Ecological Integrity in the Core Areas of Clayoquot Sound Biosphere Reserve and the Threat of Adjacent Land Use

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Abstract

The maintenance of ecological integrity is the number one priority for Parks Canada. Pacific Rim National Park Reserve is listed as one of the worst National Parks for stressors on ecological integrity. This is mainly due to the external pressures from adjacent land use, mainly logging practices. Clayoquot Sound, the location of Pacific Rim National Park Reserve Long Beach Unit has a long history of intensive logging that has only recently been looking at more sustainable practices. Tourism is also big in the area, and also contributes to the stress on ecological integrity. The introduction of the biosphere reserve in 2000 has done little in the way of influencing land use practices since the area was already moving towards a better way of logging. However, Clayoquot Sound Biosphere Reserve through the Clayoquot Biosphere Trust and Pacific Rim National Park Reserve have been involved in research and education initiatives, as well as collaboration and partnership building processes, which if continue can help with the maintenance of ecological integrity.

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Introduction

Ecological Integrity refers to the health of an ecosystem. If a system has integrity, it is fully functional with all its key biotic and abiotic processes intact. Parks Canada has attempted to manage National Parks with in a way that upholds their ecological integrity. However, the Panel on Ecological Integrity demonstrates that the parks are under stress from both internal and external sources (Parks Canada Agency, 2000). Adjacent land use adds external stress to parks because parks are open systems (Cole & Landres, 2006), thus boundaries do not halt threats from activities outside the park. In order to maintain ecological integrity in the parks, Parks Canada has adopted monitoring and measuring guidelines as well as an ecosystem-based management approach; looking at the whole system not just an individual part.

Biosphere Reserves are also formed around an ecosystem-based approach. Biosphere reserves are areas designated by UNESCO under the Man and the Biosphere Programme where human needs coincide with conservation of the environment. They fulfill three objectives; conservation, sustainable development, and logistics. In order to be designated as a biosphere reserve, the area must be split into three zones, a core zone managed for conservation, a buffer zone, which mitigates between the inner and outer zone, and a transition zone where sustainable development and resource extraction take place. Through the World Network of Biosphere Reserves, ideas and experiences are shared between all the reserves.

Clayoquot Sound, located on the east coast of Vancouver Island, has undergone a long history of conflict over logging of old growth. With the move towards sustainable logging, and a growth in the tourism sector, Clayoquot Sound began looking towards a more sustainable future. In 2000 Clayoquot Sound was designated as a biosphere reserve under the administration of the Clayoquot Biosphere Trust. Pacific Rim National Park Reserve Long Beach Unit, with its commitment to ecological integrity and ecosystem-based management became the largest core area in the biosphere reserve. While there are still threats to the ecological integrity of the core areas by adjacent land uses, both Pacific Rim National Park Reserve and Clayoquot Sound Biosphere Reserve are working on positive changes that can lead to the enhancement and maintenance of ecological integrity.

Literature Review

Ecological Integrity

Defined

Ecological integrity (EI) has never had a clear definition, and scientific debate continues on the finer points of the term (Wipond & Dearden, 1998). This is due to the vagueness of the terms 'ecological' and 'integrity'. Integrity refers to the state of being whole and unimpaired (King, 1993; pg.24). Thus, integrity of an ecosystem refers to a system being complete and undamaged. An ecosystem is defined by all of its parts, biotic and abiotic, and the interactions between them (King, 1993; pg.25). Not only must the composition and structure be intact, but also the functions and processes that maintain them (Wipond & Dearden, 1998). If the interactions between the ecosystems components are disrupted, a system looses its ecological integrity. In accordance with Parks Canada, ecological integrity is defined as "a condition that is determined to be characteristic of its natural region and likely to persist, including abiotic components and the composition and abundance of native species and biological communities, rates of change and supporting processes" (Parks Canada, 2006). An ecological system will have integrity when all of its natural systems are functioning properly. Parrish et al. (2003) define ecological integrity as "the ability of an ecological system to support and maintain a community of organisms that has species composition, diversity, and functional organization comparable to those of natural habitats within a region." In their definition, as long as a system occurs within

its natural variable range and is able to recover from most natural disturbances, it has integrity.

Disturbance and Recovery

Ecosystems go through natural changes in response to disturbance and recovery. A Disturbance is a "natural process that occurs at different spatial and temporal scales" (Pickett et al., 1989). Fire, wind, pests, etc. are examples of disturbances that can affect ecosystems on a large or small scale and at varying time periods. Ecosystems "consist of a complex mixture of infrequent, large-scale events and more frequent, small-scale events" (Perry & Amaranthus, 1997; pg. 35). Once a disturbance occurs, it takes time for the ecosystem to recover. The disturbed ecosystem will continue through a series of successional stages until it is again affected by a disturbance (Spies, 1997). Disturbances create a patchwork of landscapes, all in different successional stages. This mosaic heightens species diversity and lessens the chance that the ecosystem is impacted by one large disturbance it is unable to recover from (Perry & Amaranthus, 1997). Resilience is the ecosystems "ability to bounce back after disturbance" (Theberge & Theberge, 2002). However, it does not imply that the system will recover to the exact state it was in before being disturbed, but rather to one which contains the same basic elements and supports the same important processes (Perry & Amaranthus, 1997). If the system is unable to recover after a disturbance, the function of the system is altered and its ecological integrity may be lost (Perry & Amaranthus, 1997). Ecological integrity does not imply

an unchanging system, but rather one that is able to respond to and persist while still maintaining an acceptable level of species diversity for that region.

EI in Parks Canada

Ecological integrity has been a part of Parks Canada's policy since its introduction in 1964 and 1979. The 1979 policy stated, "Ecological and historical integrity are Parks Canada's first considerations, and must be regarded as prerequisites against use" (Parks Canada Agency, 2000). However, policy is not legally binding. It is rather a detailed statement of intent on park management (Wright & Rollins, 2002). It was not until the amendment of the 1988 National Parks Act that ecological integrity was put into legislation (Dearden & Demsey, 2004), and thus, became enforceable by the law. The act acknowledged that the "maintenance of ecological integrity through the protection of natural resources shall be the first priority when considering Park zoning and visitor use in a management plan" (Parks Canada Agency, 2000). The 1994 National Park Policy again confirms a commitment to ecological integrity as being the most important role of the national park system (Wipond & Dearden, 1998). However, while legislation and policy were advancing Parks Canada's dedication to the maintenance of ecological integrity, the parks themselves were under stress.

