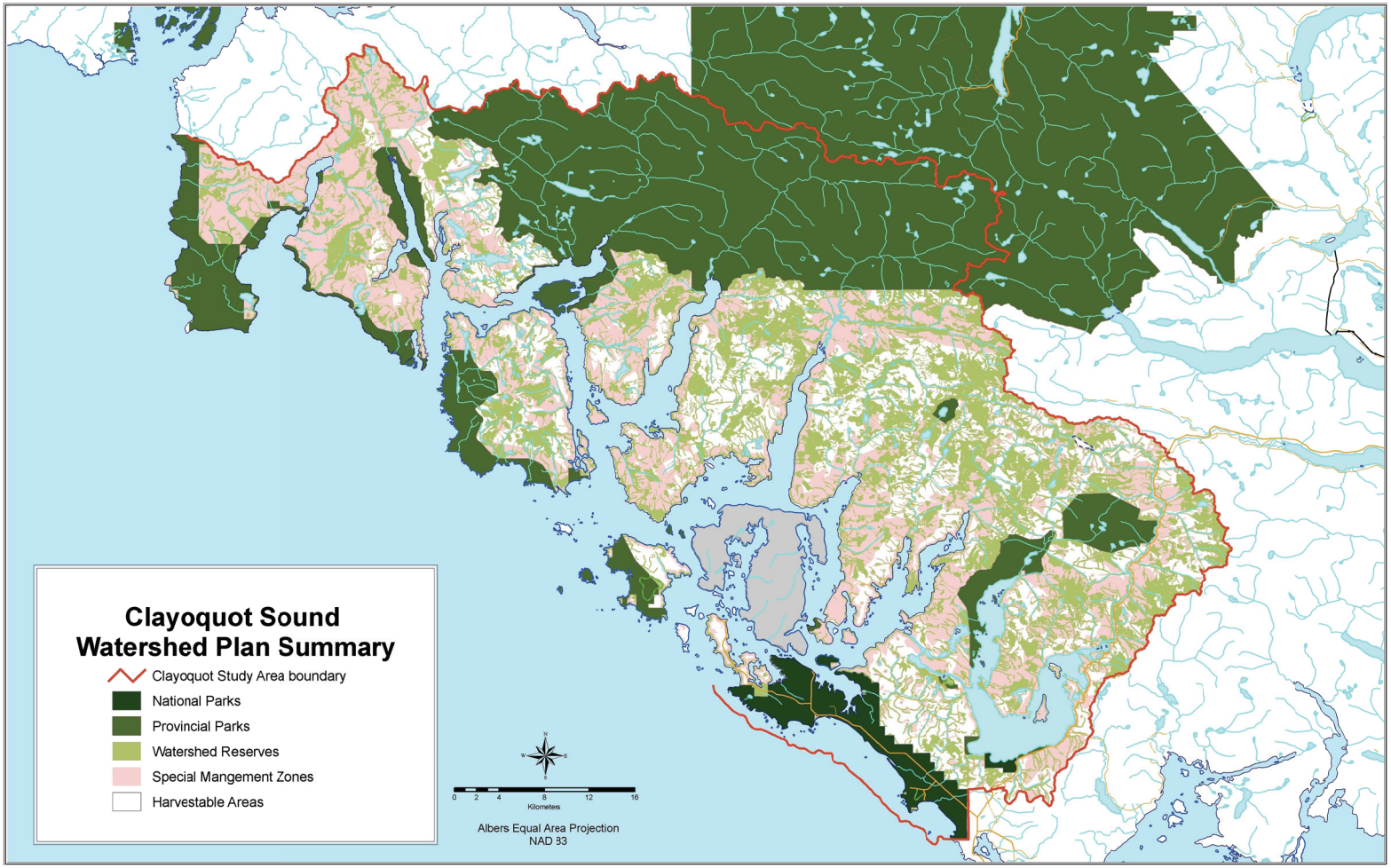
Clayoquot Sound
Watershed Plan Summary
Clayoquot Study Area boundary
National Parks
Provincial Parks
Watershed Reserves
Special Mangement Zones
Harvestable Areas
0 2 4 8 12 16
Kilometers
Albers Equal Area Projection
NAD 83

Figure 1.2: Map Showing Different Land Use Zones Designated in the Clayoquot Sound Watershed Plans.

There are five different zones each with differing levels of protection. National Parks are protected areas owned by the Federal Government of Canada. Provincial Parks are protected areas owned by the Provincial government of British Columbia. Watershed Reserves are areas protected in order to preserve watershed integrity, biological diversity and human values. Special Management Zones are reserves to protect human values – culturally important areas, scenic areas and recreational or tourism values – are better characterized as special management zones. Most areas identified to protect these values are not excluded from harvesting. However, certain conditions and requirements must be met before harvesting may proceed. Only reserve buffers around recreational and tourism features, as well as cultural and scenic features of highest significance, are excluded from harvesting. Harvestable areas are land that falls outside of reserves and on which sustainable forest harvesting can take place (Clayoquot Sound Technical Planning Committee, 2006a, 2006b).

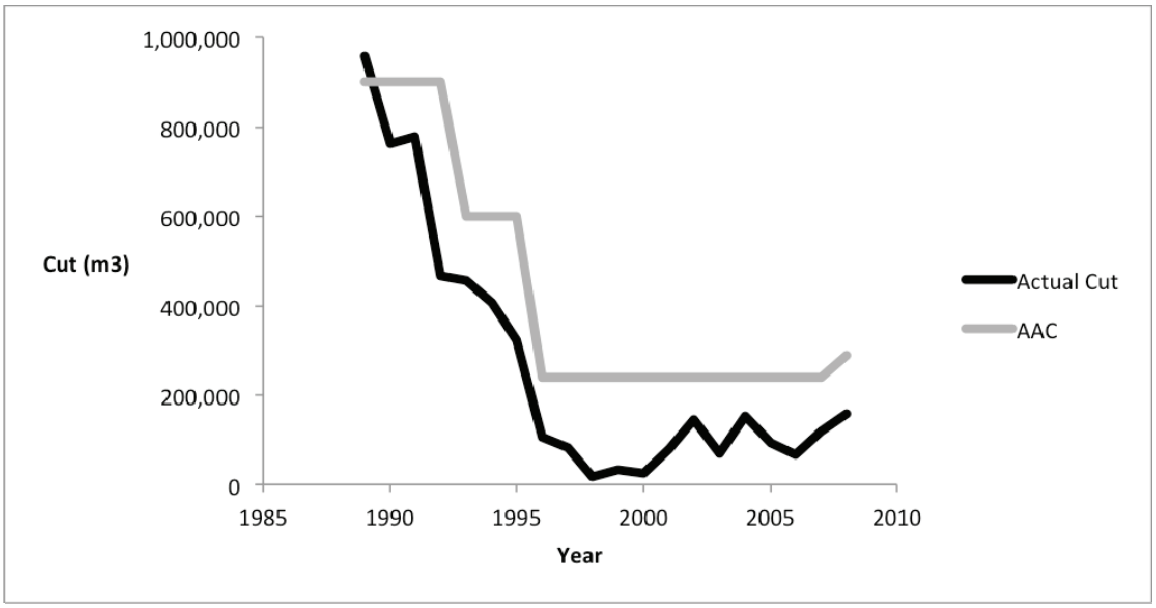

Figure 1.3: Annual Allowable Cut (AAC) And Actual Timber Harvest In Clayoquot Sound.

Graph compiled from data in Mychajlowycz (2010b).

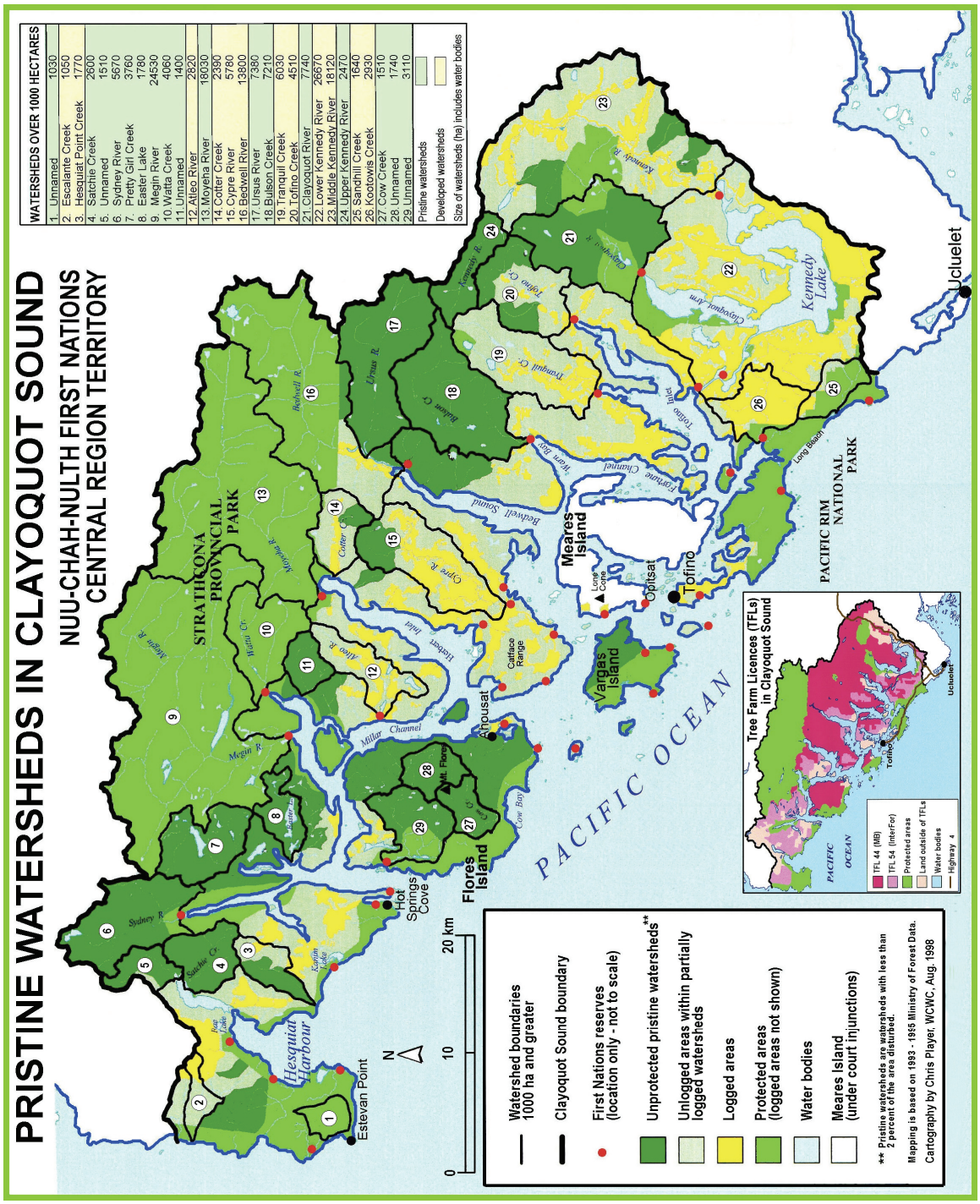

Figure 1.4: Map of Unlogged Forest Areas in Clayoquot Sound.

This map is being used by ENGOs to negotiate a conservation finance agreement. This map was created by the Western Canada Wilderness Society in 1998.

Chapter 2:

Communities Monitoring Ecosystems: Case Studies around the World

Abstract

This paper explores how the Coastal Guardian Watchmen Network (CGWN), a community-based monitoring network of 10 First Nations stewards along the central and north coast of British Columbia, can learn from other community-monitoring groups to develop an effective ecosystem monitoring system, gain enforcement authority and have a voice in decision-making. I examined community-based monitoring (CBM) groups in different parts of the world to identify factors of success, and identify how the CGWN can learn from their experiences. The case studies I examined were: 1) The Indo-Pacific Locally Managed Marine Area (LMMA); 2) The I-Tracker Network, North Australia; 3) The Great Lakes Indian Fish & Wildlife Commission (GLIFWC), USA; and 4) The Association of the Indigenous Land of Xingu (ATIX), Brazil. The case studies were narrowed down after conducting a literature review and compiling a table of several examples of CBM.

I conclude that it is important for communities to have customary title to their territories and/or be part of a co-management arrangement to ensure effective monitoring and enforcement. Supportive national and provincial governments that fund and institutionalize monitoring arrangements have helped with the development of CBM. Backing from community leaders or elders helps gain compliance from community members. NGOs and researchers played a key role in supporting CBMs with capacity development and funding. Increased research and mapping provided credibility and leads to a better understanding of ecosystem trends. The ability to demonstrate positive ecological and social impacts from monitoring also helped CBM to gain momentum, and convince governments to provide support or change policy. Being able to analyze data

and present results to government in a scientific language helped communities convince governments to implement decisions or policies.

Introduction

Community-based monitoring (CBM) stems from a community's desire to play a stronger role in the management and monitoring of resources it values and depends on (Govan, 2009; Eamer, 2006; Tawake, 2007; Carr, 2004; Harding, 1998; Irwin, 1995; Kennett et al., 2010). In the last few decades, local communities have sought a greater voice in decision-making through the recognition of their rights over their traditional territories, co-management agreements and a broader acceptance of traditional knowledge and conservation practices (Dowie, 2009; Pinkerton & Weinstein, 1995; Berkes, 2009; Govan, 2009; Govan et al., 2009; Leach, Scoones & Wynne, 2005; Leach, Scoones & Cockburn, 2006. Leach & Scoones, 2007). CBM initiatives are local responses to government failures to respond to their concerns, in which residents take control of monitoring their immediate environment with the intent of informing decisions that affect their environment and well being (Govan, 2009; Eamer, 2006; Tawake, 2007; Carr, 2004, Harding, 1998; Irwin, 1995; Kennett et al., 2010; Leach, Scoones & Wynne, 2005; Leach, Scoones & Cockburn, 2006. Leach & Scoones, 2007; Lee, 1993). The literature on the commons (Ostrom, 1990; Ostrom, 2010), community conservation (Berkes, 2007; Berkes & Siexas, 2004; Danielsen et al., 2005), co-management (Pinkerton, 2009; Pinkerton, 1992; Pinkerton & Weinstein, 1995) and traditional and local ecological knowledge (Berkes, 2009; Huntington et al., 2004; Kofinas et al., 2002; Neis & Felt, 2000; Galloway-McLean, 2010) has demonstrated how communities have managed to sustain their environment and adapt to changes, and how community knowledge can contribute to effective ecosystem management.

Increasingly citizens are invoking their right to take part in environmental decision-making and are pushing for the democratization of science (Carr, 2004, Govan, 2009; Govan et. Al, 2009; Tawake, 2007; Harding, 1998; Irwin, 1995). Top-down approaches have had limited success because local residents have not been involved in decisions that affect their lives (Dowie, 2009; Tawake, 2007; Leach, Scoones & Wynne, 2005; Leach, Scoones & Cockburn, 2006. Leach & Scoones, 2007). Community-based

monitoring fulfills local needs for surveillance and to gain a better understanding of the local environment (Berkes, 2004; Carr, 2004; Leach, Scoones & Wynne, 2005; Leach, Scoones & Cockburn, 2006. Leach & Scoones, 2007; Ecological Monitoring & Assessment Network Coordinating Office & the Canadian Nature Federation, 2003; Govan, 2009; Govan et al., 2009). Conversely, realising that social, political and economic factors need to be addressed in order for conservation to be effective, some governments and organizations have begun to adopt a more inclusive approach to conservation, involving communities who were earlier excluded (Berkes, 2004; Danielsen et al., 2005; Burgess et al., 2005; Ghimire, 1997; Govan, 2009; Govan et al., 2009; Kennett et al., 2010).

Data gathered from monitoring can provide feedback and insights that could be used to alert governments to new threats or changes, petition for demands, suggest improvements or new policies to authorities or organizations managing the resources or services (Govan, 2009; Eamer, 2006; Tawake, 2007; Carr, 2004; Irwin, 1995; Kennett et al., 2010; Leach, Scoones & Wynne, 2005; Leach, Scoones & Cockburn, 2006. Leach & Scoones, 2007; Ecological Monitoring & Assessment Network Coordinating Office & the Canadian Nature Federation, 2003). Some communities also use monitoring to keep a watch over social or economic outcomes or services such as health care (Ecological Monitoring & Assessment Network Coordinating Office & the Canadian Nature Federation, 2003; Leach, Scoones & Wynne, 2005; Leach, Scoones & Cockburn, 2006. Leach & Scoones, 2007). Besides providing relevant and useful information, CBM also strengthens local decision-making, public education, community capacity and effective public participation in local government (Tawake, 2007; Carr, 2004; Irwin, 1995; Kennett et al., 2010; Govan et al., 2009; Lee, 1993; Leach, Scoones & Wynne, 2005; Leach, Scoones & Cockburn, 2006. Leach & Scoones, 2007; Ecological Monitoring & Assessment Network Coordinating Office & the Canadian Nature Federation, 2003).

Scientists and governments across the world are acknowledging the value of community-based conservation. As Berkes notes:

> Community-based conservation has emerged at a time when the science of ecology and the various fields of applied ecology seem to be in the midst of three conceptual shifts: a shift from reductionism to a systems view of the world, a shift to include humans in the ecosystem, and a shift

> from an expert-based approach to participatory conservation and management. (Berkes, 2004, p. 621)

The value of CBM is being recognized as diverse streams of knowledge are gaining credibility as a valuable source to inform science and decision-making. The Millennium Ecosystem Assessment was one of the first global assessments to attempt to incorporate multiple scales and multiple knowledge systems (Reid et al., 2006). By monitoring ecosystems at the local level, community-based monitoring can help build the foundation for a multi-scale, multiple knowledge system-driven understanding of ecosystem dynamics.

With rapid environmental change underway, collaborations between Western science and traditional knowledge have helped scientists and communities understand and adapt to the dynamics of local and regional climate change (Robards et al., 2011; Kofinas, 2002; Berkes, 2009; Galloway-McLean, 2010). Climate science has predicted profound and wide-ranging impacts of climate change on a global scale, but it has been difficult to downscale models to anticipate local impacts (Schiermeier, 2010). Several CBM projects work with scientists, and use traditional and local knowledge as well as Western science to gain a better understanding of the impacts of environmental changes (Appendix 1, Eamer, 2006; Arctic Borderlands Knowledge Co-operative website, 2011; Aswani & Hamilton, 2004; Berkes, 2007; Boyd & Charles, 2006; Galloway-McLean, 2010; Gearheard, Aipellee & O'Keefe, 2010; Govan et al., 2009; Kofinas, G., & Old Crow, Aklavik, Fort McPherson, & Arctic Village, 2002; Krupnik et al., 2010; Robards et al., 2011). The synergy of western scientific and local knowledge has been used for different purposes:

1. For large scale monitoring of environmental change, weather patterns and sea ice melting (Berkes, 2007, 2008, 2009; Robards et al., 2011; Australian Indigenous Weather Knowledge website, 2012);
2. To understand distribution and dynamics of wildlife and fish populations (Robards et al., 2011; Aswani & Hamilton, 2004);
3. To identify protected areas in their region (Aswani & Hamilton, 2004);
4. To detect toxins (Berkes et al., 2007);
5. To regulate local fisheries (Okanagan Nation Alliance website, 2012; GLIFWC website, 2012; Mangel & Levin, 2005; Pinkerton & Weinstein, 1995; Boyd & Charles, 2006; Basurto, 2005).

