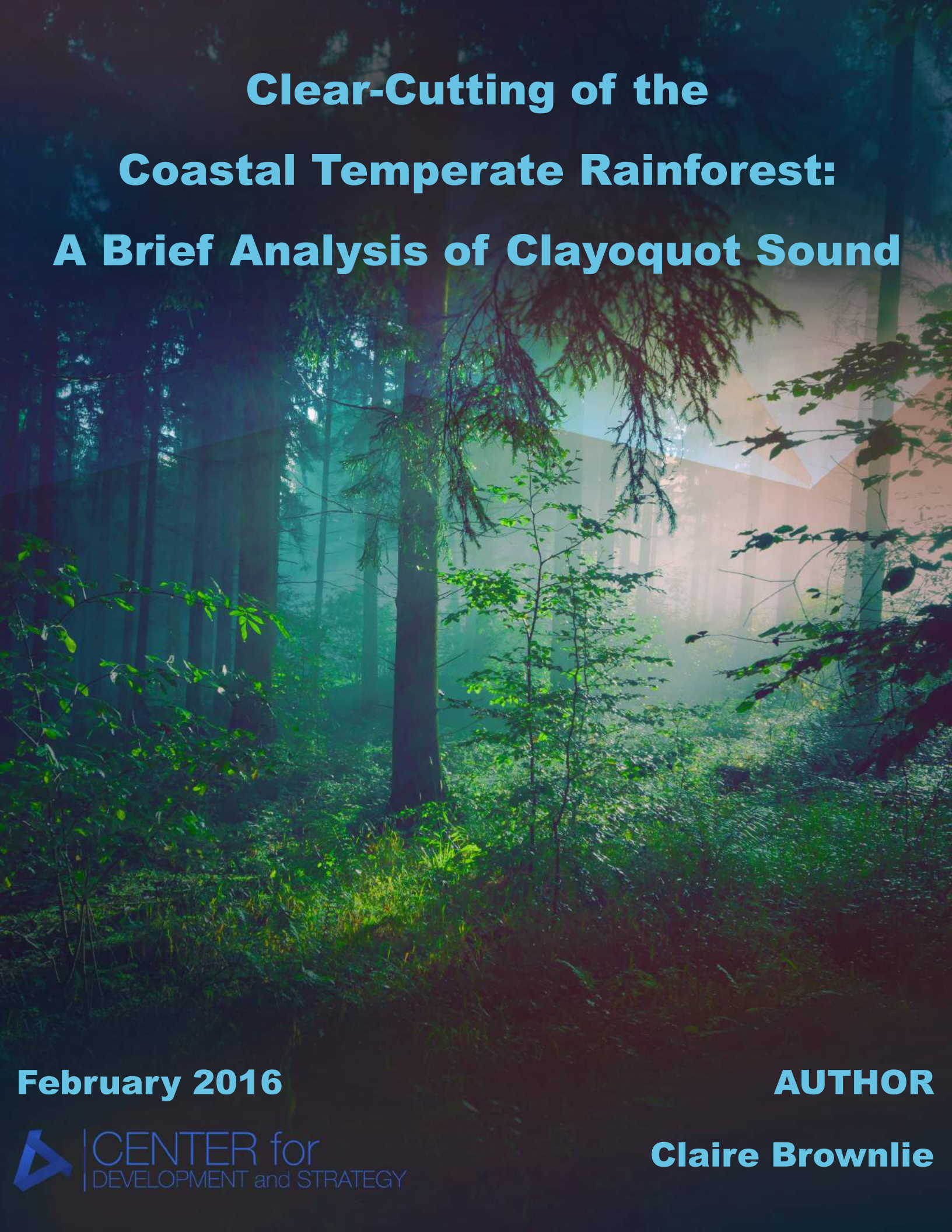
Clear-Cutting of the Coastal Temperate Rainforest: A Brief Analysis of Clayoquot Sound



February 2016

AUTHOR

Claire Brownlie

CENTER for DEVELOPMENT and STRATEGY

CENTER for
DEVELOPMENT and STRATEGY

CDS PUBLICATIONS:

REPORTS, RESEARCH, INSIGHTS
by students

Clear-Cutting of the Coastal Temperate Rainforest: A Brief Analysis of Clayoquot Sound

Author

Claire Brownlie

A Report by the Center for Development and Strategy

February 2016

About CDS

The Center for Development and Strategy, Ltd. (CDS) was founded in May of 2014 as a student-run think tank focused on development issues throughout the globe. CDS's goal is to provide students with an academic voice on pressing issues in society. Researchers think, collaborate, and promote work being done in communities that help create new approaches in development policy and business strategy. In this way, CDS helps facilitate economic and political discussions and debate among students and young professionals, while also providing academia with an influx of creativity and fresh ideas.