Panel on Ecological Integrity

Nineteen ninety-six saw the formation of the Banff-Bow Valley Task Force, which documented the environmental pressure in Banff National Park. The Task Force found that every corner of the park had felt the affect of human use, and if pressures continued the ecological integrity of Banff National Park would be faced with serious and irreversible harm (Banff Bow Valley Study, 1996). This led to questions being raised on the threat to ecological integrity in Canada's other National Parks (Parks Canada Agency, 2000).). In 1997, The State of the Parks Report was released detailing the impairment to ecological integrity within Canada's National Parks (Parks Canada, 1997). Following this in 2000 was the establishment of the Panel on the Ecological Integrity of Canada's National Parks. The Panel was created "to assess the strengths and weaknesses of Parks Canada's approach to the maintenance of ecological integrity and provide advice and recommend how best to ensure that ecological integrity is maintained across the system of national parks" (Parks Canada Agency, 2000). Members of the panel traveled to Canada's national parks to discover first-hand the stresses on the parks, which concluded with the message that the ecological integrity in the national parks was threatened (Parks Canada Agency, 2000). The panel discovered that thirty-one of thirty-eight national parks had significant to severe ecological stresses, about half of which had increased stresses since 1992 (Parks Canada Agency, 2000). Increased visitation and development inside and outside park borders has led to habitat and species loss as well as fragmentation, which in turn has led to the degradation of the ecological integrity of the parks. In order

to improve the ecological integrity of the parks, Parks Canada has adopted measuring and monitoring programs.

Monitoring and Measuring EI

It is important to be able to monitor and measure ecological integrity in order to know if management plans are working effectively. In the 1997 State of the Parks Report, Parks Canada created a framework for monitoring ecological integrity. This framework provides parks a scientific context for comprehensive ecological integrity monitoring and reporting (Parks Canada, 2006b). However, monitoring ecological integrity is a complex task. First an inventory of the ecosystem needs to be collected. Inventory provides baseline data for a system, which allows even small changes in the ecosystem to be recorded (Parks Canada Agency, 2000). Monitoring involves the observation of the system over time. The purpose of monitoring a system is to:

- track the progress of the restoration of ecological integrity
- review the effectiveness of actions and policies
- incorporate information into planning and management
- identify research needs
- hold park managers responsible for progress towards achieving ecological integrity

(Parks Canada Agency, 2000).

Monitoring requires long-term commitment. However, monitoring programs have mainly been put in place for specific management issues instead of for the overall system (Parks

Canada Agency, 2000). While monitoring is important, in order to determine the state of integrity in the park, ecological integrity needs to be measured.

In order to determine if a parks ecological integrity is being threatened, ecological integrity needs to be quantified, then measured (Henry et al., 1998). Measuring ecological integrity requires Parks Canada to determine ecological indicators. By applying indicators researchers are able to obtain objective accounts of ecological integrity rather than subjective (Cafaro & Primack, 2001). Some indicators Parks Canada uses to measure ecological integrity are:

- species richness
- population dynamics
- succession
- productivity
- nutrient retention
- human land use patterns
- habitat fragmentation
- pollutants
- climate

(Cafaro & Primack, 2001).

These indicators include activities occurring outside the park because Parks Canada recognizes that these activities can influence the ecological integrity inside the park.

Threat of Adjacent Land Use To EI

Protected areas are vulnerable to impacts from adjacent lands because they are open systems (Cole & Landres, 1996). Species and ecological functions are not hindered by park boundaries (Theberge & Theberge, 2002), thus the boundaries will not keep out negative influences occurring from activities adjacent to the park. Impacts from forestry, agriculture, mining, tourism, and urban development have added stressors to the species and processes within park boundaries, which in turn has degraded the ecological integrity of the parks (Parks Canada Agency, 2000). These land uses also fragment the landscape, which disrupts species and ecological flows as well as destroying the connectivity between natural areas (Theberge & Theberge, 2002). "Parks are part of interconnected ecosystems and very much reflect the state of the larger regions where they are located" (Parks Canada Agency, 2000). When stresses within the parks are found, it is usually an indication of a larger stress that threatens from outside the park boundaries (Parks Canada Agency, 2000). Therefore, it is important that activities adjacent to protected areas reflect a conservation approach in order to maintain the ecological integrity within the park. Due to its connection with the rest of the landscape, The Panel on Ecological Integrity recognized that by simply designating an area as a national park, the ecological integrity of the area does not necessarily get protected (Parks Canada Agency, 2000). Therefore, in order to achieve ecological integrity in its parks and minimize the threat of adjacent land use, Parks Canada has adopted the principle of ecosystem-based management.

Ecosystem-Based Management

Ecosystem-based management (EBM) “is an approach that attempts to integrate parks within their greater ecosystems through broad-based collaborative and partnership-building strategies for the purpose of maintaining ecological integrity on a regional scale” (McLean, 2003). In this way, participation and cooperation with people and organizations outside the park are important in order to make EBM work. Ecosystem-based management also recognizes the importance of moving away from ‘boundary thinking’ to an understanding of the spheres of influence that affect parks beyond the administrative boundary (Slocombe & Dearden, 2002). Parks are not separate from the rest of the ecosystem, and if managed without this in mind, key ecosystem functions and processes that occur across park boundaries would not be included in management decisions. EBM recognizes the importance of managing the ecosystem for human use as well as the environment (McLean, 2003). Humans live adjacent to park boundaries (and in some cases in the parks themselves), they are part of the ecosystem and their needs should be recognized in order to manage the whole system effectively. When taking the whole ecosystem into account, proper management plans can be created that help to maintain ecological integrity. Ecosystem-based management is also used when addressing the concept of biosphere reserves.