Ecosystem monitoring is an essential element of adaptive management, which involves flexible experimentation, monitoring, learning from the results of monitoring and adapting actions accordingly (Armitage & Plummer, 2010). Community-based monitoring has been effective in engaging communities in monitoring and adaptive management (Danielsen et al., 2009; Govan et al., 2008, 2011; Lee, 1993). Widespread community-based monitoring helps us gain greater understanding of the state of an ecosystem at both local and regional levels, providing cross-scale data (Berkes, 2004; Tawake, 2007; Govan et al., 2009). For instance, the Coastal Guardian Watchmen Network (CGWN) in British Columbia has a uniform Regional Monitoring Strategy so that data is collected uniformly in local communities to provide information at local as well as regional scales (Coastal Guardian Watchmen Network website, 2012).

The literature on co-management addresses different arrangements between government, communities and stakeholders that enable a more participatory and flexible approach to resource management, and facilitate adaptive management (Pinkerton, 2009; Pinkerton, 1992). “Co-management is power-sharing between government authorities and community groups or stakeholders in decisions over resource management” (Pinkerton, 1992, p.331). It encompasses shared data collection and analysis, allocation, shared planning of harvests, management, enforcement and habitat protection. Pinkerton (2009) lays out a hierarchy of rights in fisheries management decision-making (Table 2.1), which can be applied more broadly in resource management. This table is helpful in identifying where a community is currently in its efforts to gain co-management rights, and the potential suite of rights that it could work towards acquiring. However, it is difficult to evaluate community monitoring groups using this framework, as most of these groups are a component of a larger organization that is involved in negotiating or implementing co-management arrangements. In order to evaluate the stage of co-management that community-based monitoring groups are at, it would be necessary to examine the larger organizations that to which they belong, which goes beyond the scope of this paper. Though the goal of community monitoring is to gain more co-management rights, we will confine ourselves to understanding the unique dynamics and impacts of community-based monitoring networks in this paper.

Several of the community monitoring groups I have studied in this paper are local groups that desired a created voice in resource management and filling a void left by the

state's withdrawal or failure to monitor and enforce. Many of these groups are similar to social movements and have struggled to gain legitimacy. Pinkerton (1993) looks as co-management as a social movement using Scott's (1990) definition. Scott views social movements as a response to the failure of the institutions of representation to respond to popular sector issues, demands, or concerns (Scott, 1990; Pinkerton, 1993). Most popular movements are in fact made up either of groups which have been excluded from the polity or of issues which have been excluded from mainstream politics (Scott, 1990; Pinkerton, 1993). Scott advocates an examination of both general sociological pre-conditions and specific political conditions in attempting to predict the success to a social movement (see Table 2.2). Since CBM networks are sometimes an important component of co-management, in the Discussion section, I will examine how many of these pre-conditions are essential for successful community monitoring as well.

The Coastal Guardian Watchmen Network (CGWN) is a community-based monitoring network of 10 First Nations along the central and north coast of British Columbia. The CGWN has emerged as a dynamic force of ecosystem stewards guarding and monitoring their Nations' territories (Coastal Guardian Watchmen Network website, 2012). They have been using a co-ordinated Regional Monitoring Strategy (RMS) since 2010 (Coastal Guardian Watchmen Network website, 2012). This network has the potential to grow and develop a system that could monitor for key indicators of ecosystem resilience and environmental change that are important to their communities, that would help their communities be more adaptive and resilient.

In this paper, I will explore how the Coastal Guardian Watchmen Network (CGWN) can learn from other community-monitoring systems to further their goals: 1) to develop an effective ecosystem monitoring system; 2) to gain enforcement authority; and 3) to have input into decision-making and policy about resource management and stewardship. Using case studies of community-based monitoring groups in different parts of the world, I will attempt to understand what made them effective in achieving their goals and identify key lessons from their challenges and successes. I initially conducted a broad literature review to identify a large set of potential case studies (see Appendix 1) and then chose a smaller subset of four cases to examine in greater depth. First, I review the benefits of CBM based on my broad survey of case studies. Then I examine the focal case studies in more detail, including the CGWN. Finally, I conclude

by examining how the case studies helped answer key questions for those wishing to develop effective CBM networks.

Benefits of Community-Based Monitoring

Community-based monitoring is an effective way to develop holistic and participatory knowledge systems to inform decisions that aim to build more resilient ecosystems and sustainable communities. The effectiveness and benefits of CBM emerge in a variety of ways. We can identify ten major benefits of community-based environmental monitoring for have emerged from the literature (Table 2.3).

1. Understanding Ecosystem Change from an Indigenous Perspective

The richness of narratives and insights obtained from communities that have intimate knowledge of their ecosystem is a valuable resource in understanding ecosystem dynamics (Mangel and Levin, 2005; Reid et al., 2006; Berkes, 2008, 2009; Robards et al., 2011). There is a vast body of climate science that has documented and projected a variety of impacts of climate change on global and regional scales (IPCC, 2007; Mann et al., 1998, 2003; Berkeley Earth Surface Temperature Research Team website, 2012), but downscaling regional impacts does not yield accurate local results (Schiermeier, 2010). Hence, several adaptation projects are now looking to Local Ecological Knowledge to gain a better understanding of the local impacts of climate change and how to manage for them (Galloway-McLean, 2010; Berkes, 2008; Ostrom, 2010, Alexander et al., 2011).

Indigenous knowledge systems seem to build holistic pictures of the environment by considering a large number of variables qualitatively, while science tends to concentrate on a smaller number of variables quantitatively (Berkes et al., 2008). Areas conserved by indigenous communities are often managed based on multiple objectives - sustainable use and livelihood needs, cultural value, self-governance, economic development and biological conservation (Berkes, 2009). For example, indigenous hunters' knowledge helps to understand changes in sea ice, helping walrus hunters plan their hunt (Krupnik et al., 2010). Traditional knowledge can identify changes in species

abundance or wildlife behaviour. For instance, a study of traditional knowledge of the bowhead whale around St. Lawrence Island helped detect two different migration routes (Noongwook et al., 2009).

Riedlinger and Berkes (2001) explained how traditional knowledge can expand the range and richness of the information available, in both space and time scale. Based on research carried out in the Arctic, they further suggest that indigenous knowledge and science could be brought together through five areas of convergence (potential areas of collaboration and communication). These relate to the use of traditional knowledge (1) as local scale expertise; (2) as a source of climate history and baseline data; (3) in formulating research questions and hypotheses; (4) as insight into impacts and adaptation in Arctic communities; and (5) for long-term, community-based monitoring (Riedlinger & Berkes, 2001).

2. Collaboration and Learning

Community monitoring can build greater awareness about environmental problems like overexploitation, habitat loss or climate change that communities are experiencing as subsistence-based societies (Huntington et al., 2004; Krupnik et al., 2010; Eamer, 2006; Lee, 1993; Govan et al., 2009; Gofman, 2010; Berkes 2008, 2009; Robards et al., 2011, Alexander et al. 2011; Galloway-McLean, 2010). Collaborations between hunters, fishermen or community monitoring networks and university researchers can prompt larger studies to understand ecosystem dynamics and climate change impacts (Huntington et al., 2004; Krupnik et al., 2010; Eamer, 2006; Gofman, 2010; Berkes 2008, 2009; Robards et al., 2011; Alexander et al., 2011). Community monitoring could provide baseline data for future monitoring and could detect early warning signs about phase shifts or any other threats to ecosystems (Kofinas et al., 2002; Berkes, 2008; Galloway-McLean, 2010; Torikka-Gelencsér et al., 2004). For example, sea ice monitoring and mapping by walrus hunters in Nunavut provides baseline data to track sea ice melting in the future (Huntington et al., 2010; Gearheard et al., 2010) .

3. Empowerment

CBM decentralizes power, develops capacity within communities, mobilizes people and empowers communities (Eamer, 2006; Carr, 2004; Irwin, 1995; Leach et al., 2005, 2006, 2007; Lee, 1993; Tawake, 2007; Pinkerton & Weinstein, 2005; Berkes, 2009). For example, the Nunavut land claims agreement 1993 ushered in a new system of community narwhal management, which transferred responsibility away from the government directly to a community (Armitage, 2005). Under this multilevel governance arrangement, the Nunavut Wildlife Management Board (NWMB) plays a central role in linking the community Hunters and Trappers Organization (HTO) and the Canadian Government's Department of Fisheries and Oceans (Armitage, 2005). The HTO is required to develop, in collaboration with the government, a reporting system to accurately record harvesting information, such as the number of animals struck, landed and lost (Armitage, 2005). Community monitoring has played a role in the implementation of the co-management agreement, thus putting into practice what might otherwise be meaningless words. Empowerment is also exemplified in the following discussion of enforcement and input into decisions.

4. Enforcement Authority

Community monitoring networks could help communities gain more enforcement authority and empower them to collaborate with government agencies (Berkes et al., 2007; Govan et al, 2009; Tawake, 2007; Kennett 2010, 2011). For example, in the Philippines, after 2.5 years of collaborative monitoring by 97 community rangers and 350 community volunteers over one million hectares of Philippine protected areas, there was more collaboration between local people and park authorities, and the scope of indicators being monitored expanded from just timber extraction estimates to more holistic indicators (Danielsen et al., 2005). As a result of the collaborative monitoring, 156 management actions were undertaken by the park authorities, local municipalities, and local communities to conserve or to sustain the use of resources in the protected areas (Danielsen et al., 2005). In total 98% of these actions were considered to be meaningful and justified based on the criteria laid down by the researchers, 47% targeted the three most serious threats to biodiversity at the site (such as industrial and road development, logging, agriculture, quarrying, wildlife hunting and commercial

marine fishing), and 90% were implemented without external support, suggesting that the interventions were relevant and could be sustained over time at the local level (Danielsen et al., 2005).

5. Input into Decision-Making

In co-management or collaborative management agreements, community knowledge can play an important role in decision-making (Govan et al., 2009; Armitage, 2005; Berkes, 2007, 2008). Based on advice from the three Inuvialuit communities of Tuktoyaktuk, Aklavik, and Inuvik, the Beaufort Sea Integrated Management Planning Initiative (BSIMPI) decided to recommend to the Canadian federal government the creation of marine protected areas in the zones being considered (Berkes et al., 2007). BSIMPI Working Group on Traditional Knowledge documented detailed information on the marine resources that have historically been available in the region, and how the Inuvialuit have traditionally used these resources in order to make a strong case for the need of these protected areas (Berkes et al., 2007).

6. Communication

The information obtained by community monitoring can help local communities communicate their concerns about environmental change both within their communities and to the outside world (Eamer, 2006; Arctic Borderlands Knowledge Co-operative website, 2011; Berkes, 2007, 2008, 2009; Boyd & Charles, 2006; Galloway-McLean, 2010; Gearheard, Aipellee & O'Keefe, 2010; Govan et. al, 2009; Kofinas, G., & Old Crow, Aklavik, Fort McPherson, & Arctic Village, 2002; Krupnik et al., 2010; Robards et al., 2011). It can be used to inform decisions on resource management within communities and at a broader policy-making level (Berkes, 2007, 2008; Lee, 1993; Galloway-McLean, 2010; Gearheard, Aipellee & O'Keefe, 2010; Govan et. al, 2009). Data from community monitoring is prompting action in several places like the Philippines example mentioned earlier (Danielsen et al., 2005) as well as by the groups studied in this paper like LMMA, GLIFWC and I-Tracker (Govan et al., 2009; GLIFWC website, 2012, Kennett et al., 2010, 2011).

7. Partnership Building

Networks and collaborations to combine different knowledge systems and monitoring data help to build partnerships between First Nations, government agencies, researchers and stakeholder groups (Kofinas et al., 2002; Berkes, 2007, 2008, 2009; Galloway-McLean, 2010; Gearheard, Aipellee & O'Keefe, 2010; Govan et. al, 2009; Kennett et al. 2010, 2011, Carr, 2004; Arctic Borderlands Knowledge Co-operative website, 2011; Robards et al. 2011). These collaborations lead to better understanding of ecosystem changes, more research relevant to communities and decision-making, and efforts more focused towards a common goal. For instance, in the Xingu National Park (PIX) in the Brazilian Amazon, indigenous groups formed associations with individuals and organizations with the overall goals of taking control of park management and coping with the growing pressure on its borders (ATIX website, 2012; Brondizio et al., 2009). These alliances were with government officials [e.g., officers from the National Indian Foundation (FUNAI)], NGOs [e.g., Socioenvironmental Institute (ISA)], church-based movements, high-profile celebrities (e.g. Sting), anthropologists, and physicians working in the region (Brondizio et al., 2009). In 1994, alliances among all 14 ethnic groups led to the creation of the Association of the Indigenous Land of Xingu (ATIX website, 2012; Brondizio et al., 2009).

In the 1990s, the indigenous groups within Xingu National Park observed lower volumes of water in some tributaries (resulting from sedimentation and dried water springs), increasing loads of sediments, and decreasing water transparency, which made arrow fishing difficult (Brondizio et al., 2009). Higher levels of smoke and air pollution during the burning season and an increasing risk of fire spreading during dry years also became concerns (Brondizio et al., 2009). In order to deal with these threats, they started working with municipal governments and agencies outside PIX to mediate agreements with economic sectors, educate the regional population about indigenous peoples, and create incentives for restoration (Brondizio et al., 2009).

8. Credibility

Monitoring gives credibility and validity to community perspectives, particularly during their interactions and negotiations with government agencies. Data is increasingly becoming the currency of resource management (Govan et al., 2009; Robards et al.,

2011; Kofinas et al., 2002; Berkes, 2007, 2008, 2009; Galloway-McLean, 2010; Gearheard, Aipellee & O'Keefe, 2010; Govan et. al, 2009; Kennett et al. 2010, 2011, Carr, 2004; Lee, 1993; Aalbersberg et al., 2005). Having information to understand ecosystem processes and support the community's arguments in negotiations with governments gives them additional strength (Govan et al., 2009; Robards et al., 2011; Kofinas et al., 2002; Berkes, 2007, 2008, 2009; Galloway-McLean, 2010; Gearheard, Aipellee & O'Keefe, 2010; Govan et. al, 2009; Kennett et al. 2010, 2011, Carr, 2004; Lee, 1993; Aalbersberg et al., 2005). The backing of a united, coordinated and informed network equips communities to deal with threats to local ecosystems.

9. Spiritual, Emotional and Physical Well-Being

Guarding the land and resources links people to their culture, history, stories and sacred areas (Basso, 1996; Langdon, 2007; Andersen, 1996; Byers et al., 2001). It helps people connect to their territory and history, helps the community to be more aware of what is happening on their territory, encourages intergenerational sharing about practices and knowledge (Basso, 1996; Langdon, 2007; Andersen, 1996; Byers et al., 2001). Community monitoring enables people to reclaim and revive traditional knowledge, language, sense of place, authority, personal resilience and human well-being (Thomson, S., personal communication, April, 2012).

In fact, the health benefits, physical, mental and spiritual, of having rangers out in their territories have been well documented in research done on the Australian government's 'Healthy Country Healthy People' program (Burgess et al., 2005, Campbell et al., 2011, Putnis et al., 2007). It found that the resuming customary natural resource management results in more physical activity and a healthier diet in aboriginal people. Re-connecting with the land also makes people more satisfied in the emotional, psychological and metaphysical spheres of existence (Burgess et al., 2005, Campbell et al., 2011, Putnis et al., 2007). In addition, such reconnection significantly reduces the occurrence of chronic diseases such as diabetes and hypertension affecting aboriginal populations, and thus reduces health care costs borne by the general public (Campbell et al., 2011).

10. Shift to Ecosystem Stewardship

A shift from the extractive approach to a stewardship approach to resources is needed in order to manage ecosystems sustainably (Chapin et al., 2010; Pinkerton, 2009; Lertzman, 2009). Stewardship involves reducing vulnerability to changes, fostering resilience to perturbations and fostering transformations when opportunities occur (Chapin et al., 2010; Bliss et al. 2001;Ecological Monitoring & Assessment Network Coordinating Office & the Canadian Nature Federation, 2003). Monitoring plays an important role in developing adaptive capacity by providing information about trends and changes which can prompt action to reduce stressors in the ecosystem (Pinkerton, 2009; Chapin et al., 2010; Bliss et al., 2001; Ecological Monitoring & Assessment Network Coordinating Office & the Canadian Nature Federation, 2003). It helps community members take more responsibility for stewarding the land and sea (Pinkerton, 2009; Bliss et al., 2001; Thomson, S., personal communication, April, 2012). It could also help guide local actions and larger regional policies.

Methods

This paper is based on a literature review of papers and other sources that explore the theory behind community-based management as well as those that examine specific case studies. The focus of this paper was developed collaboratively with the Coastal Guardian Watchmen Network through ongoing conversations with their co-ordinators and participation in two gatherings of their members. The information on case studies draws from reports and information from websites of community-based monitoring networks around the world. I attended two gatherings of the CGWN as a participant observer (DeWalt & DeWalt, 2011; Spradley, 1980) and had informal discussions with its members. For other case studies, I supplemented the literature search with email correspondence and phone conversations with representatives of the CBM networks I studied. A representative of each CBM organization reviewed the information I wrote on each CBM case study.

I obtained the sources on which the literature review was based by searching Web of Knowledge, Google, websites of community monitoring groups and through recommendations by representatives of community monitoring groups. The case studies were selected to identify the most effective examples of community-based monitoring that have relevance to the Coastal Guardian Watchmen Network in terms of type of organization, structure, activities and goals. I narrowed a list of 15 examples (see Appendix 1) to four focal case studies that: 1) Have similar goals to improve ecosystem stewardship, gain enforcement authority and contribute to decision-making and policy; and 2) Are effective in making an impact on ecosystem stewardship in their territories.