CDS is an incorporated Not-for-Profit headquartered in Buffalo, New York, U.S. The Center is composed of volunteer staff members, four official advisors, and registered student members. David Harary is the current Executive Director and CEO of the Center.

CDS does not take specific policy positions; accordingly, all views expressed herein should be understood to be solely of the author(s).

Center for Development and Strategy, Ltd.

P.O. Box 219

2655 Millersport Hwy.

Getzville, New York 14068

www.thinkcds.org

Clear-Cutting of the Coastal Temperate Rainforest: A Brief Analysis of Clayoquot Sound

Claire Brownlie

University of Toronto

Table of Contents

Abstract

Using Clayoquot Sound as a reference, the consequences clear-cut logging has on the coastal temperate rainforest ecosystems was examined. Social and political outcomes from extensive protests in 1993, which opposed the destruction of the natural habitats, were also assessed. Additionally, First Nations' rights were investigated through the Interim Measures Agreement between the Government of British Columbia and the Nuu-chah-nulth community, as well as their co-management of the natural resources in Clayoquot Sound. In 2000 Clayoquot Sound was designated as a UNESCO site. The designation brought the issues in the coastal temperate rainforest to the forefront once again, and allowed for increased non-profit and governmental attention and aid. The economic benefits that can be gained from the region such as its utilization as a carbon sink, ecotourism, and fishing were also evaluated. Lastly, previous research on climate change has estimated the impacts on future biodiversity and ecosystem health of the region.

Introduction

The unique ecosystem of the coastal temperate rainforest will be examined, specifically focussing on the Clayoquot Sound region on Vancouver Island, British Columbia. The British Columbian government's decision to allow for clear-cutting of the region and the outcome of the protests opposing the clear-cutting will be outlined. Specific characteristics of a coastal temperate rainforest and outline its unique biodiversity will be identified. Aside from logging, these old growth forests have many ecological goods and services to offer, and the economic benefits of the alternatives are outlined. First Nations have a vested interest in the area, and have land rights in much of the region, their involvement in the management of the forest will be analyzed. In 2000 the area was designated as a UNESCO biosphere reserve (Reed and Massie, 2013), an examination of the changes to management and biodiversity brought on by the designation will be included. Finally, the current status of the forest and regulations will be evaluated for their usefulness to future sustainability.

Scholarly papers, government documents, and non-profit websites were examined to obtain the data required to evaluate the past and current state of the temperate rainforest in Clayoquot Sound. Due to the older nature of the logging disputes, papers from 1993 onwards were utilized in order to include all relevant information. Websites, reports, and newsletters were taken from non-profit organizations such as The Sierra Club and Friends of Clayoquot Sound as they were directly related to the Clayoquot Sound protection advocacy and implementation. The Government of British Columbia website was used to obtain information about forestry policies and First Nations Treaties. Specifically, the Ministry of Forests, Lands and

Natural Resource Operations was a significant source of information. These sources assisted in achieving the purpose of this research paper: to explore the history of Clayoquot Sound, the implications of government and First Nations intervention, the implications of logging on the biodiversity of the region, and finally any implications for the future.

Background Information

Clayoquot Sound is located on the west coast of British Columbia's Vancouver Island (Lavallee and Suedfeld, 1997). It is a culturally and naturally diverse area, as is evidenced by the biogeoclimatic map shown in Figure 1 (Government of BC, 2003). As the figure demonstrates, the province is home to over 10 unique and distinct biogeoclimatic zones, with temperatures becoming increasingly mild as you move west (Government of BC, 2003). Clayoquot Sound is classified as a coastal temperate rainforest, which is a rare biogeoclimate that covers less than 1% of the world's land base. These regions experience extremely high biodiversity due to the high quality habitat and mild temperatures (Sierra Club, 2009). A unique feature of the BC jurisdiction is that approximately 95% of the province is owned by the BC government, which means that the 90 million hectares of Clayoquot Sound are managed on behalf of the residents (Government of BC, 2003). Since the government is in charge of managing the natural resources of the province, they set the timber annual allowable cut, and are in charge of dispersing this information to the forestry companies, First Nations, communities, and individuals. The government also works closely with First Nations treaty rights to ensure they are given the land they are entitled to (Government of BC, 2003).