Biosphere Reserves

Defined

Biosphere reserves are simply “land or marine areas which are given international recognition within UNESCO’s Man and the Biosphere (MAB) Programme for promoting and demonstrating a balanced relationship between people and nature” (Biosphere Nomination Working Group, 1998). Biosphere reserves recognize the connection between people and the environment and that the ecosystem must be managed as a whole in order to conserve biological diversity. The biosphere reserve is split into three zones, the core, buffer, and transition, each managed to allow for different activities at differing levels of impact to the ecosystem. Ideally, the people in a biosphere reserve work to sustain the local economy while at the same time conserving the biodiversity and ecological integrity of the area (Canadian Biosphere Reserve Association, 2004). In order to obtain biosphere reserve status, an area needs to fulfill three objectives; conservation, development, and logistics.

Objective – Conservation

The purpose of the conservation function is to “preserve genetic resources, species, ecosystems, and landscapes” (UNESCO, 1996). The goal is for a healthy ecosystem that maintains a high level of species diversity and functions at a level that is natural for that region. Areas designated for conservation are also meant to be areas of local, national, or

international importance (McMillan, 1997). Biosphere reserves are about a balance between humans and nature, thus, the conservation areas of a biosphere reserve can have some human impact. However, it is important that any activities occurring within areas meant for conservation, exemplify the conservation objective of preserving biological diversity and protection of the ecosystem. While conservation remains the most important function of biosphere reserves (Batisse, 1990), "conservation cannot succeed unless the needs of people are taken into account" (Dasmann, 1988). Therefore, sustainable development is another important function of the biosphere reserve.

Objective – Development

Biosphere reserves promote sustainable development in order to meet the needs of the surrounding population while still maintaining its conservation value. The goal is to "foster economic and human development which is socio-culturally and ecologically sustainable" (UNESCO, 1995). The idea behind sustainability is to balance human resource use with the protection of resources for the future (Bridgewater, 2002). Biosphere reserves recognize that humans aren't separate from the environment, but a part of it. In order to conserve the environment, human needs need to be taken into account in ways that work with the environment instead of against it. In order to find the best ways to incorporate conservation and development, research and education is needed, thus the logistics function is the third objective of the biosphere reserve.

Objective – Logistics

According to Axelsson and Angelstam (2006) “people need education to understand what ecologically sustainable development is and science is needed to get the most out of our natural resources without causing harm to biodiversity, ecosystems, and our home the biosphere.” The logistic function of a biosphere reserve provides the opportunity for research and education. It provides support for “demonstration projects, environmental education and training, research and monitoring related to local, regional, national and global issues of conservation and sustainable development” (UNESCO, 1995). By researching issues related to a biosphere reserve, practices within the reserve can be improved upon and communities can become educated in ways that enable them to enhance the conservation and development functions of the biosphere reserve. In order to be designated as a biosphere reserve, not only must the area display the three objectives of conservation, development, and logistics, they must also follow the zoning pattern, having a core, buffer, and transition zone.

Zoning Pattern – Core

The zoning pattern was originally perceived as an inner zone, the core, circled by a middle zone, the buffer, circled by an outer zone, the transition (figure 1). The actual location, size, and numbers of these zones vary depending on the circumstances of the

area (Biosphere Nomination Working Group, 1998).

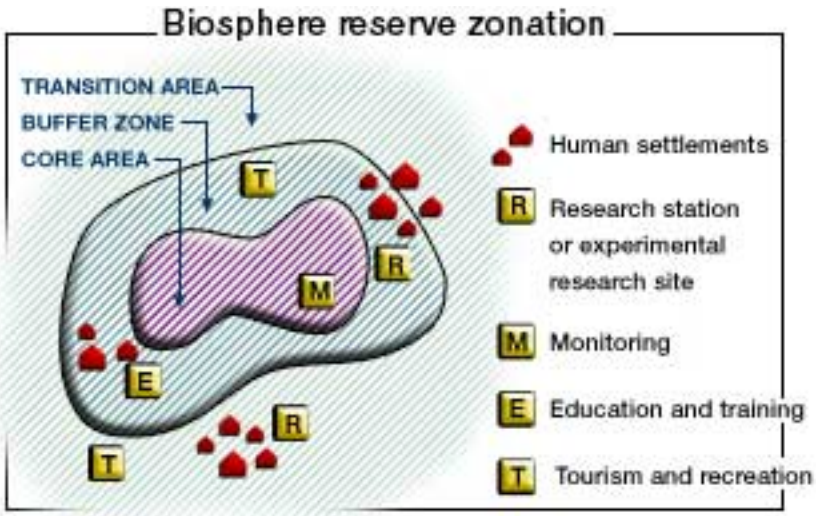

Figure 1. UNESCO, 2007

The core area is where the conservation objectives of the biosphere reserve take place. The core must be "devoted to long term protection, according to the conservation objectives of the biosphere reserve, and of sufficient size to meet these objectives" (UNESCO, 1995). Ideally the core area is meant to be the site of strict protection. However, in most biosphere reserves human use in the core is acceptable if activities follow the conservation value. Since the core areas are the only part of the biosphere reserve that must be legally protected (UNESCO, 2007), many core areas are parks, thus tourism activities often take place in the core areas. It is up to park management and the public to make sure that activities within a core area do so at little harm to the area. Core areas also provide opportunities for research and learning and provide benchmarks of ecological health for the region (Gregg, 1999; pg.25).

Zoning Pattern – Buffer

The buffer zone(s) is the area that surrounds or adjoins the core area. These areas are suppose to be managed in ways that support the conservation objectives, allowing environmentally sound activities to take place within their boundaries (Gregg, 1999; pg.25). The buffer zone is important because it mitigates between the conservation values of the core with the resource extraction and development activities that occur in the transition zone that may have negative affects on the core area. By only allowing activities in the buffer zone that don't have a negative affect on the processes and functions of the core, the ecological integrity of the core areas can be better maintained. Research and education occur within the buffer zone, as well as tourism activities, and sometimes even human settlements (UNESCO, 2007).