I studied the literature relevant to these case studies to answer the following questions:

1. What were the factors that favoured the establishment of the monitoring initiative?
2. What were the impacts of CBM?
3. What are the factors that led to the success and expansion of the network?

Case Studies of Community-Based Monitoring Networks and Outcomes of Monitoring

1. The Coastal Guardian Watchmen Network (CGWN), British Columbia, Canada.

Who is involved in monitoring?

The Coastal Guardian Watchmen Network (CGWN) is an alliance of local Guardian Watchmen from 10 First Nations communities (called the Coastal First Nations) in the North and Central Coast of British Columbia, popularly referred to as "the Great Bear Rainforest (Coastal Guardian Watchmen Network website, 2012). The Coastal First Nations include Wuikinuxv Nation, Heiltsuk, Kitasoo/Xaixais, Nuxalk Nation, Gitga'at, Haisla, Metlakatla, Old Massett, Skidegate, and Council of the Haida Nation (Figure 2.1; the community of Lax Kw'alaams is an associate member of the Coastal First Nations; Coastal First Nations website, 2012). Guardian Watchmen are resource stewardship staff in First Nations communities who monitor the health of their natural and cultural resources. They are the 'eyes and the ears' of their nations. The Great Bear Rainforest is one of the largest unlogged areas of coastal temperate rainforest remaining, containing a quarter of the world's unlogged coastal temperate rainforest (Price et al, 2009). It was the site of intense controversy over forestry, which was resolved through the Great Bear Agreements, and followed by the creation of the Coastal First Nations group (McGee et al., 2010; Smith et al., 2007; Tjornbo et al., 2010).

The concept of the Guardian Watchman is a part of the culture of some of B.C's Coastal First Nations. Guardian Watchmen have traditionally safeguarded the territorial lands and waters of their Nation (CGWN representatives, interviews, May, 2011). Figures of watchmen are often depicted in totem poles of some First Nations in B.C. as a small human wearing a conical cedar hat, usually found in groups of two or three at the top of the pole (CGWN representatives, interviews, May, 2011; Jorgenson, L., personal communication, October, 2012). Animal figures are sometimes used to symbolise protectors and guardians (Housty, J., personal communication, October, 2012). They are said to guard the village and give warnings when unwelcome people or spirits approach (CGWN representatives, interviews, May, 2011).

How was the monitoring network formed?

The CGWN, formed in 2005, when ecosystem stewards from a few First Nations got together to form a united network (Coastal Guardian Watchmen Network website, 2012). Some FN communities, like the Heiltsuk's Qqs Society, already had a Guardian Watchmen program. The FN representatives who met in 2005 to discuss the idea of the CGWN envisioned a unified force of Guardians along the central and north coast of B.C. The network works to develop and expand the role of locally based Guardian Watchmen programs and to ensure effective implementation of land and marine use plans and other sustainable resource management initiatives (Coastal Guardian Watchmen Network website, 2012). It has established a network of Guardian Watchmen practitioners to facilitate ongoing dialogue, cooperation and learning between communities (Coastal Guardian Watchmen Network website, 2012).

What are they monitoring? What are other activities of the network?

The CGWN supports local efforts by First Nations to monitor, steward and protect their traditional territories by bringing people together to share knowledge and practices, working to strengthen stewardship capacity in each First Nation and encouraging a coordinated approach to monitoring across the broader coastal region. Guardian Watchmen protect cultural sites and the health of the plants and animals that have ecological and cultural importance to their communities. They also monitor the impacts of activities such as commercial and sport fishing, logging, and tourism (Coastal Guardian Watchmen Network website, 2012). At a time when provincial and federal government funding for monitoring is being cut, the CGW are sometimes the only people undertaking environmental monitoring activities in isolated communities spread out over a vast geographical area.

The CGWN's activities are focused on connecting Guardians in different FNs and building capacity (Coastal Guardian Watchmen Network website, 2012). It organizes annual conferences for Guardian Watchmen from different First Nations to meet and share experiences. The CGWN works with communities to assess capacity and resource needs and identify priorities. The network develops a regional monitoring strategy, and creates outreach tools (Coastal Guardian Watchmen Network website, 2012). The CGWN has also developed a regionally relevant and Guardian Watchmen

Training Program, accredited and run by the Northwest Community College, that focuses on monitoring land and water-based resource activities on traditional territories, with input from the Sierra Club B.C. and Qqs Project Society and the Northwest Community College (Coastal Guardian Watchmen Network website, 2012). The main goals of the CGWN are presence on the coast, credibility, capacity-building and regional monitoring (Coastal Guardian Watchmen Network website, 2012). Guardian Watchmen play an integral role in resource management, and in implementing land and marine use plans (Coastal Guardian Watchmen Network website, 2012). They help to ensure rules are being followed and protect important cultural and ecological values (Coastal Guardian Watchmen Network website, 2012).

In 2010, the CGWN launched their Regional Monitoring Strategy (RMS), a standardized approach to monitoring priority issues at a regional scale (Coastal Guardian Watchmen Network website, 2012). Based on discussions about issues of most concern to the Nations, the Guardian Watchmen and Stewardship managers in each First Nation developed a list of most pressing concerns. To monitor these priority issues, the network then developed indicators and standardized monitoring methodologies to be used by all 10 FNs in a consistent manner. The RMS empowers Nations to use the data they collect in planning and decision-making for their territories and enables compilation and comparison of coast-wide data. The data collected is owned and controlled by each First Nation community (Coastal Guardian Watchmen Network website, 2012).

The RMS involves the use of field cards and CoastTracker (a GPS-enabled, hand-held mobile device) for collecting data in the field, and an online data management system to collect, store and access information (Coastal Guardian Watchmen Network website, 2012). The CoastTracker was an initiative modeled after the I-Tracker device, used by Aboriginal ranger across Northern Australia through the North Australian Indigenous Land and Sea Alliance (see below). Learning exchanges between these two groups is already yielding tangible outcomes.

The indicators monitored in the RMS are:

- Boat activity (including commercial fishing, sport fishing, and tourists).
- Enforcement incidents and other suspicious activities.
- Sport fishing effort.
- Tourist activities.
- Crab and prawn fishing effort.
- Whales, bears and other priority wildlife species.
- Impacts to significant cultural and ecological Sites.
- Eulachon surveys
- Salmon streams and logging impacts to streams.

(Coastal Guardian Watchmen Network website, 2012)

These indicators reflect the issues that FNs along the central and north coast of B.C. feel are most important to them. They reveal the threats their ecosystems face and the species that they feel are threatened and important (Coastal Guardian Watchmen Network website, 2012). The CGWN is responding to threats that its member communities face. The Coastal First Nations are developing a Tsunami Debris Action Plan for Nations for the CGWN to monitor radiation levels in the marine debris associated with the 2011 Japanese tsunami and respond to threats (Coastal Guardian Watchmen Network website, 2012). One Guardian Watchman has received training from Health Canada and the B.C. Centre for Disease Control to learn how to use a handheld RadEye radiation detector to assist with monitoring background radiation to ensure public safety (Coastal Guardian Watchmen Network website, 2012).

What are the outcomes of monitoring?

The CGWN has created a united presence of First Nation stewards along the B.C. Coast. Having this unified force has helped Guardian Watchmen to develop relationships with other agencies like Parks Canada and Environment Canada (CGWN representatives, interviews, May, 2011). The network has enabled training and capacity building of Guardian Watchmen in different communities and renewed interest in enforcement and stewardship (Coastal Guardian Watchmen Network website, 2012). The RMS has created a system of uniform monitoring along the coast in order to get broader trends. Though it is too early to analyse the data from the RMS, as more data

are collected, they will be used to inform management decision-making (CGWN representatives, interviews, May, 2011).

The Coastal First Nations envision that the Coastal Guardian Watchmen will be an integral part of FN Integrated Stewardship offices and have an important role in monitoring compliance toward their Land Use and Integrated Marine Use Plans (CGWN representatives, interview, May, 2011). Until 2011, the Coastal First Nations have been working with Fisheries and Oceans Canada and the B.C. government to develop an Integrated Marine Use Plan in the Pacific North Coast Integrated Management Area (PNCIMA), which would stretch from the top of the Haida Gwaii to the top of Vancouver Island (PNCIMA website, 2012). PNCIMA is a Large Oceans Management Area (LOMA) that has been identified by the Oceans branch of the Department of Fisheries and Oceans, Canada, as a pilot for the Pacific region (PNCIMA website, 2012).

In 2004-2005, the Coastal First Nations entered into an Aboriginal Aquatic Resource and Oceans Management agreement with the Department of Fisheries and Oceans that supported greater First Nations participation within PNCIMA on the collaboratively developed integrated management framework (Coastal First Nations website, 2012). Integrated marine use planning brought together stakeholders, governments, and First Nations to reach general agreement on sustainable resource use in marine areas (Coastal First Nations website, 2012). Communities were the driving force behind the planning process (Coastal First Nations website, 2012). Each Nation has developed Marine Spatial Plans that demarcate five marine zone types and two sub-areas to facilitate sustainable resource use in their territories (Coastal First Nations website, 2012).

In September 2011, the Federal government withdrew from a funding agreement meant to provide money for PNCIMA's integrated planning process (Hale, 2011). The Federal government is planning the Northern Gateway project in the PNCIMA area, which would develop a new twin pipeline system running from the tar sands near Edmonton, Alberta, to a new marine terminal in Kitimat, British Columbia, to import 193,000 barrels of condensate[5] per day and export 525,000 barrels of crude oil per day,

[5] Condensate is used to thin petroleum products for pipeline transport.

that will then be shipped via supertankers to other countries (Enbridge Northern Gateway website, 2012). The federal government was concerned that PNCIMA could be used to rally opposition to the Northern Gateway pipeline (Vancouver Sun, 2011). Although the Federal government has pulled out of the marine planning process, CFN hopes that through another process called the Marine Planning Partnership for the Pacific North Coast (MaPP), it will still be able to implement its marine use plans in partnership with the B.C. government (MaPP website, 2012).

Coastal Guardian Watchmen also play an important role in monitoring the implementation of Land Use Plans in the Great Bear Rainforest by protecting streams, riparian areas and culturally important sites (CGWN representatives, interviews, May, 2011). In 2006, Coastal First Nations and the British Columbia government signed land and resource agreements for the Great Bear Rainforest, marking an unprecedented moment in B.C.'s history. These agreements commit coastal First Nations leaders and the Province to protect one-third of the region in conservancies from logging and other industrial development and manage the remaining two-thirds of the land base using a precautionary approach to forestry called ecosystem-based management (Coastal Guardian Watchmen Network website, 2012). Guardian Watchmen Programs are critical for keeping a vigil and ensuring that the guidelines for ecosystem-based management of forests are being adhered to.

2. Indo-Pacific Locally Managed Marine Area (LMMA) Network

Who is involved in monitoring?

The LMMA network is a network of local, community-managed marine areas in Fiji, Indonesia, Papua New Guinea, Solomon Islands, Pohnpei, Palau, Vanuatu and the Philippines (LMMA website, 2012). Within each country, there is a national LMMA network which guides LMMAs in that nation and coordinates with those in other countries across the broader network. Locally Managed Marine Areas (LMMAs) exist in 15 countries in the Pacific, but only eight countries are part of the LMMA network (Govan, H., personal communication, May, 2012). The eight countries that are part of the LMMA network are the ones who have recognized the need to scale up LMMAs to island, provincial and national level using the bottom-up approach (Tawake, A., personal communication, November, 2012). In this article, I will only mention examples of LMMAs

that are part of the network. A Locally Managed Marine Area (LMMA) is an area of nearshore waters and their associated coastal and marine resources that is largely or wholly managed at a local level by the coastal communities, land-owning groups, partner organizations, and/or collaborative government representatives who reside or are based in the immediate area (LMMA website, 2012; Govan et al., 2009; Tawake, 2007).

LMMAs are based on traditional resource management practices such as closed seasons, protecting nursery habitats and spawning aggregations, restricting destructive practices, limitations on the number of fishers or the amount of fish they could harvest, restrictions on using certain fishing practices, sacred fishing grounds, no take zones and a prohibition on fishing for certain species (Aalbersberg et al., 2005; Govan, 2009). The LMMA network promotes adaptive management and learning where monitoring is one step in a larger process. Villages design, monitor and implement the marine management plans (Govan, 2009). Traditional, local conservation practices are blended with modern methods of monitoring. An LMMA differs from a Marine Protected Area (MPA) in that LMMAs are characterized by local ownership, use and/or control, and in some areas, follow the traditional tenure and management practices of the region, whereas MPAs are typically designated by higher levels of government via a top-down approach reliant on science-based designs with little local input (LMMA website, 2012; Govan et al., 2009).

LMMAs have some legal recognition and are officially referred to as “customary fishing rights areas” (Govan et al., 2009; Aalbersberg et al., 2005; Johannes, 2002). In a few countries, like the Philippines, communities do not have customary rights to their territories (Govan, H., personal communication, May, 2012,). However, in the Philippines, municipalities have considerable management power over their fisheries, including the creation of protected areas and are involved in monitoring (Pinkerton, 2009). There are more than 550 LMMA sites in the Indo-Pacific, covering in excess of 12,000 sq. km (Govan et al., 2009). The LMMA network's membership consists largely of representatives of conservation and resource management projects that are using (or planning on using) an LMMA approach, and includes community members, land-owning groups, traditional leaders, elected decision-makers, conservation staff, university scientists and researchers and donors (LMMA website, 2012).

How was the monitoring network formed?

Common threats to marine habitats and resources in the Indo-Pacific are overfishing, destructive fishing (use of dynamite and poisons), sedimentation and pollution from development or industrial activities on land, physical damage from anchors and trampling by tourists and fishers, and coral extraction for building materials and souvenirs (Govan et al. 2009; LMMA website, 2012). In the mid-1990s, various community-based projects were initiated throughout Southeast Asia and the Pacific. Three projects, one in Ucunivanua Village in the Verata district of Fiji, another at Dauwi Island in the Padaido Islands, West Papua, Indonesia, and a third, in the Arnavon Islands in the Solomon Islands, were the first to form the LMMA network. These communities were part of a Biodiversity Conservation Network project (supported by the Biodiversity Support Program of USAID to conduct an assessment of economic incentives for natural resource conservation) focused on community involvement in monitoring and evaluating marine resources. (LMMA website, 2012). The LMMA network was formed to address the communities' needs to share information and resources among various community-based initiatives. The network unites isolated projects together in order to learn collectively and improve their outcomes and conservation impact (LMMA website, 2012; Govan et al., 2009; Govan et al., 2011).

Greater commercial fishing and larger local subsistence harvests had left most of Fiji's coastal waters overfished. In 1997, Ucunivanua village initiated measures to protect its inshore areas. Here, the son of the high chief of Verata who had studied resource management at the University of the Indo-Pacific (USP) in Suva, Fiji, asked researchers to help his village (Aalbersberg et al., 2005; Johannes, 2002). At the end of two years of workshops and training in environmental education and community planning, the community decided to set up a 24-hectare *tabu* area on the mudflat and seagrass bed directly in front of the Ucunivanua village as an experiment (Aalbersberg et al., 2005; Johannes, 2002). Twenty community members were appointed to the Tabu Management Committee to monitor the area. Scientific experts from university taught community members the skills of monitoring and the basic principles of sampling and statistics. The team learned how to lay line transects and to sample the clam population at 10-meter intervals along the 500-meter transect line, then record their results and analyze them with simple statistics. Using these skills, the team established a baseline

of clam populations in the *tabu* area and in adjacent sites down current. Baseline data was used for comparison with the results of the annual monitoring that followed. From 1997 to 2004, the number of clams over 5.5 cm per 50 m^3 increased from 1 to 91, in the areas outside the no-take zone and from 8 to 530 in the no-take (*tabu*) area (Aalbersberg et al., 2005). CBM was successful in facilitating protection of an LMMA, which had positive spillover impacts on the non-protected areas adjacent to the protected LMMA.

What are they monitoring? What are the activities of the network?

The network provides information and resources on LMMAs and community-based adaptive management (CBAM), training in project design, monitoring, data management and analysis, fundraising, communications and support (LMMA website, 2012; Govan et al., 2009, 2011). The LMMA network provides guidance and capacity-building in the use of CBAM, a resource management cycle in which local stakeholders make a plan, implement the plan, check how it is going, revise the plan (if necessary), and carry on (LMMA website, 2012; Govan et al., 2008, 2011).

When a village in Fiji, for instance, decides it wants to join the Fiji LMMA network, FLMMA assists in awareness, action planning, and monitoring (Aalbersberg et al., 2005). The action-planning workshops are adapted from Participatory Learning and Action (PLA) methods and include sessions on mapping the village, understanding historical trends, resource use, identifying threats to local resources, the root causes of these threats and analyzing who the local stakeholders are. These sessions help identify resource management issues and instill community members with the confidence that they have the capacity to solve their own problems. The community develops a community action plan, charting out a course of action and people responsible for implementing tasks. Finally, the workshops then focus on training and developing community-based biological and socioeconomic monitoring plans. Besides ecological concerns, the action plan also addresses social problems such as lack of income sources, poor awareness of environmental issues, pollution, and declining community cohesiveness. Socioeconomic monitoring tests whether these problems are being effectively addressed (Aalbersberg et al., 2005).

Besides community-level planning, the LMMA network works with national governments on policies related to ecosystem-based management and adaptive management. For example, in the Solomon Islands, the LMMA is working with the government to upscale local efforts into a substantial national policy aimed at supporting inshore fisheries management, conservation, climate change adaptation and ecosystem approaches to resource management (Govan et al., 2011). It has adopted an ecosystem-wide approach called Integrated Island Management (Govan et al., 2011). The goal is to integrate LMMAs into an island-wide approach to resource management.

What are the outcomes of monitoring?

LMMAs have resulted in significant improvement in environmental conditions as well as community incomes and livelihood opportunities. The impacts of LMMAs are improved habitat quality (coral cover, seagrass, mangroves), increased fish population, reproduction and biomass, enhanced local capacity to manage their resources, increased environmental stewardship and community cohesion (LMMA website, 2012; Govan 2011; Govan, 2009). Communities set aside at least part of an LMMA as a restricted area, typically 10 to 15% of the village's fishing waters, in order to allow habitat and resources to recover from fishing pressure. The spillover effect of some MPAs has boosted local income by as much as 35% over 3 years (Aalbersberg et al., 2005).

Dramatic results in fish recovery and income enhancement at several LMMA villages have resulted in policy changes at the national level in Fiji and the spread of the LMMA concept to other Indo-Pacific island nations (Govan et al., 2009; Tawake, 2007; Leisher et al., 2007). The Fiji LMMA (FLMMA) presented the results of their monitoring to fishery policy makers of the Fijian government, and the Fiji National Government formally adopted the FLMMA approach and has designated a division of the Fisheries Department to promote inshore conservation and to work with FLMMA (Aalbersberg et al., 2005). The Ministry of Fijian Affairs uses FLMMA's participatory approach for its Community Capacity Building project, which identifies and develops action plans to deal with village problems (Aalbersberg et al., 2005).