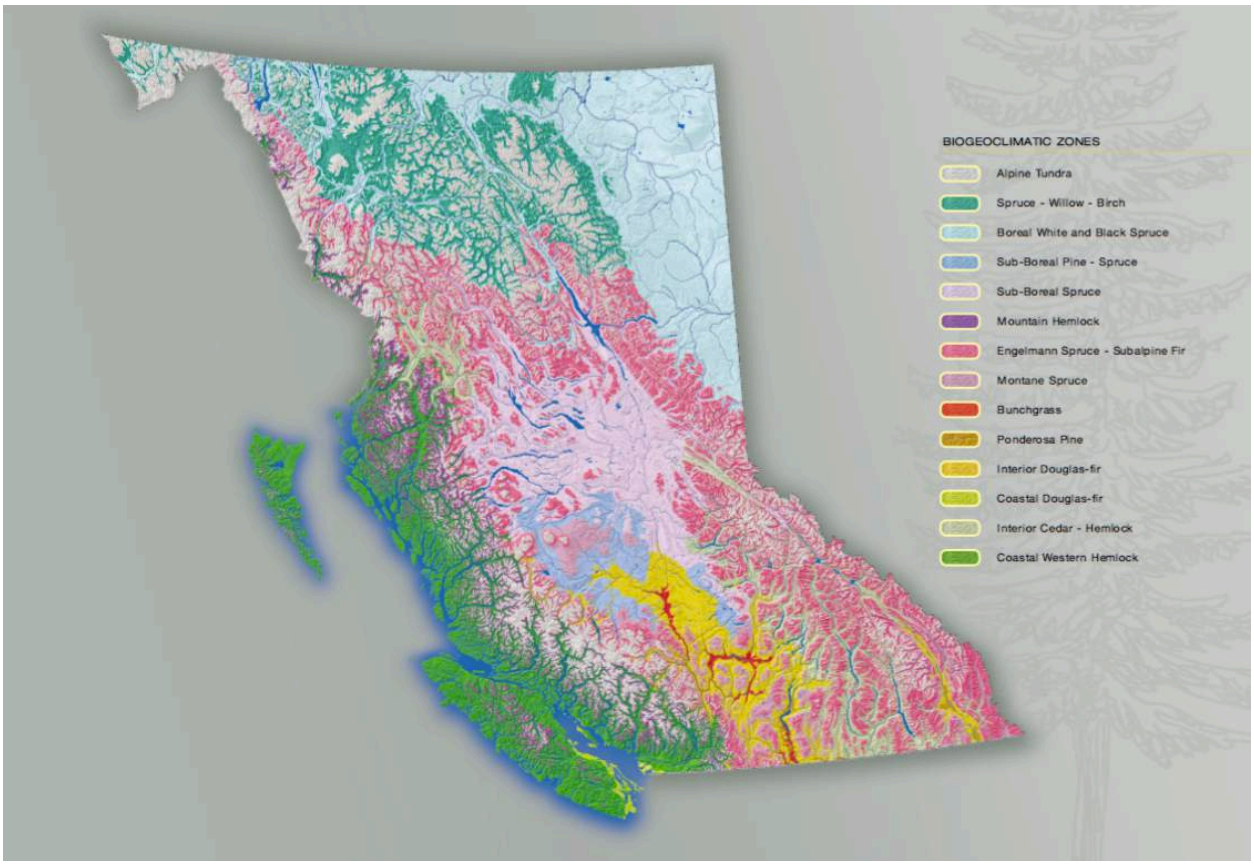


Figure 1: Biogeoclimatic Zones of British Columbia (Source: Government of BC, 2003)

Figure 1 classifies the various biogeoclimatic zones in BC, showing how diverse the region is. It is interesting to note how much of the area is represented by Coastal Western Hemlock, considering this is the main component of coastal temperate rainforest. This region represents much of the remaining coastal temperate rainforest in the world.

The history of Clayoquot Sound has been shaped through many government and First Nation interactions, as well as through input from outside sources. By 1989 most of the region had been allocated for forestry, with MacMillan Bloedel holding the largest claim (Lavallee and Suedfeld, 1997). The Clayoquot Sound Development Steering Committee was formed to