Zoning Pattern – Transition

The last zone is the transition zone, or zone of cooperation. This area supports the economic and social development needs of the people while still recognizing the importance of maintaining a healthy ecosystem. Resource extraction can still occur within a transition zone. Stakeholders in the area are supposed to come together to determine how to properly manage and develop the area and its resources in a sustainable manner (UNESCO, 1996). However, land controversy can often prevent stakeholders to actively cooperate and determine the best way to manage resources. Since the majority of land in the transition zone is private, sustainable use of the land can only be promoted,

unless otherwise dictated by policy and legislation. The transition zone is the main location of towns and cities within the biosphere reserve. When an area has the three zones and objectives they are designated as a biosphere reserve under the Man and the Biosphere Program.

Man and the Biosphere Programme

In 1970 United Nations Educational, Scientific, and Cultural Organization (UNESCO) launched the Man and the Biosphere Programme (MAB). MAB grew from the public's concern in developed countries over the cumulative impact humans were having on the environment (Gregg, 1999; pg. 24). The purpose of MAB was to globally improve the relationship between people and the environment (UNESCO, 2007). It was the first international program specifically designed for finding ways to achieve sustainable development (Gregg, 1999; pg. 24). MAB created 14 project areas to focus on with the idea of encouraging research and collaboration of both natural and social sciences in all project areas (Gregg, 1999; pg. 24). One of the project areas was biosphere reserves.

How Biosphere Reserves Evolved

MAB recognized the importance of protected areas as a place to protect the gene pools of plants and animals, and as places of research and education (Gregg, 1999; pg. 24). Thus, in 1974 the concept of a biosphere reserve was created and became MAB's primary focus. Sites began to be designated as biosphere reserves in 1976, many of which were

based on already existing protected areas (Batisee, 1997). When they were first created, biosphere reserves were meant to serve two purposes, conservation, and ecological research (Price, 2002). However, a 1984 action plan, following the first conference on biosphere reserves, which occurred the previous year in Belarus, set out with the goal of improving the biosphere reserve program (UNESCO, 1996). Newly created biosphere reserves would now have to include sustainable development as one of their objectives. By adding a development factor to the objectives of biosphere reserves, human needs are being considered, which was the original goal of MAB; strengthening relationships between the needs of humans and the environment. In 1995, an International Conference on Biosphere Reserves was held in Seville Spain. The Seville Strategy, which came out of the conference, provided an evaluation of MABs 1984 Action Plan and reflected on the role biosphere reserves were to play in the 21st century (UNESCO, 1996). It concluded that the biosphere program has been successful and innovative to date, and the three functions of conservation, logistics, and development would be valid for years to come (UNESCO, 1996).

World Network of Biosphere Reserves

MAB wanted to create a world network of protected areas that would become "vehicles for knowledge-sharing, research and monitoring, education and training, and participatory decision-making" (UNESCO, 2007). Thus they created the World Network of Biosphere Reserves, with the goal to share information in order to provide all of the biosphere reserves around the world the same opportunities to improve upon their

sustainable development and conservation practices. There are currently 507 biosphere reserves in 102 countries all of which are under their own national jurisdiction (UNESCO, 2007b). With the World Network they are able to share their ideas and experiences with other reserves around the world (UNESCO, 2007b).

Examples from Other Biosphere Reserves

Niagara Escarpment Biosphere Reserve

Niagara Escarpment Biosphere Reserve is one of Canada's thirteen biosphere reserves. It was designated as a biosphere reserve in 1990. It features important topographical features of Southern Ontario and includes portions of Bruce Peninsula National Park and Fathom Five National Marine Park (Niagara Escarpment Commission, 2007). Thus, not only does it have the main purpose of conservation, but it also has the maintenance of ecological integrity as the focus for a portion of its core areas. However, according to Dempster (2004), the whole biosphere reserve functions as one big transition zone, with the core areas having a diversity of land ownership and uses that require collaboration to manage.

The Niagara Escarpment Commission has focused their efforts on information sharing activities and research (Whitelaw et al., 2004). In 1985 the Niagara Escarpmemt Plan was created "to provide for the maintenance of the Niagara Escarpment and lands in its

vicinity substantially as a continuous natural environment, and to ensure only such development occurs as is compatible with the natural environment" (Niagara Escarpment Commission, 2007). The biosphere reserve has also adopted a monitoring framework in order to determine if the conservation value of the reserve is being upheld (Niagara Escarpment Commission, 2007).

Like all biosphere reserves, Niagara Escarpment is threatened by adjacent land uses. Resource extraction has had a significant impact on the area (Whitelaw, et al., 2004) and "there is mounting pressure around the park for recreational and vacation property development precipitating habitat loss and fragmentation as well as invasion of non-native species" (Parker, 2006). With increased fragmentation of the land due to development, the ecological integrity of the Niagara Escarpments core regions will be affected. Thus, the conservation value wont be upheld. While it is important for development and resource extraction within a biosphere reserve, it needs to be done in a sustainable manner as to not disrupt the biological diversity of the core areas.

New Jersey Pinelands Biosphere Reserve

In 1978 the New Jersey Pinelands became the United Sates first National Reserve. The purpose of the national reserve was to "direct, regulate, and mitigate the effects of an increasing population on a regional ecosystem basis rather than affording absolute protection in a designated park area with no controls outside park boundaries" (Good &

Good, 1984). This is much like the functions of a biosphere reserve, providing opportunities for development while still working to protect the ecosystem.

Nineteen eighty-three saw the designation of the New Jersey Pinelands as a biosphere reserve. A comprehensive management plan was created to regulate development in the New Jersey Pinelands. A study done by Walker and Solecki (1999) show that the management plan has reduced the conversion of natural areas in the biosphere reserve, even while it is surrounded by two major cities: Philadelphia and Atlantic City. The set up of the New Jersey Pinelands Biosphere Reserve closely reflects the ideal model of a core area, surrounded by a buffer, surrounded by a transition zone (Walker & Solecki, 1999). This design helps protect the core from resource extraction and development activities, allowing it to maintain its conservation function. However, Walker and Solecki (1999) were quick to point out that the relevant achievement of the New Jersey Pinelands Biosphere Reserve to halt development in the core areas does not indicate the success of the biosphere reserve since the protection of the core is not great enough to preserve biological diversity. Situated close to a densely populated, and highly industrialized region of the United States, activities in these areas will affect the core areas (Good & Good, 1984). Development will still occur outside the core, and with not enough protection, the core area will not be able to maintain its conservation function, regardless of the development halt.