In 2005, the Fiji Ministry publicly committed to protecting 30% of Fiji's inshore waters, a commitment that was subsequently joined by Palau and the Federated States of Micronesia (Govan et al., 2009; Aalbersberg et al., 2005). LMMAs resulted in growing

pressure for the Fiji government to return legal ownership of the country's inshore fishing areas (410 *qoliqolis*[6] in total, equalling roughly 31,000 square kilometers of coastal waters) to their traditional owners—local chiefs (Aalbersberg et al., 2005). The Fiji government has made an effort to decentralize government operations and extend LMMA work to remote areas. Members of five Fiji government agencies (Fisheries, Fijian Affairs, Environment, Tourism, and the Native Land Trust Board) have formally joined the network (Aalbersberg et al., 2005). FLMMA has supported the training of community members as fish wardens, granting them legal power to apprehend offenders (Aalbersberg et al., 2005).

The LMMA network sees integrated resource management as the basis for sustainable livelihoods. LMMAs have expanded livelihood options and incomes for local communities substantially (Leisher et al., 2007; Govan et al., 2008, 2009; Aalbersberg et al., 2005). LMMAs have resulted in localized recovery or protection of vulnerable species such as large food fish or marine turtles (Johannes and Hickey, 2004; LMMA, 2006; McClanahan et al., 2006). There are improved fishery landings in places where LMMAs are present such as the Philippines where, depending on species, catches have sustained or increased (Tawake, 2001; Russ et al., 2004; Abesamis & Russ, 2005; but see concerns in Foale & Menele, 2004; Hillborn et al., 2004). Improving or securing the supply of marine protein has had a direct impact on community well-being. Moreover, several villages have used the LMMA planning process for other community priorities including health (Leisher et al., 2007).

3. The I-Tracker Network, North Australia

Who is involved in monitoring?

The I-Tracker network (short for 'Indigenous Tracker') was initiated in 2009 by the North Australian Indigenous Land and Sea Management Alliance (NAILSMA), an indigenous-led non-company operating across north Australia. The aim of the I-Tracker network is to support Indigenous land and sea rangers across north Australia to undertake natural and cultural resource monitoring, management and research. I-

[6] Qoliqoli: Qoliqolis are officially referred to as "customary fishing rights areas". They are areas whose proprietary rights have been transferred to ethnic owners (Aalbersberg et al., 2005).

Tracker network provides tools, training and technical support to indigenous rangers to help them monitor their territories and to facilitate communication between rangers across north Australia. I-Tracker network is run by the North Australian Indigenous Land and Sea Alliance Limited (NAILSMA), an organisation that works to create livelihoods based on traditional and cultural knowledge and practice for Indigenous people across North Australia.

How was the monitoring network formed?

The last two decades have seen a rapid expansion in the number of Indigenous Land and Sea Management Organizations (ILMOs) across northern Australia, as changes in law have recognized the rights of aboriginal communities (Kennett, R., personal communication, June, 2012). When the British colonial doctrine of '*terra nullius*' (empty land) was overturned, indigenous Australians, particularly in northern Australia, began to gain legal recognition of their customary estates (Kennett et al., 2011). Around 30% of northern Australia has now been returned to indigenous ownership and around 462 legal claims extending across 80% of non-Indigenous lands of northern Australia are still to be resolved (Kennett et al., 2011). Recent legal decisions have also recognized rights of coastal indigenous peoples over their traditional coastal and intertidal estates, known as 'saltwater country' (Kennett et al., 2011). In most cases, the rights recognized, which include rights to access and extract water for non-commercial purposes, and to fish, hunt and gather, are non-exclusive, i.e. they do not grant the right to exclude other users (Kennett et al., 2011). The High Court of Australia's decision in the landmark Blue Mud Bay case (2008) recognized exclusive rights to the intertidal zone adjacent to aboriginal-owned land in a section of the Northern Territory (Kennett et al., 2011).

At the same time, the Australian government also initiated Indigenous Protected Areas (IPAs) and community based planning, which created a need for tools to implement these plans and monitor the state of natural and cultural resources. Indigenous rangers, the workforce of the ILMOs, are the 'frontline managers'. Based in remote areas of north Australia, indigenous rangers are often the only environmental management presence (Kennett et al., 2011) There are around 680 indigenous rangers employed across Australia, supported by government investment in the Working on Country program started in 2007, which has provided funding of $244 million until June

2013 (Working on Country website, 2012; Ens, 2012) and 'Community Development and Employment Projects' (CDEP) schemes which provide funding for employment (Ens, 2012). The 'Caring for our Country' grants and the Indigenous Protected Area program funding provide operational support for resources and infrastructure (Ens, 2012). Other funding sources for ILMOS is from government, NGOs, community funds, royalties from mining and extraction and, more recently, from payments for environmental services arrangements such as the growing carbon offsets market (Kennett, R., personal communication, August, 2012).

What are they monitoring? What are other activities of the network?

The I-Tracker network enables capacity development and supports local decision-making (Kennett et al., 2010). It helps communities improve their knowledge base and understanding of marine and coastal environments. It enhances indigenous livelihood options by supporting indigenous rangers to participate in payment for environmental services opportunities (Ens, 2012; Whitehead, 2012). The network incorporates indigenous ecological knowledge into management and monitoring processes.

A key component of I-Tracker network's work involves data collection, analysis and reporting (Ens, 2012; Kennett et al., 2010; I-Tracker website, 2012). The I-Tracker network uses a field-tough, portable device – called the "I-Tracker" – that helps Indigenous land and sea managers collect and manage information that informs local planning and decision-making (Ens, 2012; Kennett et al., 2010; I-Tracker website, 2012). Indigenous rangers use the I-Tracker device to collect data related to marine wildlife, foreign fishing vessels, marine debris and ghost nets, customs surveillance, weeds and feral animals, fire management, biodiversity surveys as well as cultural site protection and mapping and visitor management (Ens, 2012; Kennett et al., 2010; I-Tracker website, 2012).

I-Tracker network works with Indigenous rangers, government and industry to ensure that the data collected will allow communities to meet fee-for-service and other reporting and contract requirements (Ens, 2012; Kennett et al., 2010; I-Tracker website, 2012). For instance, indigenous rangers are monitoring the fire abatement program between Northern Territory government and Conoco-Phillips, a multinational energy

company. This data is combined with information collected by the Northern Territory Government Bushfires Council and scientific partners to quantify the carbon abatement delivered by the ranger groups (Ens, 2012). The I-Tracker network is guided by principles that respect traditional owner authority and cultural protocols and protects indigenous intellectual property and data ownership rights (Kennett et al., 2011, NAILSMA website, 2012). Australian Indigenous rangers are linked into a global network of similar community-based initiatives with access to international technical expertise and opportunities for international exchanges between community-based resource managers (Kennett et al., 2010).

What are the outcomes of monitoring?

The I-Tracker network has enabled indigenous rangers to monitor their territories and use the information they collect to inform decisions around resource management. It has improved data management, research and monitoring and reporting by indigenous ranger groups and has helped raise the profile of the work of Indigenous rangers (Kennett, R. personal communication, June, 2012). Monitoring systems set up by the I-Tracker network have laid the basis for expansion of ILMOs into natural and cultural resource management organisations that utilize contemporary and traditional tools knowledge (Kennett, R. personal communication, June, 2012).

There are several success stories from ranger groups in using the I-Tracker network's data in negotiations and reporting on activity. Rangers have recognized the value of the I-Tracker device in assisting with their reporting to local community steering committees (Kennett, R. personal communication, June, 2012). The loss of traditional knowledge is being reduced in communities that are part of the I-Tracker network (Kennett, R. personal communication, June, 2012). Community monitoring has helped people understand changes occurring at a larger scale and has improved communication tools and approaches (Bessen Consulting Services, 2008). For instance, aerial wetland mapping in the Arnhem Plateau produced a triage system of classification to prioritize wetlands for feral cull action or landscape rehabilitation according to ranger perceptions of damage and urgency (Ens, 2012). By collecting this baseline information, potential outcomes of the environmental services provided by rangers can be measured and the environmental outcomes of any payments for this service can be quantified

(Ens, 2012). Indigenous rangers across north Australia have recognized the value of standardized and coordinated monitoring and data collection (Kennett, R. personal communication, June, 2012). The tools developed by the I-Tracker network are standard operating practice for Australian government programs such as Working on Country and Indigenous Protected Areas (Kennett, R. personal communication, August, 2012).

Many rangers groups have been able to raise funds for their work and increase employment opportunities within their communities through fee for service contracts with agencies like the Australian Quarantine and Inspection Service (NAILSMA website, 2012). I-Tracker rangers have gained recognition and work on fee for service contracts with several government agencies to prosecute illegal fishing activities, locating and mapping navigation markers, weed and feral animal control and research partnerships that develop tools to support biodiversity monitoring by Indigenous land and sea managers (Ens, 2012; National Environmental Research Program website, 2012).

4. Great Lakes Indian Fish & Wildlife Commission (GLIFWC), USA.

Who is involved in monitoring?

GLIFWC is an agency comprising eleven Ojibwa nations in Minnesota, Wisconsin, and Michigan, who retain off-reservation treaty rights to hunt, fish, and gather in lands ceded via treaty. GLIFWC is actively involved in activities aimed at protecting and enhancing the natural resources and habitat in the treaty-ceded territories while also infusing an Ojibwe perspective into its work (GLIFWC website, 2012).

How was the monitoring network formed?

In treaties signed in 1836, 1837, 1842, and 1854, the 11 Ojibwa tribes reserved hunting, fishing and gathering rights in the areas (land and water) sold (ceded) to the United States (GLIFWC website, 2012). Over the past 40 years, GLIFWC member tribes have fought numerous court cases to gain recognition and re-affirmation of their treaty reserved rights (GLIFWC website, 2012). Courts, including the United States Supreme Court in its 1999 *Minnesota v. Mille Lacs* ruling, have consistently recognized and upheld these rights (GLIFWC website, 2012).

The rights over ceded territory are shared among tribes. Tribes regularly address issues related to intertribal resource allocation, coordination of harvest and natural resource management (GLIFWC website, 2012). In some areas, GLIFWC member tribes have entered into co-management agreements that require the tribes to coordinate harvest declarations and make joint management decisions (GLIFWC website, 2012). GLIFWC was created by its member tribes in 1984, to help fulfill the self-regulatory requirements laid down by the law (GLIFWC website, 2012).

GLIFWC was formed through the merger of two already existing entities—the Voigt Intertribal Task Force and the Great Lakes Indian Fisheries Commission (GLIFWC website, 2012). GLIFWC is governed by a Board of Commissioners that sets policy; a Voigt Intertribal Task Force that focuses on issues in the 1837 treaty and inland portion of the 1842 ceded territory; and a Great Lakes Indian Fisheries Committee, whose focus is Lake Superior (GLIFWC website, 2012).

What are they monitoring? What are the activities of the network?

Monitoring of natural resources within its territories enables GLIFWC to affirm and implement its tribal rights (GLIFWC website, 2012). In treaties signed by the 11 Nations in 1836, 1837, 1842, and 1854, the tribes reserved hunting, fishing and gathering rights in the areas (land and water) ceded to the United States (GLIFWC website, 2012). The treaties represent a reservation of rights by each tribe individually, but also by all the signatory tribes collectively (GLIFWC website, 2012). Rights are also shared inter-tribally and tribes must address issues related to intertribal resource allocation, coordination of harvest and natural resource management (GLIFWC website, 2012). In some areas, GLIFWC member tribes have entered into specific agreements that contain binding co-management mechanisms. These agreements obligate the tribes to coordinate harvest declarations and make joint management decisions (GLIFWC website, 2012).

More recent laws like the 2007 Wisconsin Act 27 affirm and reinforce the tribes' treaty rights in a modern day context. The 2007 Wisconsin Act 27 is based on the tribes' sovereign authority to regulate themselves in the exercise of their ceded territory rights. It recognizes the law enforcement capabilities of GLIFWC's conservation enforcement personnel and extends many of the same statutory safeguards and protections to

GLIFWC officers that are afforded to other law enforcement officers in the state (GLIFWC website, 2012).

GLIFWC staff monitor aspects of resource management in their territories and undertake activities to sustain traditional harvests and keep their culture alive, such as:

Monitoring the Great Lakes fishery

GLIFWC monitors off-reservation fishing 1-2 times per month from January through December in the 1842 Treaty ceded area within Michigan waters of Lake Superior. Data collected are length, weight, and ageing information from lake trout and whitefish and herring, all of which are culturally and nutritionally important food (GLIFWC website, 2012).

Inland fishery (in lakes not connected to Lake Superior)

Spearing fishing takes place in inland lakes. The primary off-reservation tribal fishery is the *ziigwan* (spring) spearing and gill-netting of *ogaa* (walleye). *Maashkinoozhe* (muskellunge) and other species of fish are also harvested each spring. These fisheries are highly regulated and controlled with individual lake quotas, a nightly permitting system, a requirement that only specified boat landings be used, and the stationing of tribal creel clerks and wardens at every landing each night during the spring season to count all fish harvested. Quotas are adjusted daily based on the previous night's harvest to ensure that they are not exceeded. Detailed information for describing the tribal fishery and its impact on individual walleye populations has been collected (GLIFWC website, 2012).

Mercury levels in Inland lakes

GLIFWC collects walleye samples every spring and tests them for mercury levels. Based on this data, it has published a series of "Mercury Maps" to show tribal members which lakes contained walleye with high levels of mercury (GLIFWC website, 2012). The maps help tribal members make informed choices that allow walleye fishing while reducing their exposure to mercury.

Wildlife

GLIFWC collects and evaluates information that informs recommendations for the proper use, management, and protection of wildlife. It monitors wildlife, manages harvests and

suggests actions that could enhance wildlife populations. (GLIFWC website, 2012). For some species (e.g. *waawaskeshi/* white-tailed deer) harvests are managed through a system of permits and required registration. For these species a direct count of harvested animals is produced. For other species (e.g. *manoomin/* wild rice) harvests are estimated using mail and/or telephone surveys. For still other species harvest levels are not quantified (e.g. *wabooz*/rabbit).

Wild plants

Manoomin (wild rice) is a highly nutritious and culturally-important food for the Ojibwe people. GLIFWC conducts annual surveys on existing rice beds to determine density and overall health of the bed. Select lakes are also reseeded for the purpose of enhancement or re-establishing old beds. GLIFWC completed a comprehensive wild rice lake inventory and plans to launch a comprehensive wild rice management plan. GLIFWC also monitors tribal gathering of wild plants for food, medicines and other practical purposes in national forests. (GLIFWC website, 2012).

Monitoring environmental threats

The Environment division works with all GLIFWC divisions (such as fisheries or wildlife) and staff to investigate threats to resources from many different sources (GLIFWC website, 2012). It has a satellite office on the University of Wisconsin – Madison campus, which allows GLIFWC to maintain contact with researchers at the university and gives GLIFWC staff access to a wide variety of hardware and software resources, including GLIFWC internet mapping servers. Most of the mapping is linked to reviewing proposed mining projects, as well as analyzing the impacts of past mining (GLIFWC website, 2012).

The environmental division also participates in several climate change projects to define the extent and severity of climate change impacts so that tribes can plan to adapt to those changes that are inevitable, and work to prevent changes that are avoidable (GLIFWC website, 2012). Climate change has the potential to disrupt treaty harvests of natural resources by altering the environment across the ceded territories, e.g., changes in the range of fish species and wild rice could be affected by intense spring storms and temperature changes (GLIFWC website, 2012).

Enforcement

GLIFWC's enforcement division monitors all off-reservation treaty harvest seasons in the ceded territories and enforcing the tribal codes that regulate each season. Its staff are fully certified conservation officers, many of whom are cross-deputized with the state of Wisconsin, which means that they enforce rules in their territories but have to work with the state enforcement authorities for 40 hours per year. The scope of their work includes fish and game protection, public safety services, training, and public education/outreach (GLIFWC website, 2012).

GLIFWC wardens patrol and monitor enforcement of treaty harvest activities in the ceded territories of Michigan, Wisconsin and Minnesota, checking for infractions of tribal codes governing treaty harvest seasons. Violations are referred to tribal courts. They monitor commercial fisheries in Lake Superior, spearing/netting, game/trapping and gathering, and safeguard habitat to prevent practices that degrade habitat of fish and game (GLIFWC website, 2012).

Outreach and Language

The GLIFWC conducts traditional harvesting skills workshops for their youth (GLIFWC website, 2012). In order to keep their language and traditions alive, GLIFWC produce interactive CDs (GLIFWC website, 2012) teaching traditional names for species, geographic locations (like lakes, rivers etc.) in two dialects of the Ojibwe language and others teaching non-medicinal uses of plants. The CDs are a result of numerous meetings with elders from GLIFWC's eleven member tribes (GLIFWC website, 2012).

What are the outcomes of monitoring?

Monitoring for walleye provides data that is used by the Technical Working Committee (a co-management board) to decide total allowable catch (Maulson, F., personal communication, November, 2012). Monitoring data is also used to decide threshold levels for deer, bear, otter, fisher and bobcat subsistence harvests (Maulson, F., personal communication, November, 2012). Community monitoring has also alerted residents to changes in water quality and fish habitat taking place due to climate change and invasive species (Maulson, F., personal communication, November, 2012). Mercury maps provide community members information about the amount of fish they can safely

consume, resulting in changes in peoples' consumption patterns (Maulson, F., personal communication, November, 2012). Studies indicate that mercury toxicity in residents hair samples have decreased due to these changes in consumption patterns (Maulson, F., personal communication, November, 2012). Monitoring data helps determine allocation of whitefish for commercial fishermen (Maulson, F., personal communication, November 2012). Wild rice monitoring informs community members about the health, abundance and location of wild rice harvests as well as threats to the harvest due to invasive species or damage from boats (Maulson, F., personal communication, November, 2012). GIS mapping helps communities find ceded land for harvests (like Birch bark, conifer) and accessibility for harvesting on public land (Maulson, F., personal communication, November, 2012). Maps are also distributed to community members to help them find public boat landings on lakes (Maulson, F., personal communication, November, 2012).

Monitoring provides GLIFWC with information to make decisions on how it can manage resources and regulate harvesting such as fishing, hunting, wild plants (GLIFWC website, 2012). GLIFWC also tracks threats to the environment such as pollution and climate change. Wardens have powers to ensure rules are being followed. Monitoring enables sustainable management of natural resources in the Ojibwa territories and the helps keep Ojibwa culture alive (GLIFWC website, 2012).