prepare a land use plan for the region, however their plan did not receive unanimous support, therefore it did not pass. In April of 1993 the BC government released its land use plan, based on what the Clayoquot Sound Development Steering Committee had previously recommended, for the area (Lavallee and Suedfeld, 1997). The plan designated 33% of the area for protection, 45% for commercial timber use, and 17% for special management areas (Lavallee and Suedfeld, 1997). The special management areas were primarily buffer zones between logging regions and the coastline of the island (Lavallee and Suedfeld, 1997). Through this plan the British Columbian government had also given MacMillan Bloedel permission to clear-cut up to 70% of the 350,000 hectares of Clayoquot Sound (Walter 2007). Clear-cut logging is the process of removing all trees from a portion of forest (NRDC, N.D.). The implementation of this management plan was not supported by the First Nations communities or the general population. In 1993 the Friends of Clayoquot Sound organization set up a protest camp along an active logging road to voice their displeasure for the clear-cutting practices of the logging industry. Over 10,000 protestors participated in the protests that lasted from July to October, making it the largest demonstration of its type in Canadian history (Lavallee and Suedfeld, 1997). In order to keep the protests in line with the initial purposes, a “Peace Camp” was created to house the protesters, as well as to ensure there were rules and standards for continuing a nonviolent protest (Walter, 2007). The protests were nationally recognized, partially due to Clayoquot Sound being a popular tourist destination, as well as its pristine natural beauty (Tindall, 2013). The environmental movement had been blossoming in the years before, also leading to increased attention for the 1993 protests. This movement helped people

to understand the importance of ecology and biodiversity, and the health, aesthetics and spiritual aspects of the environment (Tindall, 2013).

Coastal Temperate Rainforest

The coastal temperate rainforest is a unique ecosystem, with approximately half of the global rainforest left worldwide, and half of this occurring in North America. In BC the coastal temperate rainforest occurs on the coast of the mainland and covers most of Vancouver Island, see Figure 1 for a map (Government of BC, 2003). Almost all of the undeveloped coastal temperate rainforest exists in British Columbia (Bunnell, 2008). The forest on Vancouver Island is warmed by passing ocean currents and experiences large volumes of rain due to the prevailing westerly winds (Walter, 2007). Measurable precipitation occurs 200 or more days of the year, and temperatures are relatively mild in the winter and relatively cool in the summer due to the regulating properties of the nearby ocean. The coastal temperate rainforest is made up of three major biogeoclimatic zones: Coastal Western Hemlock, Mountain Hemlock, and Coastal Douglas-Fir (Bunnell, 2008).

The Coastal Western Hemlock zone covers about 87% of the temperate coastal rainforest on Vancouver Island and occurs at elevations below 900m sea level. Flora and fauna flourish in the zone and some of the largest and oldest trees grow there (Bunnell, 2008). Western hemlock is the most abundant tree in the zone with Western red cedar and Douglas-fir also occurring. Wetter and higher elevation sites grow the Amabilis fir and yellow cedar. 1000 to 4400 mm of precipitation falls in the zone, and the average temperature ranges from 5.2-10.5°C (Bunnell,

2008). An abundance of bryophytes and lichens grow in the area, many endemic, or native, to the region. Mountain Hemlock represents 12% of the land and the remaining one percent is represented by Coastal Douglas-fir, in the southern rain shadow (Bunnell, 2008).

Biodiversity is extremely high in the coastal temperate rainforest. Approximately 175 forest-dwelling, terrestrial vertebrate species breed within the area, which reflects the complex stand structure (Bunnell, 2008). Lichens, bryophytes, and vascular plants prosper in regions where there are dead trees and rotting wood, as is common on the forest floor of the region. More species use these structures, cavities and downed wood, than in any other forest type in the forest, emphasizing the diversity of the region (Bunnell, 2008). The area is naturally very diverse and is important not only for economic reasons, but also in preserving the culture of the First Nations who traditionally lived in the area.

First Nations' History on Vancouver Island

The West Coast of Vancouver Island is home to 14 Nuu-chah-nulth First Nations. The Ahousaht, Hesquiaht, and Tla-o-qui-aht are the three First Nations that have traditional territories in the region of Clayoquot Sound (Mabee and Hoberg, 2006). The Nuu-chah-nulth First Nations have interacted and maintained relationships with non-Native people since as early as the 1770s. These relationships began with the fur trade and European interests that were focused on profits through sea otter pelts (Goetze, 2005). Nuu-chah-nulth were some of the first communities to take part in the fur trade on the Pacific Coast due to their strong bargaining abilities and confidence in negotiating with the European settlers (Goetze, 2005). When the fur

trade ended in the 1850s the Nuu-chah-nulth helped the Europeans create settlements on the land. This proved to be less beneficial to the First Nations as the settlers looked to develop more permanent economies on the land, and did not require the trade assistance of the communities (Goetze, 2005). In 1849, after Vancouver Island was established, the governor purchased 14 segments of land from First Nations living along the south and north east coasts. The First Nations were free to continue their routines such as hunting, fishing, and trapping in the area; although their subsistence lifestyle did not continue for long as the settlers quickly bought the land for their own gains (Goetze, 2005).