Case Study – Clayoquot Sound Biosphere Reserve

Location

Clayoquot Sound Biosphere Reserve is located on the West Coast of Vancouver Island. With an area of 349 947 hectares, the reserve extends from Esowista Peninsula in the south to Estevan Peninsula in the north (MacIntosh, 2006) (figure 2).

Figure 2. Clayoquot Sound Research Group, 2002.

The Clayoquot Sound area is part of the coastal temperate rainforest biogeoclimatic zone and consists of coastal plains, idlands, peninsulas, rocky shores, sandy beaches, and mountainous topography (Clayoquot Sound Scientific Panel, 1995). BC contains a quarter of the world's old growth forests, with Clayoquot Sound containing the only significant tract of old growth left on Vancouver Island (Friends of Clayoquot Sound,

2003). The area is inhabited by local communities, and the Nuu-chah-nulth First Nations; the traditional land occupants.

History of the Area

Clayoquot Sound has been the home to intense conflict and controversy. Nineteen seventy-nine saw the beginning of the conflict over the proposed logging on Meares Island (Parai & Esakin, 2003). With the Nuu-chah-nulth unresolved land claim over Meares Island, logging on the island was prohibited in 1985 until the claim was resolved. This led the forest companies to direct their attention to other unlogged forests in the Clayoquot Sound area. With increased environmental awareness and resistance to logging of the old-growth forests, opposition grew. In 1993, the government created a land-use plan as a way to halt conflict. However, the land use decision saw the government keep two-thirds of the land open to logging (Gibbs, 2006). Conflicts reached their peak with Canada's largest act of civil disobedience during the summer of 1993 when more than 100 000 people participated in a mass blockade and approximately 850 were arrested (Parai & Esakin, 2003). With the failure of the 1993 land use decision to end the conflict, the government turned to scientists. The Scientific Panel for Clayoquot Sound was established with the goal of determining how to log in the Clayoquot Sound area in a way that would be acceptable to the environmentalist movement. The panel made their report in 1994, making 125 recommendations (Clayoquot Sound Scientific Panel, 1994). In 1995, the government accepted all of the panel's recommendations which included adopting ecosystem-based management, create watershed plans with

reserves that are off limits to logging, restrict logging rates in each valley, and retain at least 15% of the trees in each cutblock (Clayoquot Sound Scientific Panel, 1994, & Friends of Clayoquot Sound, 2007).

Biosphere Reserve Designation

The idea of designating Clayoquot Sound was first proposed by the Commissioner on Resources and Environment in response to the 1993 land use decision made by the BC government (McMillan, 1997). The provincial government proceeded with the idea after gaining substantial local support and First Nations endorsement (McMillan, 1997). UNESCO designated Clayoquot Sound as a biosphere reserve on May 5, 2000. It was established in recognition of the initiatives in Clayoquot Sound to balance protection of the environment while supporting sustainable local economies (Biosphere Nomination Working Group, 1998). The biosphere reserve initiative was created as a means of "promoting positive change in the region and to implement a vision for the future" (Biosphere Nomination Working Group, 1998). Clayoquot Sound Biosphere Reserves objective was to follow the Nuu-chah-nulth philosophy of 'Hishuk ish ts'awalk' or 'everything is one' (MacIntosh, 2006), thus looking at the region as one interconnected landscape.

All the parks and protected areas in the region comprised the biosphere reserve's core areas, including Pacific Rim National Park Long Beach Unit, as well as 16 provincial parks and two ecological reserves (MacIntosh, 2006). The core (figure 3) covers an area

of 110 281 hectares, of which 19 869 hectares is marine (Clayoquot Sound Biosphere Nomination, 1999). The buffer zone (figure 3) is 60 416 hectares and consists of all major watersheds which have had little to no logging occurring in them (MacIntosh, 2006). The transition zone (figure 3) contains all the major developed areas (McMillan, 1997), it covers 116 557 hectares of land and 62 693 hectares of marine (MacIntosh, 2006). This zonation framework is based on the 1993 Land Use Decision, which the First Nations have not endorsed (Clayoquot Sound Biosphere Nomination, 1999). Therefore, zonation patterns are subject to change in response to treaty negotiations. This however, is outside the scope of this paper.