5. Association of the Indigenous Land of Xingu (ATIX), Brazil

Who is involved in monitoring?

ATIX is an alliance of 16 indigenous communities that live in the Xingu Indigenous Park (PIX) located in the watershed of the Xingu River (Instituto Socioambiental website, 2012). The Xingu river is one of the main tributaries of the Amazon River, that extends 2,300 km, linking the states of Mato Grosso and Para, and discharges into the Amazon River just below Maraj ´o Island in the Amazon estuary (Brondizio et al., 2009). The PIX covers 2.8 million hectares and a perimeter of 920 km, in northern Mato Grosso, created by the federal government in 1961 (Instituto Socioambiental website, 2012). The park is located in an ecological transition zone, consisting of tropical forests to the north and Savannah south. (Y Ikatu Xingu website, 2012) The Xingu watershed covers 51 million hectares, cutting across 35 municipalities,

with a population of approximately 450,000, and 27 indigenous groups (Brondizio et al., 2009).

ATIX has been at the forefront of protecting the borders of PIX as well as creating broader alliances with stakeholders (agriculturalists, municipalities, schools, workers unions, etc.) outside the park boundaries (Brondizio et al., 2009; Y Ikatu Xingu website, 2012).

How was the monitoring network formed?

PIX was created in 1961, around the same time when the Brazilian government was promoting agro-development of the Amazon. As a result, PIX is surrounded by cattle ranches and soya plantations (Brondizio et al., 2009; Instituto Socioambiental website, 2012). The forest within PIX area has remained relatively intact although the rates of deforestation in the broader Xingu watershed have been very high (Brondizio et al., 2009). In the 1980s, indigenous groups started to deal with the colonization of forests around PIX (Brondizio et al., 2009). Their priorities were to protect park borders from farming incursions, logging, hunting and fishing (Brondizio et al., 2009). To take over control of park management and protect the borders of the park, ATIX also formed alliances and associations with other organizations and government officials [e.g., officers from the National Indian Foundation (FUNAI)], NGOs [e.g. Instituto Socioambiental (ISA)], church-based groups, international celebrities (e.g., singer Sting), anthropologists, and physicians working in the region (Brondizio et al. 2009). ISA has provided ATIX with training, infrastructure and capacity building support for over 15 years. The ATIX representatives travelled to the park boundaries and made visited land adjacent to the boundaries (Brondizio et al., 2009). Over the years, they acquired new partners as some neighbouring farmers lent a hand to keep the borders clear (Y Ikatu Xingu website, 2012; Brondizio et al., 2009). In recent years, the indigenous peoples of the lower and middle Xingu have taken over enforcement. (Velasquez, C., personal communication, May, 2012).

What are they monitoring? What are the activities of the network?

ATIX established 10 monitoring posts, mostly at the intersections of park borders and riverways through the park. Support from outside organizations (e.g., Instituto

Socioambiental) and external financing led to the creation of effective boundary controls (Y Ikatu Xingu website, 2012; Brondizio et al., 2009). ATIX monitors deforestation and forest fires, and also organizes expeditions to protect the PIX borders (Brondizio et al., 2009). With the help of ISA, it is monitoring deforestation through GIS mapping. ATIX set up a program to restrict entrance to PIX, to clean and demarcate trails, to effectively use global positioning system units to produce and update local maps, and to work with organizations using geographic information systems (GIS) and remote-sensing mapping (Y Ikatu Xingu website, 2012; Brondizio et al., 2009). These measures were effective in curbing deforestation and its impacts inside the park and around the Xingu headwaters (Brondizio et al., 2009).

The effects of deforestation in the areas outside the PIX borders became apparent within PIX in the 1990s (Y Ikatu Xingu website, 2012; Brondizio et al., 2009). Indigenous groups observed lower water volumes in some tributaries (due to sedimentation and dried up water springs), increasing sediment loads, and less water transparency, which made arrow fishing difficult (Y Ikatu Xingu website, 2012; Brondizio et al., 2009). Indigenous people living within PIX were also impacted by higher levels of smoke and air pollution during the burning season and an increasing risk of fire spreading during dry years (Brondizio et al., 2009). Concerns about pesticide pollution needed further investigation. (Brondizio et al., 2009) The headwaters of the Xingu river are outside park boundaries and are threatened with deforestation. In 2004, ATIX and ISA, allied with other stakeholders to launch a campaign to protect and restore the riparian forests in the Xingu basin called '*Y Ikatu Xingu*' (Save the good waters of the Xingu).

In order to address factors outside the park that were impacting the ecosystem inside PIX, ATIX and ISA started reaching out to form alliances with municipal governments and agencies to mediate agreements with farmers, to educate the regional population about indigenous peoples, and to create incentives and partnerships for restoration (Brondizio et al., 2009). They are also trying to create alliances with indigenous groups outside PIX in an attempt to extend the indigenous park territory (Brondizio et al., 2009). ATIX has also done extensive mapping and GIS-based surveying of all neighbouring farms and properties bordering the park (in collaboration

with national NGOs, and FUNAI) (Brondizio et al., 2009). They are attempting to get farmers involved in forest restoration along riverways (Brondizio et al., 2009).

Forest restoration began in 2006 with the aim of restoring springs; riparian forests are in the process of being restored in 18 municipalities (Y Ikatu Xingu website, 2012). Restoration increased the demand for native seed, and this spurred another initiative called the Seeds of the Xingu Network, a platform of exchange and marketing of seeds involving 300 families of collectors, seven indigenous communities and 25 organizations from 19 municipalities (Y Ikatu Xingu website, 2012). Seed collection has been of great value in restoration and cultural revival. The seed network project has also generated income for farmers and indigenous communities and enables communication and exchange among seed collectors, nurseries, NGOs, landowners and other interested parties (Y Ikatu Xingu website, 2012).

The Y Ikatu Xingu project also works to promote agroforestry and alternative sustainable income for farmers who have cut down forests adjacent to the borders of PIX (Y Ikatu Xingu website, 2012). Y Ikatu Xingu organizes workshops for the proper management and controlled use of fire to prevent forest fires in the dry season. It creates new capabilities for the sustainable agriculture in rural properties and enhances initiatives that combine conservation or restoration of natural resources and income generation. (Y Ikatu Xingu website, 2012).

ATIX is also engaged in land-use planning, to help shape policy and institutional arrangements for sustainable development at different levels: basin, sub-basin, county and property (Y Ikatu Xingu website, 2012). Currently, the campaign supports planning initiatives and social and environmental sustainability of the municipalities of Canarana Querencia, Sao Jose do Xingu, Marcelândia and Claudia (Y Ikatu Xingu website, 2012). Organizations that are part of the Y Ikatu Xingu project also track public policies and developments that directly affect the territory of the Xingu Basin, such as the Forest Code, the socio-economic ecological zoning exercise (ZSEE) of Mato Grosso and infrastructure development (Y Ikatu Xingu website, 2012). ATIX represents its member communities concerns at different levels of policy-making. It has also articulated its opposition to the Belo Horizonte dam that threatens its territories.

What are the outcomes of monitoring?

Monitoring has helped enhance ATIX's participation in land use planning and its political presence in other policy and decision-making processes. ATIX was able to curb deforestation and its impacts inside the park and around the Xingu headwaters by monitoring at ten posts in PIX boundaries and GIS mapping of PIX and adjacent areas (Brondizio et al., 2009). By mapping areas outside PIX boundaries to demonstrate the extent of deforestation, ATIX mobilized support for forest restoration in 18 municipalities (Y Ikatu Xingu website, 2012). Some municipalities supported the ATIX deforestation prevention project by launching a campaign to generate awareness among farmers and prevent them from planting soya near PIX boundaries (Velasquez, C., personal communication, May, 2012; Y Ikatu Xingu website, 2012). The Y Ikatu Xingu project is creating awareness about agroforestry and forest fire management through workshops. The Seeds of the Xingu Network has spread the use of indigenous seeds and, besides its value in restoration and cultural revival, it has generated income for farmers and indigenous communities and has enabled communication among seed collectors, nurseries, NGOs and landowners (Y Ikatu Xingu website, 2012).

Discussion

The main factor that led to the formation and success of the focal case studies was the existence of some form of agreement, which acknowledged the rights of the community to have a say in how their local environment is governed. Such agreements varied across cases from land claims agreements, customary rights, to some form of co-management agreement, but the existence of some enabling agreement was necessary. Moreover, the willingness of governments to recognize customary rights and work with communities to implement their plans was important to the success of the CBM projects examined in this paper. Collaborations with university researchers also provided some communities with technical support, credibility and funding. Several CBM projects have received funding and support from ENGOs, foundations and governments to help them start up and expand their activities. In most cases, the CBM projects have resulted in positive ecological and social benefits for the communities, and increased awareness of changes in ecosystems. CBM diversified the number of tools available to a community to

understand its environment, such as community planning, GIS mapping and handheld GPS or data loggers. CBM has resulted in greater communication and sharing of information between different communities, building long term working relationships between them. Monitoring has helped people connect to their land and culture (Table 2.4). Several of these factors of success for CBM networks are similar to Scott's conditions for the success of social movements (Table 2.2) such as the ability to demonstrate that radical reform is necessary and not being addressed, access to financial and logistical resources, the existence of new or expanding forms of political expression, the ability to form issue networks and the ability to form coalitions at the local and provincial levels (Scott 1990; Pinkerton, 1993).

1. What were the factors that favoured the establishment of the monitoring networks?

Land claims agreement, customary rights or a co-management agreement.

Several networks like the LMMA or GLIFWC have established customary claims or treaties over their lands, which give them a degree of control over their territories and provisions for co-management with government agencies. For example, in the Xingu Indigenous Park (PIX), the ATIX communities had control over the park, which gave them the credibility and authority to form alliances with organizations and governments in adjacent areas (Brondizio et al., 2009). In Australia, court judgements that acknowledged indigenous rights and government programs such as Indigenous Land Management Organizations gave indigenous communities more control over resource management decisions (Kennett, R., personal communication, August, 2012).

The Coastal First Nations, with which the CGWN are associated, have not settled land claims with the Canadian government. Some have opted out of the treaty process while others at different stages in the process. In 2009, they signed a Reconciliation Protocol agreement with the British Columbia government and can negotiate co-management arrangements in that context (Coastal First Nations Reconciliation Protocol Agreement, 2009). However, many of their concerns fall under the jurisdiction the Federal Government's Department of Fisheries and Oceans (DFO), whose priorities are often different from those of First Nations. Recently, the Federal government pulled out of the Pacific North Coast Integrated Management Area agreement, which would have

developed a working relationship between First Nations and B.C. and federal governments. The CGWN could be good working partners for several government agencies such as Parks Canada, DFO, and Environment Canada, since government agencies often do not have enough enforcement staff to monitor large portions of the remote B.C. coast.

Supportive national or provincial governments that fund or institutionalize the arrangements

Merely having a treaty or co-management arrangement isn't enough to make community monitoring effective, unless governments back it up with funding and support. The LMMA was able to expand across hundreds of villages because the government of Fiji decided to adopt the model of the Fiji LMMA and support their endeavours. NAILSMA's projects are funded by the Australian government, and this has helped them expand (Kennett et al., 2010; NAILSMA website, 2012). More government involvement and institutionalization might seem like a dampener on independence of an organization. But having a supportive government that is invested in the network gives the government a stake in the network's success, and hence it is more likely to provide other forms of support as well. This raises questions for the CGWN and CFN about how they negotiate partnerships with government agencies like Parks Canada and Environment Canada. The CGWN should ensure that it gets adequate institutional support if it is going to collaborate with government agencies.

Legislation or policy that supports collaborative resource management.

Most CBM networks mentioned in this paper have been able to develop because of laws that recognize their communities' customary rights and title to their territories (Table 2.4). In Australia, the Federal government has acknowledged aboriginal title to land and sea territories and has several government programmes to support indigenous resource management such as the *Indigenous Land Management Organizations*, *Indigenous Protected Areas* and *Healthy Country Healthy People* (Kennett et al., 2010).

The Coastal First Nations Reconciliation Protocol Agreement (2009) gives the Nations that are part of the CGWN some degree of power over their territories and the recognition of some rights over their territories. This gives the CGWN some control over their territories, although they do not have enforcement authority if there is an offence of

any government laws. When CFN's marine use plans are implemented, the formal authority of the CGWN to implement the plans may be enhanced, as the plans envisage the Guardian Watchmen as the people who will ensure that plans are implemented (Marine Planning Partnership for the North Pacific (MAPP) website, 2012; Coastal First Nations website, 2012).

Settlement of land claims in the Great Lakes Indian Fish and Wildlife Commission (GLIFWC) were followed by legislation that led to the formation of co-management boards and other institutions that provided the institutional framework and support for community participation in resource management. The 2007 Wisconsin Act 27 is based on the tribes' sovereign authority to regulate themselves in the exercise of their ceded territory rights (GLIFWC website, 2012). It recognizes the law enforcement capabilities of GLIFWC's conservation enforcement personnel and extends many of the same statutory safeguards and protections to GLIFWC officers that are afforded to other law enforcement officers in the state (GLIFWC website, 2012; Maulson, F., personal communication, September, 2010). Other laws have also provided the GLIFWC wardens with enforcement authority in three different states in the US, in which the GLIFWC member communities are located, and the requisite training to enforce environmental regulations from government agencies (Maulson, F., personal communication, September, 2010). GLIFWC wardens must work 40 hours per year with the state authorities enforcing hunting and fishing regulations and can work the rest of the time with their indigenous government, a process referred to as cross-deputation (Maulson, F., personal communication, November, 2012).

Technical support and credibility from involvement of university-based researchers

In many of the CBM networks, partnerships with external researchers have helped give the networks a voice and increased their credibility with external audiences. NAILSMA's I-Tracker network is working with researchers on several scientific studies (Kennett et al., 2010; NAILSMA website, 2012). The I-Tracker network has designed research protocols and guidelines specifying the nature of the collaboration with partner Aboriginal communities, ensuring that the intellectual property remains within the community.

In most of the communities where the CGWN work, local First Nations are working with researchers. For example, the QQS society in the Heiltsuk nation is collaborating on research projects, such as Grizzly Bear monitoring, with university researchers (Qqs Projects Society website, 2012). The CGWN has collaborated with researchers at the University of Victoria for help on an environmental law field guide (Sattarzadeh et al., 2011) and for technical assistance with CoastTracker, their digital field devices (CGWN representative, interview, May, 2011).

Community's willingness to forego their own individual interest for conservation of a shared resource

In the LMMAs, communities agreed to abstain from fishing in the no-take areas, even though peoples' subsistence was already under threat due to the decline of the fishery (Aalbersberg et al., 2005). In order for any Guardian group to be effective, the community must be willing to accept their authority. The GLIFWC also has its own governance system that regulates harvesting of fish, wild rice and other natural resources (GLIFWC website, 2012). In the communities where the CGW work, they are highly respected and their work is valued, and hence most people are likely to accept their authority (Coastal Guardian Watchmen representatives, interview, May, 2011). In several communities, the data gathered by fisheries officers is used to determine aboriginal fishing quotas etc.

Funding for monitoring and support

Funding to start up community monitoring projects often comes from foundations or non-governmental organizations (Table 2.4). Groups like NAILSMA and LMMA started with funding help from outside agencies like universities, ENGOs or government (Govan, 2009; Govan et al., 2006; WRI, 2005). The CGWN was started with money from the Coast Opportunity Fund, and receives funding from other agencies to fund some of their projects like CoastTracker (Coastal Guardian Watchmen representatives, interview, May, 2011).

2. What were the impacts of CBM?

Positive ecological outcomes at an early stage

Demonstrating success or benefits of CBM within a few years after being established helps CBM groups gain community support and funding and support from external agencies (Table 2.4). After the LMMA villages in Fiji enforced no-take zones, the results were seen within a few years both inside the no-take zones as well as in spillover areas adjacent to the no-take zone. Fish stocks increased dramatically and local income rose by up to 35% over 3 years (Aalbersberg et al., 2005). Community members were in economic hardship due to depleting stocks of fish when they agreed to the LMMAs (Aalbersberg et al., 2005). The fact that results were seen within a matter of a few years motivated the community to continue to adhere to the rules they had agreed to (Aalbersberg et al., 2005).

Since the CGWN has only been monitoring for a few years, it is difficult to assess the ecological impacts of monitoring (CGWN representatives, interview, May, 2011). The CGWN has enormous community support because people feel that they are protecting the community's territories (CGWN representatives, interview, May, 2011). Ecological outcomes from CGWN are likely to be more apparent when the North and Central Coast Marine Use Plans are implemented, in which the Guardians are envisaged to play a key role in enforcing rules and monitoring outcomes (CGWN representatives, interview, May, 2011).

Social and economic benefits at an early stage

The recovery of fish stocks has resulted in improved livelihood opportunities for LMMA villagers (Aalbersberg et al., 2005). NAILSMA's projects employ several community members and its association with the Australian government's 'Healthy Country Healthy People' program has also created job opportunities for indigenous people (NAILSMA website, 2012; Kennett et al, 2010). Moreover, the growth of the I-Tracker network and NAILSMA has resulted in the revival of aboriginal resource management practices and languages (Kennett et al. 2010). The re-connection of people to their culture and territories has resulted in better community health (Kennett et al. 2010). In several places in the Arctic, CBM projects such as the Igliniit project and the Arctic Borderlands project, have developed community capacity to monitor

environmental conditions, training modules and a sense of pride in local knowledge and culture (Appendix 1).

The data by the CGWN collected informs local community decisions on resource management (CGWN representatives, interview, May, 2011). The social benefits of the CGWN are palpable in capacity building, training and mentoring leaders within the community (CGWN representatives, interview, May, 2011). It has also increased community pride and a feeling that their cultural values are being upheld (CGWN representatives, interview, May, 2011). The CGWN has also united people from different FN communities and created an alliance of support and camaraderie (CGWN representatives, interview, May, 2011).

Committed support from governments for long-term adoption of community-based monitoring

The success of the LMMA prompted the governments of Fiji and Samoa to commit to adopt the LMMA as a national policy and protect 30% of inshore waters (Aalbersberg et al., 2005; Govan, 2009). It has also prompted the Fijian government to collaborate with FLMMA and to adopt its participatory process in its own projects. The success of NAILSMA's I-Tracker ranger projects prompted the Australian government to fund their initiatives (NAILSMA website, 2012; Kennett et al., 2010). In the case of the GLIFWC, their recognized rights under treaty enable them to partner with government and access government funding (GLIFWC website, 2012). In the case of the Philippines, the government committed to community monitoring of protected areas by passing a law (Danielsen, 2005; Appendix 1).