Comprehensive treaties were required to be negotiated in order to identify their traditional territories and rights (Goetze, 2005). As logging concerns arose in the 1970s the Nuu-chah-nulth Nations brought up the conflicts surrounding irresponsible resource use by the government. Damage to streams due to the logging debris, among various other issues, was addressed through negotiations with the government and logging companies (Goetze, 2005). Throughout the 1980s and 1990s the Nuu-chah-nulth Nations had many land claims surrounding their traditional territories. By 1994 they entered a treaty process with the BC Government (Goetze, 2005). Their aim with the treaty formation was to recognize and protect their Aboriginal rights to resources, but also ensure decision making would continue within a cooperative framework (Goetze, 2005).

The Nuu-chah-nulth Tribal Council is currently negotiating a treaty with the Government of British Columbia. They are in Stage 4, which is outlined by the BC Treaty website as the agreement that will form the basis for the eventual treaty (BC Treaty, 2009). Throughout this

process both parties must include their essential points of agreement and develop plans for implementation of the treaty (BC Treaty, 2009). The framework must be agreed upon by both parties before it can move on to Stage 5, which is the negotiations that will finalize the treaty (BC Treaty, 2009).

Government Management of Clayoquot Sound

The government management of old-growth temperate rainforests in Clayoquot Sound was catered to multinational forestry companies. Originally, the resources were harvested in pursuit of short-term profit through clear-cutting, the most efficient mode of extraction (Goetze, 2005). The province was aiming to encourage economic growth and job creation. Due to the recession in the 1980s the government saw logging as a large economic benefit and relaxed their sustainability guidelines around the amount of timber logged (Goetze, 2005). The increase in logging resulted in a decrease in consultation with the First Nations communities, with the forestry companies taking charge in what was deemed to be sustainable for the forests and the surrounding ecosystems (Goetze, 2005). While the government did recognize that clear-cutting was an unsustainable solution to forest management, they were primarily focused on the economic bottom line (Goetze, 2005). After the 1993 Land Use decision, 900 square kilometres, or 34% of Clayoquot Sound, were designated for protection by the government (BC Ministry of Forests, N.D.). The land was designated to ensure the protection of the environment, local communities, and the economy (BC Ministry of Forests, N.D.). The reserve forms a link from the mountains of interior BC to the coast line of Vancouver Island, providing less chance for fragmentation of key species and habitat areas (BC Ministry of Forests, N.D.). Of the 900 square

kilometres, 700 of them are temperate rainforest, providing a key ecosystem for approximately 29 rare plant species, significant old growth forest, salmon spawning habitat, and rare marine ecosystems (BC Ministry of Forests, N.D.). It was critically important that the government set aside this area for protection, as all other stands of temperate rainforest ecosystems in the world are under some sort of threat from human destruction. Aside from the 34% of Clayoquot Sound that was completely protected, the government also placed 21% more of Clayoquot Sound under "special management" (BC Ministry of Forests, N.D.). This special management allows for some logging, but no clear-cutting, and still emphasizes the importance of protecting wildlife, along with recreational and aesthetic values (BC Ministry of Forests, N.D.). After the Land Use Decision was enacted only 40% of Clayoquot Sound was open to integrated resource management (BC Ministry of Forests, N.D.). Integrated resource management allows for logging and other resource extraction such as mining and fishing (BC Ministry of Forests, N.D.). In order for a forestry company to receive approval from the Government of BC to undergo any logging in Clayoquot Sound they must meet standards for forest management planning, road building, and harvesting limits (BC Ministry of Forests, N.D.). Conventional clear-cutting has been replaced by variable retention harvesting – which is a system that ensures key elements of the forest are left intact, allowing for the forest to healthily regenerate (BC Ministry of Forests, N.D.). The Scientific Panel also recommended that ecological assessments should be conducted for undeveloped watersheds before any additional resource extraction was undertaken (BC Ministry of Forests, N.D.).

Discussion

The coastal temperate rainforest is an essential asset to the province of British Columbia, and should be protected accordingly. A 2009 report by the Sierra Club of BC outlines the importance of old-growth forests in BC's greater ecosystems. In order to avoid species extinction in the coastal temperate rainforest, a minimum of 30% of old-growth forests need to be conserved, while 70% of natural levels should be conserved to ensure low risks to species loss (Sierra Club, 2009). Much of the ecosystems on Vancouver Island are below this threshold, with many species extinct or close to extinction. A potential benefit of the coastal temperate rainforest is its proximity to the ocean, which may buffer it from some effects of climate change (Sierra Club, 2009).