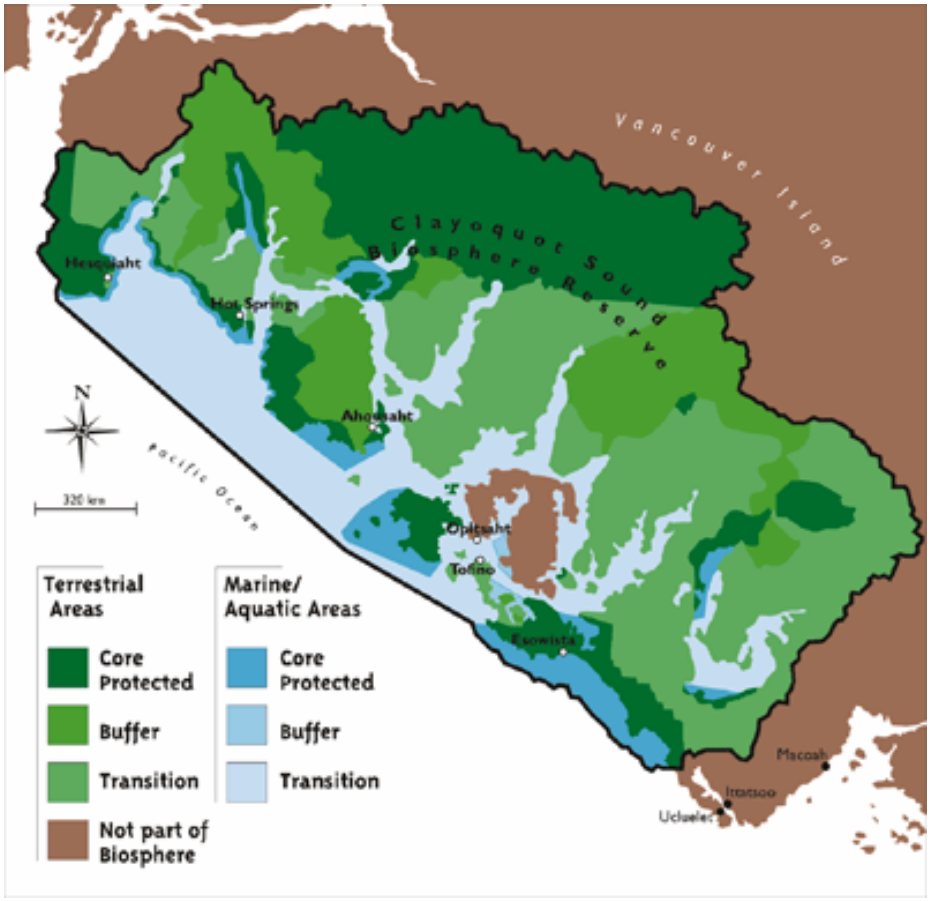

Figure 3. Clayoquot Biosphere Trust, 2007.

Clayoquot Biosphere Trust

The Clayoquot Sound Biosphere Trust (CBT), a community-based, non-profit organization, was established to serve as the biosphere reserve's administrator (Parai & Esakin, 2003). The CBT has members from the Nuu-chah-nulth First Nations and the local communities, all with equal representation (Francis, 2004). The CBT is also in charge of managing a $12 million endowment fund given to the reserve by the government of Canada to support research, education, and training (Parai &Esakin, 2003). The goals of the CBT, which were established from the Seville Strategy recommendations are to:

- become a model of ecosystem-based management and sustainable development,
- support research and educational initiatives,
- develop and deliver local training initiatives,
- promote cross-cultural understanding, and
- contribute to the success of the World Network of Biosphere Reserves

(Clayoquot Biosphere Trust, 2007b).

Pacific Rim National Park Reserve

An agreement for the creation of Pacific Rim National Park Reserve was reached in 1970 with a renegotiation in 1987 (Parks Canada, 2005). However, it wasn't until February 19, 2001 that the park was formally proclaimed under the National Parks Act. The park will

remain a National Park Reserve until resolution of land claims with the Nuu-chah-nulth people. The 500km2 park representing the Estevan Coastal Plain portion of Canada's Pacific Coast Mountain Region, as well as the near shore waters of the Vancouver Island Shelf Marine Region (Parks Canada, 2005), is split into three distinct sections; The West Coast Trail, The Broken Group Islands, and Long Beach. The Long Beach unit is a part of Clayoquot Sound Biosphere Reserve.

The Long Beach unit of Pacific Rim National Park Reserve resides in Clayoquot Sound Biosphere Reserve as the largest of the core areas within the park. Concurrent with Parks Canada's mandate, the main objective of Pacific Rim National Park Reserve is to preserve ecological integrity within the park. However, the primary purpose for the parks establishment was for recreation, not conservation (Parks Canada Agency, 2000). Because the government was unwilling to take too much land away from forestry operations, the boundary to the park remained a narrow strip of coastal land (Parks Canada Agency, 2000). This leaves the park more open to many external stressors that can affect its ecological integrity, which is less likely in larger parks. The 1997 State of the Parks Report detailed the impairment to ecological integrity within Canada's National Parks. Pacific Rim National Park Reserve was listed as the third worst park for impairment to ecological integrity. Impacts from internal source was listed as significant level of impairment, while impacts from external sources and cumulative impacts of all stressors were listed as severe levels of impairment (Parks Canada, 1998).

Land Use

There are many different land-use activities occurring within Clayoquot Sound Biosphere Reserve. While forestry and tourism are the most known, mining, fishing, aquaculture, and urban development are also taking place in the region. All land use activities if not done in a sustainable manner can affect the ecological integrity of the core areas of the biosphere reserve. Logging in the region has been a major part of Clayoquot Sound, and contributes to the external stressors placed on Pacific Rim National Park Long Beach Unit, and the other core areas (figure 4).

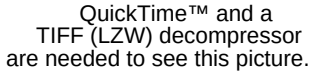

Figure 4. Clayoquot Sound Technical Planning Committee, 2006b.

Land Use – Logging

Logging in Clayoquot Sound was traditionally done by MacMillan Bloedel, which was eventually bought out by the American company Weyerhaeuser. Iisaak was created in 1998 as a joint-venture operation between Weyerhaeuser (49%) and the Nuu-chah-nuth Central Region Board (51%) (Wilson, 2002). Their tenure consists of 87 000ha in Tree Farm Licence (TFL) 57 (Friends of Clayoquot Sound, 2003). Iisaak is "working on developing cost-effective ways to log the non-pristine areas of its Clayoquot Sound permit in accordance with the stringent local industry standards established by the Scientific Panel" (Parai & Esakin, 2003). The goal of Iisaak is to be a world leader in conservation management of forests and forest products and services (Wilson, 2002). Iisaak means respect in the Nuu-chah-nulth language, and Iisaak Forestry Resources Ltd demonstrates their dedication to their name by being committed to economic, environmental, and social, and cultural sustainability (Wilson, 2002). While they have a long way to go before they reach a sustainable forest company, it is the step in the right direction. By becoming more sustainable, logging activities wont add as much of a stress on the core areas in the biosphere reserve.