The CFN, to which the CGWN belongs, already has a decision-sharing agreement with the B.C. government (Coastal First Nations Reconciliation Protocol, 2009). However, most members of the CGWN work on marine-related issues, issues that fall under the jurisdiction of the Federal government's Department of Fisheries and Oceans. At this point, the Canadian Federal government is attempting to dissolve existing environmental legislation and cutting funding for environmental enforcement (Struzik, 2012). It might be more difficult to build alliances with government agencies because the CFN are protesting the construction of the Northern Gateway pipeline project (CFN website, 2012). It might not be possible for the CFN and CGWN to get

funding support from the Federal government, since the government is reducing its existing staff and expenses on environmental monitoring and regulation (May, 2012; Moore, 2012; West Coast Environmental Law, 2004). However, since the government is cutting back on monitoring, the void will be filled by groups like the CGWN, whose work will be invaluable to government and other agencies.

Improved community health and well-being through potential for community members to re-connect to their land and sea

Connecting to their culture and territories improves health in indigenous communities. Research on the Australian government's 'Healthy Country Healthy People' project explored the health benefits of getting indigenous communities to connect with their environment (Burgess et al., 2005). It concluded that an essential part of aboriginal physical and spiritual health is an ability to connect with and care for their territories (Burgess et al., 2005). Being outdoors gave people more opportunities for physical activity and improved diet (Burgess et al., 2005). It also boosts individual autonomy and self-esteem, and increases collective esteem and social cohesion (Burgess et al., 2005). Burgess et al. point out that internationally, such culturally congruent health promotion activities have been successful in programs dealing with substance abuse and chronic diseases (Burgess et al., 2005).

Increased use of community knowledge in resource management decisions

The LMMA's *tabu* areas were created based on the villager's traditional knowledge (Aalbersberg et al., 2005). The I-Tracker network and NAILSMA have been working to incorporate indigenous knowledge in resource management (Kennett et al. 2010). NAILSMA has managed to implement eight community-based management plans. In the Arctic, several projects like the Igliniit project, the Arctic Borderlands Project, Bering Watch and the Snowchange Project are using local knowledge to track impacts of climate change (Appendix 1).

As part of the Marine Use Planning process, extensive interviews with elders were conducted to ensure that traditional knowledge informed stewardship practices (CGWN representatives, interview, May, 2011). The monitoring priorities reflected in the CGWN Regional Monitoring Strategy, are based on common concerns identified by Guardian Watchmen, resource stewardship managers and community members from

the First Nations that are members of the network (Interviews with CGWN representatives, interview, May, 2011). Additional indicators important for implementing the integrated marine use plans are likely to be monitored by the CGWN in the future (CGWN representatives, interview, May, 2011).

Research and increased awareness about the local environment

CBM networks are prompting more research and are generating more awareness and knowledge about local environmental issues (Table 2.4; Appendix 1). In some villages in Fiji, villagers laid transects with the help of scientists in order to track the effectiveness of the no-take zone (Govan, 2009; WRI, 2005). They are also using new technology like GIS mapping to improve their understanding of their territories. For example, the ATIX uses GIS mapping to understand what activities outside PIX that are affecting the ecosystem inside the park (Brondizio et al., 2009). In the Arctic, the Igliniit project has helped communities map patterns in hunting success, changes in animal populations, changes in snow conditions, connections between weather conditions and travel conditions, and locations of hazards. Community leaders can use the maps in matters related to land use planning or land use negotiations, to clearly and easily show up-to-the-day use of land and resources that might be affected by the placement of a mine or protected area. Schools can use the maps in combination with trips on the land to study hunting, geography, and weather. Weather information collected by Igliniit is valuable, as it provides more representative data of weather conditions in the local/regional area, potentially leading to better weather forecasts (Appendix 1).

The CGWN, NAILSMA and the Igliniit project (Appendix 1) are using mobile devices and other digital tools to make it easier for their staff to collect, share and map data. Websites and online databases also help these networks to communicate, pool data and make data accessible to people in remote communities. For the CGWN, the data from its Regional Monitoring Strategy will provide a larger regional perspective on issues and species of concern (Coastal Guardian Watchmen Network website, 2012).

Increased surveillance and enforcement of rules in community territory

The presence of community members to monitor natural resources in the territories of the GLIFWC, LMMA, NAILSMA and has increased enforcement of

environmental regulations, reduced illegal harvesting, and protected sacred sites. The GLIFWC also have the power to enforce and monitor fisheries rules in their territories (GLIFWC website, 2011; Kennett et al., 2011). CGWN members have taken measures toward increasing their presence on their territories including developing relationships with Parks Canada staff (CGWN representatives, interview, May, 2011).

Community participation in decision-making / planning

Networks like LMMA, GLIFWC and NAILSMA have given communities a greater voice in decision making and planning. Impressed by the LMMA, the Ministry of Fijian Affairs uses FLMMA's participatory approach for its Community Capacity Building project, which identifies and develops action plans to deal with village problems (Aalbersberg et al., 2005). The CGWN has also managed to gain a stronger voice in decision-making through their collective strength. For instance, several Guardian Watchmen were community representatives spearheading community interviews that guided the marine planning process called MaPP in the North and Central coast (MaPP website, 2012). Yet, many Guardian Watchmen feel there is a disconnect between people working in the field and those working at a political level within the community (CGWN representatives, interview, May, 2011). First Nations need to build mechanisms through which people working in the field are heard by their leaders.

Communities/First Nations working together on issues of a regional nature

Community monitoring networks like GLIFWC, NAILSMA and Snowchange (Appendix 1) have connected communities who are facing the same challenges. The CGWN has built connections and relationships between Guardian Watchmen in 10 First Nations communities, some of which have old rivalries (CGWN representatives, interview, May, 2011). These connections have fostered strong friendships, sharing and learning (CGWN representatives, interview, May, 2011). Other initiatives, like CFN's participative processes for developing harmonized Marine Use Plans for the North and Central Coast, have also helped connect people in different First Nations communities in the Great Bear Rainforest region (CGWN representatives, interview, May, 2011).

Community monitoring networks in various parts of the world are also developing partnerships to learn from each other. For instance, NAILSMA and CGWN have been

exchanging information and learning from each other (CGWN representatives, interview, May, 2011; Coastal Guardian Watchmen Network website, 2012). CGWN's CoastTracker project was inspired by NAILSMA's I-Tracker device (CGWN representatives, interview, May, 2011). The CGWN could learn from their experiences and strategies to engage with government and contribute to decision-making.

Sustainable funding sources

Although several of the LMMA's costs were funded by international NGOs, several communities are trying to become self reliant by including some income-generating activity in their community management plans (Govan, 2009; Aalbersberg et al., 2005). For example, Verata village in Fiji entered into a bio-prospecting arrangement with a pharmaceutical company in which the community was paid licensing fees for samples of medicinal plants and marine invertebrates collected in their district (Aalbersberg et al., 2005). At another site, a hotel in Fiji pays $2 to a community trust fund for each scuba diver that utilizes the village's protected area. This gives the community enough money to fund their monitoring (Aalbersberg et al., 2005).

3. What were the factors that led to the success and expansion of the monitoring network?

Monitoring fulfills a very real need or addresses a threat or problem within the community

A CBM is more likely to be successful when it fulfills a need or attempts to address a pressing question or issue that the community faces. The LMMAs started at a time when several villages in the Indo-Pacific were facing increased poverty due to the decline of fishing stocks (Aalbersberg et al., 2005). LMMAs fulfilled the community's need to try new strategies to overcome this crisis. When LMMAs demonstrated results within a matter of a few years, it resulted in increased community support. Hearing of the success of the LMMA, other villages expressed interest in starting an LMMA in their community (Aalbersberg et al., 2005).

Partnerships with government

Attempts to partner with government have often been successful and have led to the expansion of community monitoring groups (Table 2.4). The LMMA shared the

results from their monitoring data with the Fijian government and it resulted in the government adopting their method for local governance as a national policy (Aalbersberg et al., 2005). NAILSMA has also been involved in shaping government policy with the 'Healthy, Country Healthy People' project and several others (NAILSMA website, 2011). The CGWN is has a friendly relationship with a few government agencies like Parks Canada and is in the process of building alliances with other government agencies (CGWN representatives, interview, September, 2012). While building these partnerships, it should use the opportunity of data sharing to ensure that in return, government agencies share power. Pinkerton (2009) lays out a hierarchy of co-management rights that extends from data collection, which is considered a lower level right, to participation in policy making, which is listed as the highest level of rights (Table 2.1). While sharing monitoring data and information with agencies, the CGWN should ensure that it is able to force government to share power and that the CGWN can gain greater rights in decision making.

Working with other stakeholders

In Brazil, ATIX managed to reach out to farm owners and municipalities outside their park boundaries to start river restoration projects (Brondizio et al., 2009). NAILSMA has the support for their land management from Land Councils across North Australia (Kennett et al., 2010). In some FN communities, Coastal Guardian Watchmen are working with tourism operators to monitor bears (CGWN representative, interview, May, 2011). The CGWN is reaching out to build alliances with government agencies, researchers and non-governmental organizations (CGWN representative, interview, September, 2012).

Alliances with researchers and NGOs

Working with international NGOs raised the profile of ATIX's struggle to protect PIX (Brondizio et al., 2009). Engaging with organizations that are working on similar issues at the international level gives a stronger voice and support to people working on the ground. Village surveys and meetings organized by researchers led to the formation of the LMMA (Aalbersberg et al., 2005). ENGOs played an important role in supporting and funding the work of the LMMA (Govan, 2009). Guardian Watchmen in some communities, like the Heiltsuk First Nations, have developed close ties with university

researchers and NGOs such as The Hakai Network for Coastal People, Ecosystems and Management at Simon Fraser University and The Nature Conservancy (CGWN representatives, interview, September, 2012).

Ability to demonstrate and communicate successful outcomes

The LMMA was able to demonstrate tangible results. They were also able to communicate the results of their work to their communities and to the national government. The FLMMA took the data from their monitoring and presented it to the Fiji government, which was so impressed that they decided to get their ministries to spread the concept of LMMA throughout the country. The Fiji government also committed to protect 30% of the country's inland waters (Govan et al., 2009; Aalbersberg et al., 2005). The CGWN are still at a very early stage of development and it will take some time before they can demonstrate more tangible ecological outcomes of community-based monitoring.

Training programs and learning from other communities

Village residents in Fiji were trained to scientifically monitor transects in their LMMA (Aalbersberg et al., 2005). There is also a lot of shared learning from experiences and practices in different communities that help others start LMMAs in their communities or expand LMMA activities within their villages (Govan, 2009; Aalbersberg et al., 2005). The CGWN has formulated its own training programme for members, the Guardian Watchmen Certificate Program, conducted by the Northwest Community College, which has some practical safety training as well as ecology, monitoring training and cultural knowledge (Coastal Guardian Watchmen Network website, 2012). Moreover, members informally share experiences and learn from what is happening in other communities.

Support from community elders and leaders

The first few villages to adopt LMMAs in Fiji focussed on no-take zones that were enforced by village leaders at a time when fishermen were facing a downfall. Yet, people respected the rules, even though it went against their own immediate interests, because it had the support and backing of their village chiefs (Aalbersberg et al., 2005). The CGWN was also formed by when a few community leaders started talking about ways to build a network of Guardian Watchmen along the coast of B.C. Taking up this idea, the

founding co-ordinator of CGWN visited several communities to work on this idea and start the network. Having the support of these respected community members helped build the network (CGWN representatives, interview, September, 2012). The presence of Guardian Watchmen in some communities like the Heiltsuk also helped develop the network (Jorgenson, L., personal communication, October, 2012).

Learning from other networks within the network and around the world

LMMAs spread as people learned from what was happening in other villages and wanted to adopt it in their villages (Aalbersberg et al., 2005). The CGWN learned about the I-Tracker portable device and CyberTracker software, that allows communities to record and share their data digitally, and adopted it for their own databases and launched their own CoastTracker mobile devices (CGWN representatives, interview, September, 2012). It considerably reduced the time spent recording and uploading field data (CGWN representatives, interview, September, 2012).

Conclusions

I have highlighted a number of key principles that might be useful for the CGWN. The Guardian Watchmen are likely to be implementing the Coastal First Nations marine use plans, in which different zones where certain activities are allowed and others not have been mapped out, based on local and traditional knowledge (Coastal First Nations website, 2012; MAPP website, 2012). They will be an important force in enforcement and data collection for monitoring and adaptive management. In order to gain a greater voice in decision-making, the Guardian Watchmen could attempt to form alliances with several government agencies and other organizations. The CGWN is trying to form alliances with Environment Canada, Parks Canada and DFO. At the same time, CFN could be working to negotiate agreements that give them greater control over their natural resources in a legally binding framework. Moreover, defining the outcomes of monitoring more clearly would help the CGWN. The Regional Monitoring Strategy could provide a powerful picture of the environment in a region that is under threat from oil spills and environmental disasters if the Northern Gateway pipeline project is cleared. The CGWN should use this tool to its full potential and define clearly how the network will use the data and what their goals and outcomes from monitoring will be.

The Coastal Guardian Watchmen have a vital role to play as stewards of their territories at a time when the Canadian government has massively cut spending on environmental protection and is planning to dilute existing environmental legislation. The Canadian government has dismantled the nation's ocean contaminants program (a premier research and monitoring institution), as part of layoffs at the Department of Fisheries and Oceans (Ross, 2012). The Federal government has cut funding for environmental protection and enforcement (Eilperin, 2012). It has made fundamental changes to the Fisheries Act, removing much of the protection for fish habitat, which would mean that the majority of freshwater fish and up to 80% of the 71 freshwater species at risk of extinction would lose protection (O'Neil and Pynn, 2012). At a time when the government is dissolving enforcement and monitoring along this endangered coast, the Guardian Watchmen might be the only presence guarding these shores.

CBM network create the presence of a unified monitoring force helps attract funding, influence policy and build alliances with government agencies, researchers, NGOs and other CBM networks. Data collected by CBM groups in remote areas, where government presence is scarce, is valuable to several organizations such as government, ENGOs and researchers. Often, CBM can provide important inputs to co-management boards (eg. community monitoring guides the decisions of the Great Lakes Indian Fish and Wildlife Committee) or aboriginal resource management boards (eg. I-Tracker rangers provide feedback to the Indigenous Land Management Organizations in northern Australia). A unified monitoring network gives communities more credibility while carrying out enforcement work.

Often, CBM projects are very successful and grow much bigger than initially envisioned. For instance, the villages that started the LMMAs in Fiji didn't envision that it would grow into an international network that has effected change in national and international policy. CBM allows communities to support each other in ways that they would not otherwise. CBM networks ensure that communities prioritize their goals and focus on common problems and commonalities, rather than on rivalries and differences, often transforming relationships between communities. CBM unites communities on a regional or international level, and builds capacity within communities by enhancing training and the use of technology. Often, CBM extends beyond a single community, and connects small, remote communities to the rest of the world, enabling them to feel heard

and fostering a sense of belonging to a bigger collective force. CBM often leads to tangible social benefits that were not initially anticipated, such as better livelihoods, health, community cohesion and spiritual connection to the land. It helps develop leadership amongst youth within communities and helps them connect with the land/sea and their culture.

Community-based monitoring is most effective when it is linked to clear goals. For instance, in the LMMA, where monitoring helped ascertain the impacts of no-take zones and other measures on different species such as fish, clams etc. Goals evolve as the CBM network grows or they change to adapt to new situations and developments. Several CBM groups have a common framework within which they work but also leave room for flexibility to adapt to local situations and needs.

Customary title to the land and sea, or a co-management arrangement with the government helps CBM groups with monitoring and enforcement. The degree of enforcement authority depends on how clearly laid out legal title is. For instance, in the Great Lakes Indian Fish and Wildlife Commission (GLIFWC), because the communities have clear treaty rights, their wardens are equivalent to state wardens and are trained by and work with their agencies. In the case of the CGWN, Guardian Watchmen currently have no enforcement authority, but have informal respect and co-operation from certain government agencies. NGOs and researchers have played a key role in helping with funding and credibility, helping the networks to grow.

CBM is empowering communities by helping them reinforce stewardship authority in their territories and provide meaningful input into decisions that affect the resources they depend on. It re-connects people with their land and heritage, instilling a sense of pride and belonging and infusing new ideas, innovation and hope in communities. CBM amplifies the voice of small remote communities and democratizes science and resource stewardship. The importance of CBM in conservation and adaptive management is growing as policy makers and scientists are increasingly emphasizing approaches that synthesize multiple scales, knowledge systems and objectives (Berkes, 2007; Reid et al. 2006) to deal with ecosystem change.

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Tables

Table 2.1: Hierarchy of Rights in Fisheries Management Decision-Making.

Pinkerton, 2009

Type of Management Right	Specific Right
Lower order rights	Data collection Data analysis
Higher order rights	Plan timing and location of fishery Rule-making regarding fishing methods Allocation of fishing opportunity among rights holders Enforcement of fishing rules Defining who has fishing rights
Broader rights affecting other actors and users of marine space	Rule-making regarding fish habitat protection Enforcement of habitat protection rules Coordination of fishing and other competing uses of marine space Returning optimum value to fishermen
Highest level rights	Fisheries policy development Identification of key problems, issues Creating a vision of what fishery is desired, goals of management.

Table 2.2: Sociological and political conditions that help predict the success of a social movement

(Scott, 1990; Pinkerton, 1993)

General sociological conditions
Ability to articulate a consistent vision.
Access to financial and logistical resources.
The ability to demonstrate that radical reform is necessary and not being addressed.
Access to old and new public forums of debate and dissemination of opinion.
Specific political conditions
The existence of new and expanding organizations.
The ability to articulate a consistent vision.
The existence of new or expanding forms of political expression.
The ability to form issue networks.
The ability to form coalitions at the local and provincial levels.
The ability to identify issues with the public interest.
Access to power.