Coastal temperate rainforest is an excellent carbon sink, with an estimated carbon storage potential of 1,000 tonnes per hectare (Sierra Club, 2009). Taking advantage of this carbon storage opportunity will be important in achieving carbon reduction goals faced by Canada in the future. On Vancouver Island alone, approximately 1 million hectares of old-growth forest have already been lost, amounting to a loss of approximately 100 million tonnes of carbon reservoir (Sierra Club, 2009). Emissions from logging also contribute close to 370 million tonnes of carbon to the atmosphere (Sierra Club, 2009). This loss of a carbon reservoir coupled with the emissions from logging lead to an unbalanced emissions profile. The coastal temperate rainforest is set to become an important resource in a potentially carbon focused market of the future.

These important ecosystems are rapidly declining, with approximately 50% of all coastal temperate rainforest on Vancouver Island at high risk for species loss. It is essential to create protection and conservation areas on the island, especially since 13% of the land on Vancouver Island has already been converted from old-growth forest (Sierra Club, 2009).

Climate Change Impact on the Coastal Temperate Rainforest

Climate change has to the potential to impact almost every ecosystem on the planet, and coastal ecosystems are often the first to feel the effects. Coastal temperate rainforest is no different. Shanley et al. (2015) conducted a study of the Intergovernmental Panel on Climate Change (IPCC) models predicting the possible scenarios due to anthropogenic climate change. They found the results for indicators on the coastal temperate rainforest in Alaska and British Columbia are all projected to increase. Specifically, the report found, through analysis of IPCC models and representative concentration pathways:

Table 1: Potential Increases Due to Climate Change (Source: Shanley et al., 2015)

Year	Temperature (°C)	Precipitation – Rain (mm)	Precipitation – Snow (mm)
1961-1990	3.2	3130	1200
2080	4.9 – 6.9	3320 - 3690	720 - 500

This table outlines the potential for a large increase in temperature and precipitation in the form of rain, but a decrease in precipitation in the form of snow. There are many outcomes for the region based on these increases. These results will cause a cascade effect on the ecosystem, with a plethora of new and extreme weather events. Some issues will include an increase in floods, reduced snowpack, effects on river flow, shifts in suitable wildlife habitat, and many

additional impacts (Shanley et al., 2015). The people of the region typically rely heavily on the ecosystems goods and services, such as fishing, forestry, and ecotourism (Shanley et al., 2015). If these extreme events start occurring with more frequency the First Nations and other community members will lose their livelihood.

Climate change could potentially affect the ecosystem goods and services that the population depend upon for their economic benefits. Particularly, the fishery habitat could be altered, hydropower opportunities may become less dependable, and ecotourism activities could decline (Shanley et al., 2015). It is not expected that climate change will have an affect on forestry, further to the restrictions already put in place in the region (Shanley et al., 2015). Climate change also has the potential to effect the biodiversity of the region, so measures must be taken to protect the endemic and rich variety of species living in the coastal temperate rainforest.

Biodiversity Conservation Strategies

As outlined by the Government of British Columbia in the 1970s and 1980s, the logging company MacMillan Bloedel was granted logging rights of the region. Forestry in the region is difficult to pursue due to steep slopes, wet soil, and large equipment. After strong opposition to the clear-cutting of the region, MacMillan Bloedel agreed to stop clear-cutting in 1998 (Bunnell, 2008). In order to create a more sustainable forestry management plan, the company divided the forest into three different harvest zones, based on intensity of harvest. The first zone is the timber zone, and is classified as the primary source of economic value, and most of the

productive harvest was found in the area (Bunnell, 2008). The provision of late-seral features is meant to allow for species to survive that would not otherwise if clear-cutting was in place (Bunnell, 2008). Secondly, the habitat zone has higher retention levels than the timber zone, and only 70% of the forest is available for harvest. The goal of the habitat zone is to conserve organisms that make up the biological diversity of the area (Bunnell, 2008). Finally, the old growth zone is mostly protected as to maintain late-seral forest conditions (Bunnell, 2008).

Variable retention was implemented in all zones to retain appropriate habitat structures to maintain biodiversity. Objectives of structure retention include:

increasing species richness in managed stands through connection across the landscape to provide refuge and survival for species after harvesting of timber; creating opportunities to meet market demand of harvesting trees that will not be detrimental to forest health, vigour, genetic composition, or timber quality; meeting social expectations of stewardship and visual aesthetics; and, meeting site-specific needs for regeneration and habitat (Bunnell, 2008).