Interfor is the other logging company operating in the area, although in a recent move, they sold their tenure to a joint-venture between the Nuu-chah-nulth Central Region Board (51%) and the Coulson Brothers (49%), a logging operation based out of Port Alberni. Interfor had 49 000ha in TFL 54 (Friends of Clayoquot Sound, 2003). Before they sold their tenure, Interfor's logging practices was one of the main reasons for severe

etxernal stressors on Pacific Rim National Park. Interfor's five year harvesting plan was to create 37 cut blocks near the park boundary (Parks Canada Agency, 2000). Twenty-two of those cutblocks were logged between 1999 and 2002, coming within 25 metres of the park boundary (Friends of Clayoquot Soundm 2003). With logging adjacent to the park border, the ecological integrity of Pacific Rim National Park Reserve was threatened. Proper flows of species and processes across the boundary would have been disrupted, therefore disrupting the parks ability to maintain its ecological integrity.

Land Use – Tourism

Tourism is Clayoquot Sound's other well-known industry. In the past twenty years Clayoquot Sound has shifted from a resource-based economy to one based on tourism (Vines, 2005). Over 800 000 people visit the area every year contributing approximately $21 million to the surrounding communities (MacIntosh, 2006). Some of the main tourist activities in the region are:

- whale watching
- wildlife viewing
- hiking
- camping
- surfing
- kayaking
- storm watching

Due to such seasonal activities, the Clayoquot Sound area becomes very busy during the summer months. With increasing amount of visitors in the region, there is a need for an improvement in facilities and infrastructure (Vines, 2005). With more people visiting Pacific Rim National Park Reserve, there is a higher risk for internal stressors to be added to the ecological integrity of the park. Building up of infrastructure around the park, will only become an added external stressor. While tourism activities are not as detrimental as logging, they still have an impact on the ecological integrity of the core areas in the biosphere reserve.

Efforts to Improve EI in Pacific Rim National Park Reserve

In 1994/95, a study done by Wipond and Dearden (1998) indicated that while efforts were being made to improve ecological integrity in Pacific Rim National Park Reserve, the goal of maintaining integrity surpassed the ability of the small fragmented park to achieve on its own. The park was having problems with differing management opinions on goals for ecological integrity maintenance, as well as on the definition of ecological integrity itself (Wipond & Dearden, 1998). With the Report from the Panel on Ecological Integrity, and their recommendations for the use of ecosystem-based management, a framework for park management was established (McLean, 2003). Pacific Rim National Park Reserve now follows a series of guidelines and policies for EBM. These include:

- Interim Management Guidelines
- Ecological Integrity Statement
- Ecosystem Conservation Plan
- Canada National Parks Act
- Parks Canada's Guiding Principles and Operating Policies

(McLean, 2003)

While it is still unclear as to whether this has made any difference to the maintenance of ecological integrity in the park, it is a step in the right directions. By following a list of guidelines, park management and staff can be clearer on the goals for maintaining ecological integrity. Pacific Rim National Park Reserve has also become involved in many partnership opportunities. The park has developed relationships in the areas of:

- Restoration
- Research
- Forestry planning and management

(McLean, 2003).

By developing relationships, the collaboration process can become easier. The park signed a Memorandum of Understanding with the BC Ministry of Forest and has "informal cooperative relations with forestry companies harvesting adjacent to the park boundary" (McLean, 2003). However, McLean (2003) notes that there is still a need for formal guidelines to assist partnership building and relationships with stakeholders, which is hindered by organizational constraints as well as inadequate policies, plans, and procedure.

Other Efforts to Improve EI

While Pacific Rim National Park Reserve is attempting management strategies in order to enhance the ecological integrity of the park, activities are taking place in other areas of Clayoquot Biosphere Reserve that are aimed at improving the conservation function of the biosphere reserve. The Kennedy Flats, a 12 937 hectare area of flood plains and meandering stream channels is the site of previous intensive logging operations (Warttig et al., 2001). The Kennedy Flats restoration project was implemented to restore the Kennedy Flats in order to enhance the salmonid populations in the Clayoquot Sound area (Warttig et al., 2001). Collaboration on the project includes:

- Interfor
- Parks Canada
- Central Westcoast Forest Society
- Representatives from the public and government
- First Nations

(Parks Canada, 2005b).

Beginning in 1995, the Kennedy Flats has now over 16 kilometres of restored streams (Parks Canada, 2005b), which has allowed the return of the salmonid populations.

In 1999, Iisaak signed a memorandum of understanding with environmental groups. Iisaak agreed to leave pristine or intact areas in its tenure unlogged with the eventual plan of transitioning out of old growth all together (Friends of Clayoquot Sound, 2003). Iisaak

is also working with the Clayoquot Biosphere Trust on the Iisaak Sustainable Forestry Project. The goal is to design a program that monitors selected indicators of sustainability to assess Iisaak's progress towards sustainable logging (Wilson, 2002). However, with the loss of their certification and threat of losing their tenure due to a lack of timber production, Iisaak has lots of work ahead in order to achieve their goal of sustainable forestry in Clayoquot Sound.

Discussion / Analysis

The introduction of ecosystem-based management to achieve ecological integrity in Pacific Rim National Park Reserve was not the result of the biosphere reserve, but rather Parks Canada's response to degrading ecological integrity within the national parks. The 1997 State of the Parks Report declared Pacific Rim National Park Reserve as one of the worst for stressors affecting the integrity within the park and that stressors outside the park were listed as severe impairment. In order to alleviate these stresses on the natural system, management of the park began to look at the park within the broader ecosystem by following an ecosystem-based approach to manage the park. However, there is little information out there regarding what has happened on the ground within the park since the new management strategies have been put in place. The general public was committed to putting conservation before recreation in the park (Wipond & Dearden, 1998) before the biosphere had been designated.

Land use activities after the implementation of the biosphere reserve have not changed drastically other then heading down the same path they were going before the biosphere reserve was designated. Historical land use practices in the Clayoquot Sound area consisted of intensive clear-cut logging. It wasn't until the 1994 introduction of the Scientific Panel for Sustainable Forestry Practices in Clayoquot Sound and their 125 recommendations, that the government required the changed to the forestry standards in Clayoquot Sound. This was six years before the biosphere reserve was designated.