Table 2.3: Benefits of Community-Based Monitoring

- Understanding of ecosystem change from an indigenous perspective
- Collaboration and Learning
- Empowerment
- Enforcement authority
- Input into Decision-Making
- Communication
- Partnership Building
- Credibility
- Connection to the land brings spiritual, emotional and physical well-being
- Shift to Ecosystem Stewardship

Table 2.4: Summary of Results from Examining Case Studies of Community-Based Monitoring

CONCLUSION	EXAMPLE
1. What favored the formation of community monitoring networks?	
Land claims agreement with provisions for co-management, or a co-management agreement, which allows for monitoring.	GLIFWC, LMMAs have customary rights established (GLIFWC website, 2012; LMMA website, 2012). CGWN's member First Nations have a collective agreement with the B.C. government for joint decision making in resource management (CFN website, 2012).
Supportive national and provincial governments that fund or institutionalize the arrangements.	NAILSMA gets funding from government for several of its projects (NAILSMA website, 2012; Kennett et al., 2010).
Legislation that supports collaborative resource management.	GLIFWC that has an institutionalized form of co-management because of treaty signed. (GLIFWC website, 2012).
Legitimacy from involvement of university-based researchers.	Researchers helped LMMA villages design monitoring and research experiments (Aalbersberg et al., 2005).
Community's willingness to forego their own individual interest for conservation of the shared resource.	In the LMMAs, communities agreed to abstain from fishing in the no-take areas, even though peoples' subsistence was already under threat due to the decline of the fishery (Aalbersberg et al., 2005).
Funding for monitoring and support from ENGOs and Foundations.	NAILSMA and LMMA started with funding help from outside agencies like universities, ENGOs or government (Govan, 2009; Govan et al. 2006; Aalbersberg et al., 2005). CGWN got funding from Coast Opportunities Fund for conservation and social initiatives in the Great Bear Rainforest.
2. Impacts of Community Monitoring?	
Positive ecological outcomes at an early stage.	In Ucunivanua village in Fiji, it increased local income by up to 35% over 3 years (Aalbersberg et al., 2005).
Social and economic benefits at an early stage.	The recovery of fish stocks has resulted in improved livelihood opportunities for LMMA villagers, and has enabled women to expand their livelihood options (Aalbersberg et al., 2005).
Committed support from governments to long adoption of community-based monitoring.	The success of the LMMA prompted the Fiji and Samoa governments to commit to protect 30% of inshore waters (Govan, 2009).
Improved community health and well-being through potential for community members to re-connect to their land and sea.	Study in Australia found that rangers who re-connected with their land had better physical, emotional and spiritual health. An essential part of aboriginal health is an ability to connect with and care for their territories (Burgess et al., 2005).
Increased use of community knowledge in resource management decisions.	The LMMA's no-take areas were created based on the villager's traditional knowledge, and positive ecological outcomes were observed in a few years of no-take zones being implemented (Aalbersberg et al., 2005).
Research and increased awareness about the local environment	In some villages in Fiji, villagers laid transects with the help of scientists in order to track the effectiveness of the no-take zone (Govan, 2009, Aalbersberg et al., 2005).

CONCLUSION	EXAMPLE
Increased surveillance and enforcement of rules in community territory.	The presence of community members to monitor natural resources in the territories of the CGWN, LMMA, NAILSMA and GLIFWC has increased enforcement presence, deterring illegal harvesting and protecting sacred sites (GLIFWC website, 2012; Govan, 2009; NAILSMA website, 2012; Kennett et al., 2010).
Community participation in decision-making / planning.	Networks like GLIFWC and NAILSMA have given communities a greater voice in decision making and planning. Impressed by the LMMA, the Ministry of Fijian Affairs uses FLMMA's participatory approach for its Community Capacity Building project, which identifies and develops action plans to deal with village problems (Aalbersberg et al., 2005)
Communities/Nations working together on issues of regional nature.	CGWN has built connections and relationships between Guardian Watchmen in 10 First Nations communities, some of which have old rivalries.
Sustainable funding sources.	Although several of the LMMA's costs were funded by international NGOs, each community is trying to become self reliant by including some income-generating activity in their community management plans (Aalbersberg et al., 2005)
3. Factors that led to Success?	
Partnerships with government.	The LMMA shared their observations with the Fijian government and it resulted in the government adopting their method as a national policy (Aalbersberg et al., 2005).
Working with other stakeholders.	In Brazil, ATIX managed to reach out to farm owners and municipalities outside their park boundaries to start river restoration projects (Brondizio et al., 2009). In some FN communities, Coastal Guardian Watchmen are working with tourism operators to monitor bears.
Alliances with researchers and NGOs.	Working with international NGOs raised the profile of ATIX's struggle to protect PIX (Brondizio et al., 2009).
Ability to demonstrate and communicate successful outcomes.	The FLMMA presented their monitoring data to the Fiji government, which was so impressed that they decided to get their ministries to spread the concept of LMMA throughout the country. The Fiji government also committed to protect 30% of the country's inland waters (Aalbersberg et al., 2005).
Training programs and learning from other communities.	The CGWN has formulated a training programme for members, the Guardian Watchmen Certificate Program, conducted by the Northwest Community College, which has some practical safety training as well as ecology, monitoring training and cultural knowledge (CGWN website, 2012).
Support from community leaders and elders.	The first few LMMAs in Fiji were no-take zones that were enforced by village leaders at a time when fishermen were facing a downfall. Yet, people respected the rules, though it conflicted with their interests, because it had the support and backing of their village chiefs (WRI, 2005).
Learning from other networks around the world.	The CGWN learned about NAILSMA's I-Tracker device and CyberTracker software, to record and share data, and adopted it to their system, and launched their own CoastTracker mobile devices. It considerably reduced the time spent recording data.

Figures

Figure 2.1: Map of First Nations that are part of the Coastal Guardian Watchmen Network.

(Coastal Guardian Watchmen website, 2012.)

Appendix.

Summary of Community-Based Monitoring Case Studies

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
The I-Tracker Network (http://www.nailsma.org.au/hub/programs/i-tracker) North Australia.	The I-Tracker network provides tools, training and technical support to indigenous rangers to help them monitor their territories and to facilitate communication between rangers across north Australia. Indigenous rangers, the workforce of the ILMOs, are the 'frontline managers'. Based in remote areas of north Australia, indigenous rangers are often the only environmental management presence (Kennett et al., 2011). There are around 680 indigenous rangers employed across Australia (Working on Country website, 2012)	The Australian government initiated Indigenous Land Management Organizations (ILMOs) and Indigenous Protected Areas (IPAs) for community based planning. This created a need within communities for tools to implement these plans and monitor the state of natural and cultural resources. The I-Tracker network is run by the North Australian Indigenous Land and Sea Alliance Limited (NAILSMA), an organisation that works to create to create livelihoods based on traditional and cultural knowledge and practice for Indigenous people across North Australia.	A key component of I-Tracker alliance's work involves data collection, analysis and reporting (Kennett et al., 2010; I-Tracker website, 2012). The I-Tracker initiative uses a field-tough, portable device, called the "I-Tracker", that helps Indigenous land and sea managers collect and manage information that informs local planning and decision-making. Indigenous rangers use the I-Tracker device to collect data related to marine wildlife, foreign fishing vessels, marine debris and ghost nets, customs surveillance, weeds and feral animals, fire management, biodiversity surveys as well as cultural site protection and mapping and visitor management (Kennett et al., 2010; I-Tracker website, 2012). The I-Tracker Network enables capacity development and supports local decision-making (Kennett et al., 2010). It enhances indigenous livelihood options by supporting Indigenous rangers to participate in payment for environmental services opportunities (Whitehead, 2012).	Monitoring systems set up by the I-Tracker network have laid the basis for expansion of ILMOs into natural and cultural resource management organisations that utilize contemporary and traditional tools knowledge (Rod Kennett, Pers. Comm., 2012). Rangers have recognized the value of the I-Tracker device in assisting with their reporting to local community steering committees (Rod Kennett, Pers. Comm., 2012). The loss of traditional knowledge is being reduced in communities that are part of the I-Tracker network (Rod Kennett, Pers. Comm., 2012). Community monitoring has helped people understand changes occurring at a larger scale and has improved communication tools and approaches (Bessen Consulting Services, 2008). The tools developed by the I-Tracker alliance are standard operating practice for Australian government programs such as Working on Country and Indigenous Protected Areas (Rod Kennett, Pers. Comm., 2012).

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
South Pacific Locally Managed Marine Area (LMMA) (www.lmmanetwork.org) Fiji, Indonesia, Papua New Guinea, Solomon Islands, Pohnpei, Palau, Vanuatu and the Philippines. There are more than 550 LMMA sites in the South Pacific, covering in excess of 12,000 sq km (Govan, 2009).	LMMAs are local, community-managed marine areas in 15 countries in the South Pacific, but only eight countries are part of the LMMA network (Govan, Pers. Comm., 2012). An LMMA is an area of nearshore waters and adjacent marine resources that is largely or wholly managed at a local level by coastal communities, land-owning groups, partner organizations, and/or collaborative government representatives who reside or are based in the immediate area (LMMA website, 2012). The Network's membership consists of staff of conservation and resource management projects that use an LMMA approach - community members, land-owning groups, elected decision-makers, conservation staff, researchers, donors.	In the mid-1990s, various community-based projects were initiated throughout Southeast Asia and the Pacific. Three projects, one in Ucunivanua Village in Verata district in Fiji, another at Dauwi Island in the Padaido Islands, West Papua, Indonesia and a third, in Arnavon Islands in the Solomon Islands, were the first to form the LMMA network. These communities were part of a Biodiversity Conservation Network project (supported by the Biodiversity Support Program to conduct an assessment of economic incentives for natural resource conservation) focused on community involvement in monitoring and evaluating marine resources. (LMMA website, 2012). The LMMA network was formed out of communities' needs to share information and resources among various community-based initiatives. The network unites isolated projects together in order to learn collectively and improve their outcomes and impact (LMMA website, 2012).	LMMAs monitor fish, clams, lobsters, whatever is the species of concern. The Network provides information and resources on LMMAs and community-based adaptive management (CBAM), training in project design, monitoring, data management and analysis, fundraising, communications and support. The LMMA Network provides guidance and capacity-building in the use of CBAM, a resource management cycle in which local stakeholders make a plan, implement the plan, check how it is going, revise the plan (if necessary), and carry on (LMMA website, 2012). Fiji LMMA teams offer assistance in three types of workshops: action planning, biological monitoring, and socioeconomic monitoring (World Resources Institute, 2005). The action plan also contains ways to address other issues faced by the community, such as lack of income sources, poor awareness of environmental issues, pollution, and sometimes declining community cohesiveness (World Resources Institute, 2005). Socioeconomic monitoring tests whether these broader problems are being addressed (WRI, 2005). Training fish wardens to protect against poaching (WRI, 2005).	LMMAs are working with national governments to adopt Integrated Island Management (Govan et al. 2011). LMMA impacts are improved habitat quality (coral cover, seagrass, mangroves), increased fish population, reproduction and biomass. It has enhanced local capacity to manage resources, increased environmental stewardship, community cohesion and livelihood options (LMMA website, 2012; Govan 2011; Govan, 2009). Fiji National Government formally adopted the FLMMA approach and designated a division of the Fisheries Department to promote inshore conservation with FLMMA (World Resources Institute, 2005). The Ministry of Fijian Affairs uses FLMMA's participatory approach for its Community Capacity Building project, which identifies and develops action plans to deal with village problems (WRI, 2005). The governments of Fiji, Palau and Micronesia publicly committed to protecting 30% of inshore waters (Govan, 2009; World Resources Institute, 2005). LMMAs resulted in growing pressure for the Fiji government to return legal ownership of the country's inshore fishing areas (roughly 31,000 sq km of coastal waters) to their traditional owners (WRI, 2005). Communities have re-asserted their traditional rights.

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
Great Lakes Indian Fish & Wildlife Commission (GLIFWC). (http://www.glifwc.org/) USA.	GLIFWC is a group of eleven Ojibwa nations in Minnesota, Wisconsin, and Michigan, who retain off-reservation treaty rights to hunt, fish, and gather in lands ceded via treaty. GLIFWC is aims to protect and enhance the natural resources and habitat in the treaty-ceded territories while also infusing an Ojibwe perspective into its work (GLIFWC website, 2012). Treaty rights, the rights to hunt, fish and gather on ceded lands were reserved by certain Ojibwe bands in Michigan, Minnesota and Wisconsin in the Treaties of 1836, 1837, 1842, and 1854 with the U.S. government, and were affirmed by the SC in 1999.	Formed in 1984, the Great Lakes Indian Fish & Wildlife Commission (GLIFWC) assists its eleven member Ojibwe bands in regulating treaty harvests and managing off-reservation natural resources. The courts' ruling, affirming treaty rights, established a number of principles regarding off-reservation resource management and harvest regulation. One principle is that the tribes may preempt state regulation if they establish an effective system of tribal self-regulation addressing conservation, health and safety interests. To exercise the treaty rights, the tribes must individually and collectively: 1) undertake effective resource management programs; 2) stay within the total tribal allocation of natural resources; and 3) engage in intertribal co-management to preserve a system of tribal self-regulation by effectively managing and regulating treaty rights.	Self Regulation Agreements with the Fish and Wildlife Service, Forest Service, Coast Guard and National Park Service grant the Commission concurrent jurisdiction with federal agencies such that the federal agencies refrain from enforcement activities in areas where the tribes operate this service. The tribal regulations enforced by the wardens include for ricing (the harvest of wild rice), fishing, hunting and the introduction of aquatic invasive species.10 Conservation wardens also enforce state environmental laws against non-tribal members on ceded lands through cross-deputization agreements with state departments. Focus areas: • Great Lakes fishery- harvest monitoring and fisheries assessments. • Inland fishery- Tribal harvest management, fisheries surveys and assessments. • Creating maps of inland lakes with high mercury levels. • Wildlife • Wild plants • Mapping mining impacts • Enforcement • Invasive species • Outreach & language	Monitoring provides GLIFWC with information to make decisions on how it can manage resources and regulate harvesting such as fishing, hunting, wild plants. GLIFWC also tracks threats to the environment such as pollution and climate change. GLIFWC's Enforcement Division works cooperatively with state conservation officers and local law enforcement. Cooperation may include joint patrols, like night patrols for shining, jointly monitoring a deer decoy during deer season, or checking out suspected illegal fishing. Wardens also work cooperatively with local emergency medical services and fire departments. GLIFWC conservation officers must attend basic law enforcement recruit training, completing a minimum of 520 hours of basic training to qualify as a conservation officer. The training is the same as states require for law enforcement certification. GLIFWC conservation wardens' primary duty is to enforce tribal, ceded territory, conservation codes.

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
Association of the Indigenous Land of Xingu (ATIX). (http://www.socioambiental.org/e/prg/xng.shtm#atix) (http://www.yikatuxingu.org.br/) Xingu Indigenous Park (PIX), Mato Grosso, Brazil. (Brondizio et al 2009)	Association of the Indigenous Land of Xingu (ATIX), an alliance of 16 indigenous communities that live in the Xingu Indigenous Park (PIX) (Instituto Socioambiental website, 2012). ATIX collaborates with an NGO called Instituto Socioambiental (ISA) and FUNAI, the National Indian Foundation, is the Brazilian government body that establishes and carries out policies relating to indigenous peoples.	In contrast to the high rates of deforestation during the 1980s and 1990s in the broader region, PIX maintained nearly intact forest cover. Indigenous groups began to confront the occupation around PIX during the 1980s. Protecting park borders from farming incursions, logging, hunting, and fishing became an important priority for political organization and negotiations. In the late 1980s-90s, alliances led to the creation of several kinds of associations within the park, with the overall goals of taking control of park management and of coping with the growing pressure on its borders. These alliances were with government officials [e.g., officers from the National Indian Foundation (FUNAI)], NGOs [e.g., Instituto Socioenvironmental (ISA)], church-based movements, celebrities, anthropologists, and physicians. In 1994, alliances among all 14 ethnic groups led to the creation of the Association of the Indigenous Land of Xingu (ATIX).	Monitoring at park boundaries for deforestation and through GIS mapping. Deforestation at PIX borders, led ATIX to prioritize the monitoring of borders through the creation of 10 monitoring posts, mostly at the intersections of borders and riverways in the park. Their monitoring program was created to restrict entrance to PIX, to clean and demarcate trails, to effectively use global positioning system units, and to cooperate with organizations using remote-sensing mapping (at three-year intervals), and GIS. But impacts of deforestation outside the park boundaries were still affecting. Communities, such as lower water volumes in some tributaries (resulting from sedimentation and dried water springs), increasing sediment loads, and decreasing water transparency (making arrow fishing difficult). There were higher levels of smoke and air pollution during the burning season and an increasing risk of fire spreading during dry years. Communities suspected possible pesticide pollution in water. ATIX worked with farmers and municipalities outside PIX to restore springs and riparian forests along riverways in 18 municipalities (Y Ikatu Xingu website, 2012). Restoration increased the demand for native seed. This spurred the formation of the Network Seeds of the Xingu.	ATIX built alliances with municipal governments to mediate agreements with stakeholders, educate people about indigenous communities, and create incentives for restoration. Extensive mapping and GIS-based surveys of neighboring farms and properties bordering the park. Riparian forests are being restored in 18 municipalities (Y Ikatu Xingu website, 2012). The formation of Network Seeds of the Xingu, a platform of exchange and marketing of seeds involving 300 families of collectors, seven indigenous communities and 25 organizations from 19 municipalities (Y Ikatu Xingu website, 2012) has helped economic development and revival of cultural heritage. The seed network project has also generated income for farmers and indigenous communities. It enables exchanges among seed collectors, nurseries, NGOs, landowners and other interested parties (Y Ikatu Xingu website, 2012). The Y Ikatu Xingu project also works to promote agroforestry and alternative sustainable income for farmers who have cut down forests adjacent to the borders of PIX. It organizes workshops for the management and controlled use of fire to prevent forest fires in the dry season.