The three categories of retention are shown on Figure 2. Retention is managed differently based on the amount of trees that need to be kept in place to achieve biodiversity. Small groups of trees are retained together on the same cut block for

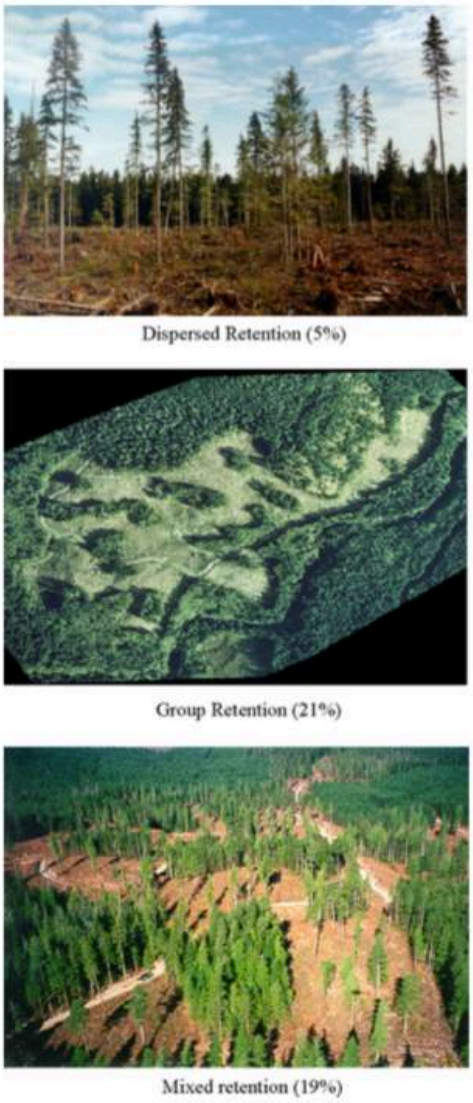


Figure 2: Retention Practices (Source: Bunnell, 2008)

group and mixed retention, while substantial amounts of trees are cut without leaving any in groups for dispersed retention (Bunnell, 2008). These methods are important to reduce potential habitat fragmentation that occurs with logging roads and powerlines. For species to have the best chance of survival, large areas of habitat must be preserved.

Economic Valuation of the Coastal Temperate Rainforest

Clayoquot Sound and The Great Bear Rainforest are both coastal temperate rainforest. The Great Bear Rainforest is located on the west coast of inland British Columbia. Both are positioned to provide economic benefits for the province, with and without logging. The book "*Great Bear Markets: The Interface of Finance, Forestry and Conservation in BC's Great Bear Rainforest"* by Andrew Norden and James Tansey outlines the economic gains that the Great Bear Rainforest can produce. Since Clayoquot Sound is the same ecosystem, and under the same provincial governance, comparisons and suggestions can be made between the two. Reduction of logging in the area can create carbon offsets through the carbon that is being stored in the remaining trees (Norden, 2011). Potential ways to earn revenue in the area include: ecotourism, hunting, logging, fishing licenses, and carbon offsetting. Carbon offsetting has the largest and most immediate potential to be economically viable based on the large stands of forests. The initial obstacle is the development of a carbon market with formal compliance. In BC, this began with the formation of the Pacific Carbon Trust (Norden, 2011). In 2013 Pacific Carbon Trust, responsible for carbon offsets for the provincial public-sector organizations, announced that the organization would be transitioned to fall under the Climate Action Secretariat through the Ministry of Environment (Pacific Carbon Trust, 2014). The

potential offset inventory of the Great Bear Rainforest, which covers 6.4 million hectares of land (Price et al., 2009), is 1 million tonnes per year for the first 30 years. A typical carbon transaction for a single buyer is usually 30,000 to 100,000 tonnes (Norden, 2011). This means that the revenue coming from carbon offsetting alone could be valued at $4 million a year. This will be split 50/50 between the First Nations in the area and the provincial government (Norden, 2011). In Clayoquot Sound, First Nations have similar land rights, and the government would have to reach an agreement with them to start carbon offsetting projects. Clayoquot Sound covers 350,000 hectares, and is substantially smaller than the Great Bear Rainforest, but there is still economic potential for the First Nations and government to profit from a carbon offsetting project (Mabee and Hoberg, 2006).