Watershed plans, implemented from the Scientific Panels recommendations, were introduced as a way to identify reserves to protect forest values and the natural diversity of the area (Clayoquot Sound Technical Planning Committee, 2006). However, neither the watershed plans nor the Scientific Panel's recommendations provide any legally binding directions for logging operations (Clayoquot Sound Technical Planning Committee, 2006). After the biosphere reserve was designated the first three watershed plans were completed in 2003; Flores Island, Cypre River/Bedwell Sound, and Bedingfield Area. Flores Island contains 58% reserve land (Clayoquot Sound Technical Planning Committee, 2003a), Cypre contains 43.3% reserve land (Clayoquot Sound Technical Planning Committee, 2003b), and Bedingfield contains 48.2% reserve land (Clayoquot Sound Technical Planning Committee, 2003c). However, the reserves in these watersheds are fragmented, consisting of steep unstable terrain and they do not protect much additional forest (Friends of Clayoquot Sound, 2003). Also, certain reserves are still open to logging (Clayoquot Sound Technical Planning Committee, 2006). While

steps were taken to implement a more sustainable way of logging, large tracts of old growth are still disappearing, and Interfor is still logging adjacent to park boundaries. Even with the advance in the direction of sustainable logging, especially with Iisaak's commitment towards environmentally conscious harvesting, all this took place before the introduction of the biosphere reserve. While Parai and Esakin (2003) believe that without the biosphere reserve Iisaak and future logging efforts would face strong opposition, the people of Clayoquot Sound were already looking for a better way to harvest the timber resources and embraced the decisions of the Scientific Panel for Sustainable Forestry in Clayoquot Sound back in 1994.

The Clayoquot Biosphere Trust, with the help of the $12 million endowment fund has supported many research and education endeavors. Not only has the CBT provided funds for scientific research related to conservation, sustainable development, and community health, they have also been a strong supporter of community development opportunities. The purpose of the biosphere reserve is conservation with sustainable development. There is also an emphasis on research and education due to the fact that without new knowledge on how to best manage the area to achieve certain goals, the biosphere reserve program would not grow, and the objectives of MAB would not be reached. By providing research opportunities, the CBT is creating a center of knowledge that can be drawn on in order to improve the community and surrounding ecosystem. Even if there is no direct actions being taken to enhance the ecological integrity of the core areas, or influence land use activities in ways that enhances the conservation objective, the conservation function of the biosphere reserve has not been forgotten. Be enhancing community support and

awareness, the vision of the biosphere reserve and its commitment to preserving the ecosystem is strengthened.

Since the management of a biosphere reserve relies heavily on the actions of the surrounding community, partnership building is an important process. Two achievements of Clayoquot Sound Biosphere Reserve has been its "ability to unite what was a polarized community…[and the] collaboration between different public and private sector operations (MacIntosh, 2006). Managing Pacific Rim National Park Reserve as a part of the greater ecosystem, requires collaboration with organizations outside the park borders. With the introduction of the biosphere reserve, Pacific Rim National Park has been able to work with the Clayoquot Biosphere Trust and other organizations on ecosystem conservation initiatives. Although the park has a lack of skills and resources in the collaboration process (McLean, 2003), working with the Clayoquot Biosphere Trust will strengthen their partnership building process. With stronger partnerships, collaborating on conservation projects related to the maintenance of ecological integrity will be improved. Thus, the biosphere reserve has made an improved towards the protection of ecological integrity in the core areas by its achievements in collaboration and partnership building, not by influencing land use activities.

Conclusion

Clayoquot Sound, an area of intense conflict and under pressure from logging was put on the world stage in 2000 as a UNESCO biosphere reserve. The aim was for sustainable development amidst ecosystem conservation. Logging is one of the greatest stressors on the ecological integrity of the core areas in the biosphere reserve. While Clayoquot Sound has been heading towards more sustainable logging operations, this began before the designation of the biosphere reserve. Therefore, it cannot be concluded that the biosphere reserve has influenced land use activities in a way that reflect the core values of conservation. This does not mean that the introduction of the biosphere reserve has not helped the goal of achieving ecological integrity in its core areas. Through collaboration and partnership building, the Clayoquot Biosphere Trust is able to include all organizations in the management of the entire ecosystem. Working with Pacific Rim National Park Reserve, they are able to collaborate on projects that are geared towards the preservation of ecological integrity. The Clayoquot Biosphere Trust also provides research and education opportunities, thus providing a knowledge base for future use in conservation, sustainable development, and community health.

With the World Network of Biosphere Reserves, information between reserves can be shared. Methods that work in a reserve can then be used in another. In this way, Pacific Rim National Park and the Clayoquot Biosphere Trust can both learn from other biosphere reserves on how they uphold ecological integrity and experiment with the newfound knowledge in Clayoquot Biosphere Reserve. Every biosphere reserve is going

to have different problems facing them on achieving the goal of sustainable development and conservation. However, by continuing research initiatives, working together, and sharing knowledge, advances can be made towards a system where development and ecosystem preservation coexist.

One major issue facing Clayoquot Sound Biosphere Reserve is the location of the core, buffer, and transition zones. Many of the core areas are not surrounded by a buffer zone, and thus are still threatened by resource extraction and development on their borders. Ecological integrity can only be maintained if the core areas are managed as part of a greater ecosystem. To do this, the buffer zones need to be surrounding the core areas in order to alleviate stressors occurring from activities in the transition zone. The current buffer zones are areas of little to no logging, however they are still open to future logging operations. The current buffer zones need to be protected against timber production and areas around the core areas that have had logging operations in them need to be restored to a state where they can function as a complete system again.

Clayoquot Sound has moved from an intensive forestry dominated area, to a more environmentally aware community. Tourism is starting to dominate the area and the movement towards sustainable forestry is replacing intensive logging. The biosphere reserve can help lead the way by improving the partnerships and collaboration efforts as well as by providing research, education, and the access to the World Network of Biosphere Reserves. Pacific Rim National Park is working to maintain ecological integrity within its borders. Achievements have been made since the 1997 state of the

parks report, and ecosystem-based management has begun in the park. To achieve anything requires time and effort. Clayoquot Sound Biosphere Reserve is still relatively new, but the effort is there to make Clayoquot Sound an example for the world where sustainable development and conservation coexist. Given the time, it may achieve just that.

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