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
Narwhal Monitoring Baffin Bay, Arctic, Canada. (Armitage 2005)	Monitoring done by community-based Hunter and Trapper Organizations. A multilevel governance arrangement supervised by the Nunavut Wildlife Management Board (NWMB) and government. Community Hunters and Trappers Organization (HTO) must establish and enforce by-laws and hunting rules to control harvesting by members. The HTO must also develop—in collaboration with Government—a reporting system to accurately record harvesting information, such as the number of animals struck, landed and lost.	Ushered by Nunavut land claims agreement 1993. After ratification of the Nunavut Final Agreement in 1993, the Nunavut Wildlife Management Board (NWMB) received numerous requests from communities to change narwhal quotas and update the narwhal management regime and so initiated this in 1999. Earlier, there was lots of conflict over narwhal hunting quotas. Allocation of community narwhal quotas was arbitrary. The scientific basis for the quotas was unclear. Three regional wildlife organizations (RWOs) in Nunavut mediate concerns among HTOs. The Nunavut Wildlife Management Board (NWMB), a comanagement body, links local, regional and national priorities. The DFO and the NWMB link federal and Inuit priorities, and the claims implementation organization (Nunavut Tunngavik, Inc., NTI) serves as the ‘‘voice’’ of Inuit, but it plays a limited management function.	Monitoring the Baffin Bay Narhwal population. There is still some uncertainty (for wildlife biologists and government managers at least) about the size, identity, distribution, reproduction, and natural mortality of the Baffin Bay narwhal population. There is also a high degree of uncertainty about catch rates and hunting mortality of the population. Reporting of narwhal catch may be incomplete.	- Flexibility in Harvest quotas - In contrast to the smaller and static community quotas in place prior to the start of the community-based narwhal monitoring process, there is some flexibility associated with the new limits. Communities have an opportunity to carry over the total allowable harvest from the previous year or borrow from the next year’s limit under special circumstances and with approval of the NWMB. Flexibility in the limits is intended to reduce incentives to harvest as much as possible as quickly as possible, especially when sea ice conditions are not suitable. - Unless the community-based narwhal management regime can strengthen local decision making, monitoring, and enforcement capacity, and make the use of traditional knowledge and rules-in-use less ambiguous, the efficacy of the governance framework will be limited. - Clarification of resource rights, which is important to collective monitoring and enforcement, is made difficult by the mobility of the resource and the high degree of scientific uncertainty about narwhal stocks. A reluctance by bureaucracy to equally value traditional knowledge about narwhal ecology exacerbates uncertainty and reduces the prospects of shared learning among the actors engaged in community-based narwhal management.

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
Arctic Borderlands Ecological Knowledge Co-op (ABC) (http://taiga.net/coop/) Mackenzie Delta area in North West Territories, Yukon & Alaska, Canadian-USA border, Canada and United States. (Gofman, 2010; Torikka-Gelencsér et al., 2004, Kofinas et al., 2002)	A collaborative partnership between the villages of Kaktovik, Old Crow, Aklavik, Fort McPherson, Tsiigehtchik, Inuvik, Tuktoyaktuk, Arctic Village and Environment Canada. Villages are self-selected. Interviews are conducted by local residents who have been hired by the project and are paid for their work. Participants are compensated for their time with a fuel voucher. Monitoring focuses on what the community's most active hunters, fishers, and berry pickers of all ages have observed over the preceding year. Interviewers also ask for interpretations of what people have seen, which are based on personal experiences and traditional knowledge.	A meeting in Dawson City in 1994 brought together interested parties to start an ecological monitoring program for the Northern Yukon. Participants identified the three main issues that should be the focus of ecological monitoring: climate change, contaminants and regional development. Participants also decided that an important part of the program should be to bring together science and local and traditional knowledge. Communities and scientists from the University of Alaska committed to working on this together. The Arctic Borderlands Ecological Knowledge Co-op grew from that meeting.	Monitors ecosystem changes in the range of the Porcupine Caribou Herd and adjacent coastal and marine areas. It focuses on three areas of overriding concern to the Native peoples who live in the region – climate change, development, and contaminants. Most of the indicators are based on results of science-based monitoring (such as temperature records and animal population estimates) or on government records (such as community population census figures and airport flight records). Each year at the annual gathering, the indicator set is reviewed and discussed by the general membership. The participants provide guidance regarding what indicators are most useful in assessing and communicating conditions and trends. A copy of the annual monitoring report is mailed to each person who was interviewed in each community. This annual reporting by the community monitors to all contributors is crucial to the profile and success of the program. It allows people to see how their information is being used in developing a regional picture, and it reinforces community ownership of the results.	The Borderlands Co-op's indicator series, community-based monitoring program, and Web-based database of information sources are incorporated into the implementation section of the Wildlife Conservation and Management Plan of the Wildlife Management Advisory Council (North Slope), a co-management council set up under the Inuvialuit Final Agreement land claim settlement. The Borderlands Co-op is a member of the implementation team for this plan and receives funding to provide information to the council in support of their assessment and management activities. The project is building up a long term monitoring database. It has resulted in capacity building in the community. It has improved the ability for regional participation in land management issues. It has increased collaboration between communities and governments. The project collaborates with research initiatives and co-management regimes, but has no management authority itself.

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
Bering Sea Sub Network: International Community-based Environmental Observation Alliance for Arctic Observing Network (BSSN) Russian Federation, United States (Gofman, 2010; Torikka-Gelencsér et al., 2004)	The Aleut International Association (the main initiator), the University of Anchorage, the Alaska Native Science Commission (Anchorage, Alaska, U.S.), UNEP/GRID- Arendal (Norway), the Chukotka Business center and the Russian American center in Kamchatka (Russia), village research assistants, and hunters and fishermen in the 6 participating villages (3 in US and 3 in Russia).	Six villages (three in the US, Alaska): Gambell, Togiak, and Sand Point, and three in Russia: Kanchalan, Tymlat, and Nikolskoye, were selected by respective regional organizations after receiving an invitation to participate during the proposal preparation time. Letters of request with the project description were sent to the presidents of five regional consortia in Alaska (the Aleutian Pribilof Island Association, the Bristol Bay Native Association, Kawerak, Maniilag Association, and the Association of Village Council Presidents) and to the regional Indigenous organizations in Kamchatka and Chukotka. The final selection was confirmed at the workshop where regional representatives selection the locations based upon agreed criteria that included geographic location, community capacity to run the project, community interest, needs, and previous project experience, as well as potential project contributions to the community.	Observations on subsistence and local commercial marine species, as well as observations on the physical state of the environment in places of harvest. The methods of research is a non-probability purposive survey. It is believed that a non-random selection method is best suited for this type of research because of the small size of the communities and close ties that exist between community members. Local community members are trained as interviewers and instructed to interview the most experienced harvesters. When permission is granted interviews are recorded on a digital audio recorder. The survey instrument (questionnaires) was developed with input from community representatives. The questionnaire contains a variety of questions: closed-ended, open-ended, and multiple choice. Over 600 surveys were received from BSSN villages in the pilot project in 2008-09 and are being processed. BSSN does not rely on volunteers. As it works mostly in impoverished, disadvantaged communities, it is important to provide paying jobs and to bring small tokens of appreciation to all participants in the form of small cash payments. All village research assistants are paid for their work. Communities decide the size and type of the appreciation payment or gifts.	Local observations are recognized by the mainstream science as valid and important data. This is manifested by the support of one the main science funding agency in the US. The infrastructure and methods developed in the course of the project will strengthen connections between Russian and Alaskan indigenous communities. They could be utilized by other research projects initiated by communities, academia or government. By training and hiring local residents, the majority of whom are indigenous, an interest in science in generated, and it builds pride in being a bearer of local, traditional and indigenous knowledge. It is expected that the data will be of use to the broader scientific and local communities. It is also anticipated that the findings may yield new knowledge that could help address many important issues, such as adaptation to climate change and sustainable resource management, just to name a few.

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
Community Moose Monitoring Project (CMMP) and Community Ecological Monitoring Project (CEMP). Mayo area of the Yukon, located in the traditional territory of the First Nation of Nacho Nyak Dun, Canada. (Gofman, 2010; Torikka-Gelencsér et al., 2004)	CMMP – Mayo Community is monitoring. CEMP - which is run out of the local Fish and Wildlife office in Mayo, has been active in the area for 25 years. The purpose of the program is to gather systematic observations about the boreal forest food web. There are two parts to the CEMP – a technical monitoring component and a local and traditional knowledge component – both of which involve the active participation of local community members. Partnership between residents of the Mayo community, the local Fish and Wildlife office, and participants from local universities, First Nations, Parks Canada, and Yukon College.	The local Fish and Wildlife office was set up in the Mayo area for the express purpose of working directly with local Northern Tutchone communities. This grew out of an agreement with First Nations. It was widely known that they had a huge body of knowledge about the environment and wanted it be incorporated into management decisions. The intention of establishing the Fish and Wildlife office was to help with monitoring, but also to just listen to what the communities were saying. It also offers input on programs and management decisions.	CMMP - every fall 20 local hunters or skilled residents, write down their observations about the moose they see in a small booklet with maps. CEMP - Technical monitoring happens at five long-term sites set up in the surrounding forest. Each year, residents, along with a technician from the local Fish and Wildlife office, take measurements and make scientific counts of indicators like the volume of berries, the amount of snow cover, the numbers of hares and mice, etc. Community members do counts of carnivore tracks, owls, songbirds etc. within a 25 km transsect. During the summer, technicians from the local Fish and Wildlife office play a leading role in monitoring. In the winter, these responsibilities are shared equally between the office and community members. The Local and Traditional Knowledge component consists of interviews with local residents who have been most active out on the land during the previous year. About 20 surveys are done every year with people who have extensive experience in everything from hunting, to trapping, to fishing, to berry picking. The surveys used were modelled after those developed by the Arctic Borderlands Ecological Knowledge Cooperative, which also helped train interviewers.	Results: The data collected from the CEMP technical monitoring is analysed and published in an annual report. The reason is that the communities want to gather this information for their management decisions. The projects are a source of pride for participants. The hunters who take part in the CMMP enjoy the fact that they have been singled out by the community as people with valuable knowledge and experience. The communities really like the traditional and local knowledge part added to the CEMP. The people being interviewed like the fact that local schoolchildren are doing the interviews. They feel it is a way for them to share their knowledge with a younger generation. When the local and traditional knowledge component of the CEMP was being carried out by a grandfather-grandson team, a 5-10 page report was produced by them every year and presented to the local co-management board.

Name & Location	Who Is Involved? Who Is Monitoring?	How Was It Formed	What Are They Monitoring	What Are The Outcomes
Community Moose Monitoring Project and Community Ecological Monitoring Project (ECORA) The Russian Federation The Model Areas, Kolguyev Island, Kolyma River Basin, and Beringovsky District, were selected because of their rich biodiversity, the presence of resource development industries, and indigenous population. (Gofman, 2010; Torikka-Gelencsér et al., 2004)	Collaboration between the Conservation of Arctic Flora and Fauna (CAFF) Working Group of the Arctic Council, UNEP/GRID –Arendal, and the Russian Federation initiated ECORA, a Global Environment Facility (GEF) project in the Russian Arctic. Project is co-led by Russia and United Nations Environment Programme-Global Resource Information Databank - Arendal (UNEP GRID- Arendal) with the participation of advisors from other Arctic Countries and Russian Association of Indigenous Peoples of the Far North, Siberia and Far East and (RAIPON). Local residents are participating in the CBM component of the project.	ECORA was conceived in 1999 by CAFF and UNEP-GRID Arendal. The Model areas were selected by a group of project experts based on the following criteria: 1.) presence of indigenous peoples; 2.) biodiversity of global significance, 3.) current or planned industrial activities; and 4.) location within CAFF. Other factors that played a role were the presence of other large international programs in the area, cooperation from local and regional authorities. The Model Areas were selected in 2003. Since all three areas had small populations and only a few villages, all ten communities were included in the project. Goal: to address threats to habitats, fragmentation of ecosystems, and disruption of ecological balance, especially in lowland tundra, forest tundra, and coast and nearshore marine areas. The main goal is harmonization of relationships between industries and indigenous populations, leading to the sustainable use of biodiversity..	Two types of community based monitoring are used in ECORA: 1.) A sentinel monitoring performed by a selected observer who regularly fills out questionnaires and sends them to the researchers for data management and analysis, and 2.) A freestyle diary of observations by one individual. A set of 12 thematic questionnaires was designed by researchers based on results of population surveys to determine subsistence activities in each Model Area. Two local observers were hired and trained in each village. Each observer has a set of questionnaires based on his/her type of harvesting activities. They are equipped with digital cameras. An experienced subsistence harvester writes about 100 pages of observations over one year, creating an environmental observation diary. No instructions are provided, the writer should document everything that he/she deems important. It is his/her vision of the environment. All participating villages use the same set of survey materials and methodology. For traditional knowledge interviews, ECORA asked for assistance from Snowchange, a community based monitoring project with experience in gathering oral traditions.	Strengthening legislative, administrative and institutional frameworks Enhancing the knowledge base through involvement of local residents Integration of indigenous and traditional environmental observation. Relationships with regional governments vary. Reporting to Russian officials is necessary regardless of their interest in the project. Data derived from this research cannot be used officially in natural resource management. However, it can be used as a reference material, and ECORA has had success in doing this. The most tangible benefit to communities from the project's interactions with the regional governments was drawing authorities' attention to the dire situations in those remote communities. The main objective of CBM in ECORA was to develop long-term monitoring of selected biodiversity components that would serve as indicators of species' status and trends, habitat fragmentation, and climate change. However, in Russia, the results of such monitoring would be difficult to apply in the same manner as official scientific data are used. The focus of CBM shifted to nurturing partnership relationships between local participants and project scientists, with special attention to cultivating interest and respect for traditional knowledge.

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Favllis Network Norway Four municipalities in Finnmark are participating in the project. (Gofman, 2010; Torikka-Gelencsér et al., 2004)	The research project initiated by the Favllis network is centered around the traditional knowledge of Sami fishermen: documenting traditional ecological knowledge, developing a model for a knowledge data base for marine resource management, and using documentary to increase the visibility of traditional knowledge and its relevance for effective resource management.	Fåvllis is a network of academic and community collaborators that was created to advance knowledge relevant for effective resource management, including understanding interactions between ecosystems, culture and local societies in the northern fjords.	The project is trying to establish baseline data over a period of time that people can remember, approximately from 1945. It does not use the word "monitoring". The activities include: - Interviewing fishermen using open-ended, guided questionnaires and an interview guide. Interviews are conducted by the researchers, sometimes with the assistance of local residents. About 20 people are interviewed in December, May, June, and in autumn. Village populations range from 50 to 200. - Making use of the interviews that were conducted in the 1970s and 1980s by local research institutions. - GIS mapping. - Making a documentary film about traditional knowledge because traditional knowledge cannot be documented by words alone. The film will also capture differences between fishermen's knowledge and researchers' when they have discussions on such topics as causes for seal-population change. The team is planning to analyze GIS biological data derived from the summaries of the surveys stored at the National Statistics Bureau. The goal is to put together different types of knowledge and have it available for open access.	This project has advanced cooperation between local residents and scientists. Through its work Sami traditional knowledge is made relevant and its use should improve local fisheries management. This project is about how to use all types of knowledge and make the best management decision. This project is also important for documenting traditional knowledge.

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Siku-Inuit-Hila (Sea ice-People-Weather) Project Three different communities: Barrow, Alaska, Kangiqtugaapik, Nunavut, and Qaanaaq, Greenland. (Gofman, 2010; Torikka-Gelencsér et al., 2004)	Looks at the different ways in which the Inuit communities of Barrow, Alaska, Kangiqtugaapik, Nunavut, and Qaanaaq, Greenland live with and from sea ice. The purpose of the project is not simply to understand human-sea ice relationships, but also to facilitate the exchange of knowledge between the indigenous peoples who live in these places, and between local sea ice experts and scientists.	The project was initiated jointly by community members and researchers who already had long standing relationships in each community at the project outset. Community members have been involved in all parts with regards to design, research, logistics, analysis, and oversight. This project built on a pilot project conducted between two of the communities a few years before. So when the proposal was written for funding, people were already on board and helping to design and write it. When new funding was received, Greenland was added. The Inuit Circumpolar Council (ICC) joined as a partner in the research and recommended adding the Qaanaaq community in Greenland. Qaanaaq's local government was enthusiastic about joining the project and they had their own meetings to decide on which local experts would be appropriate to create Qaanaaq's core team.	Three components to the project. 1. An exchange of people, in which participants visit different communities and learn about local sea ice knowledge and the activities that people do on the ice and related skills. There was one exchange to each participating community. There are about 12-14 people going to different places, where they spend about 2-3 weeks. In each place, they try to spend as much time on the ice as possible. Local hosts plan ice trips during hunts. 2. Establishment of a sea ice working group in each community that meets on a regular basis to discuss their observations of ice conditions and their experiences on the ice. They focus on issues like what the ice is doing at that time versus what it normally should be doing, documenting knowledge and language about sea ice, and the results of the technical monitoring from the local sea ice stations. 3. In each of the locations, 3-4 sea-ice monitoring stations record a variety of data about ice conditions. With training by the project glaciologist and supported by a manual, local residents gather quantitative information about the sea ice including parameters like sea ice temperature and thickness. The method developed for this work is simple but yields robust data.	The project developed a manual for local communities for setting up sea ice monitoring using a simple but robust method that can be used in other projects. Integrated activities, which enhanced connections between Inuit living in different countries. It has built successful relationships between scientists and indigenous communities. The results of the Siku-Inuit-Hila project are being compiled in a book, which is being written and illustrated primarily by the local sea ice experts. One of the aims of this book is to show what life with ice is really like from the practical standpoint of people who live and depend on it. The authors hope that this approach might reach a broader audience including the public, students, science, and industry. But the first audience for the Siku-Inuit-Hila project is the communities themselves. The people in these communities want to know and share amongst their own people what is valuable and important to them.

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Snowchange (Canada, Finland, Russia, United States) (Gofman, 2010; Torikka-Gelencsér et al., 2004)	The Snowchange Cooperative consists of various projects aimed at documenting indigenous views on climate change and ecology. Snowchange activities are comprised of education and cultural events (crafts fairs, workshop facilitation etc.) and scientific research focused on traditional knowledge.	Initial meetings were held with Saami in 1996. At one of the meetings in 2001, an Inuit lady was talking about what united all indigenous peoples in the Arctic. Everyone agreed that it was snow. Then the conversation turned into a discussion on climate change and the fact that people should have a positive outlook on change, something that people can influence, rather than seeing it as negative and destructive. By combining two words together they got the idea of the Snowchange project. It took several years to organize it and in 2001 the first project activities took place. Snowchange's approach is community-centered. It all depends on what people want it to do. Snowchange does not initiate activities.	Researchers conduct open-ended interviews with local residents. Sometimes local peoples are trained to interview but the interviewing is performed only during the team's visit. If permission is granted, information is recorded on audio and video, and locations are mapped. In the project on the Environmental Observations of Seal Hunters in Southern Finland, Snowchange researchers have been coming to the community every year since 2002 to document and map the use of the sea-ice in the Baltic Sea and the interactions between sea-ice and seals. Oral history, as told by the hunters, was compared with scientific data. In partnership with the Saami Council, Snowchange has been working in two communities, Sevettijarvi in Finland and Lovozero in Kola peninsula in Russia, to document observations on climate change and biodiversity on and off for about ten years. The observations collected in 2000 and 2002 were included as case studies in ACIA.	An expansive library of materials has been accumulated and shared with communities and scientists. Several books based on the research results and articles in science journals were published. The main benefit to the Finnish community of Merikarvia is in the recording and preservation of traditional knowledge. This is one of the few communities in Finland where these stories are still told. By nurturing long-term relationships, Snowchange is helping communities to develop their own capacity for Community based monitoring .