Ecotourism is a main source of income for communities on northern parts of Vancouver Island (Dodds, 2012). Tourism growth began in the mid 1980s when activities such as whale watching became popular. By the year 2007 approximately 35,000 people visit the area per year. These tourists bring in an economic value of close to $50 million a year for the region (Dodds, 2012). While there is the economic incentive to have tourists in the area, the influx of people also causes issues within the community. A survey was conducted regarding the benefits and effects of tourism in the region, and half of the respondents suggested that tourism was a good livelihood but did not enhance the community, and their sense of place was in jeopardy (Dodds, 2012). There are also potential issues surrounding infrastructure, such as sewage, in the summer months when the population is more than doubled. The small communities directly dump their sewage in the ocean and allow the strong currents to disperse it (Dodds, 2012). In

the summer when there is the large influx of people the currents are not always fast or strong enough to dispose of the excess sewage. Another issue with ecotourism is the potential for human and wildlife interactions (Dodds, 2012). There is the potential of feeding from tourists as well as close encounters, especially with bears. When tourists feed the wildlife this creates a situation where wildlife becomes dependent on the food, and are unable to survive on their own (Norden, 2011). Bear interactions typically cause more harm to the bears as they become familiarized with humans and are more likely to become pests. Unfortunately, this typically ends in their destruction by wildlife officials (Norden, 2011).

Fishing licenses are important on the West Coast due to the large salmon population of the area. There is also an abundance of aquaculture farms because of the suitable ocean habitat and ease of access. The Department of Fisheries and Oceans (DFO) are responsible for determining the rate at which fish are caught, which is a vital calculation to ensuring the sustainability of the salmon and other fish in the region (Norden, 2011). Commercial salmon farming, or aquaculture, was valued at $215 million in 2005 with the recreational fishing industry worth nearly $230 million (Norden, 2011). It is clear that salmon fishing is vital to BC as a whole, which provides further incentive to preserve the integrity of the ecosystem. Aquaculture is growing as the demand for seafood has grown, therefore it has the potential to be a key industry in British Columbia's economy.

Forestry has the opportunity to contribute to a green economy if improved forest management practices are implemented. Selective logging and longer rotation periods will contribute to

more jobs than clear-cutting would, and introduction of value-added products will also help move toward a sustainable forestry sector (Sierra Club, 2009). If the practices, such as variable retention, suggested above were to be implemented, Clayoquot Sound could once again become a viable economy for Vancouver Island and the surrounding areas. Clear-cutting has already been phased out due to government policies and agreements with logging companies such as MacMillan Bloedel, but clearing practices such as those suggested by Bunnell (2008) need to be implemented to ensure continued sustainability of the forests. Working towards a carbon economy, such as the model suggested by Norden (2011) is essential for the economic wellbeing of the region. If Clayoquot Sound and the neighbouring communities are able to achieve accreditation for their carbon sinks, this could be a profitable endeavour. Finally, ecotourism must continue to grow in a sustainable way. As Dodds (2012) outlined in her surveys, ecotourism must be completed, but the local communities must not feel as if their traditional ways are in jeopardy. The industry cannot grow at an unsustainable pace that does not allow for infrastructure to keep pace. Issues such as sewage and lodging for tourists in the summer months must be acknowledged and addressed if the industry is to continue to grow.

UNESCO

United Nations Education, Scientific, and Cultural Organization (UNESCO) biosphere reserves were first created in 1976 to create a better understanding on how to conserve biodiversity and improve human-environment interactions (Reed and Massie, 2013). Reserves are created due to the sustainability desire of local communities (Reed, 2007). All biosphere reserves are designated to “demonstrate three functions: environmental protection; logistical provisioning

for scientific research; and sustainable resource use" (Reed, 2007). These reserves contain three zones: "a core that must be protected by legislation; a buffer where research and recreational uses compatible with ecological protection are allowed; and a transition zone where sustainable resource use is practiced" (Reed, 2007). Clayoquot Sound was designated as a reserve in 2000 to help promote the conservation of biological and cultural diversity; advance sustainable development; and provide support for research, learning, and public education (Tindall, 2013; Reed and Massie, 2013). A biosphere reserve is not a protected area, but is known for being a living laboratory or a learning site. Periodic reviews are conducted for the Clayoquot Sound Biosphere Reserve (Reed and Massie, 2013). Clayoquot Sound receives much media and stakeholder attention due to the large amount of work done by non-profits in the area to raise awareness and encourage involvement in preservation of the region (Reed, 2007). These non-profits, along with government sources and First Nations, have a high level of involvement in managing Clayoquot Sound (Reed, 2007).

The idea that a biosphere reserve is a learning site encourages inclusion of local people in the process of creating a sustainable site (Reed and Massie, 2013). First Nations inclusion in the decision making process is vital for Clayoquot Sound, with the government and First Nations co-managing the area. In general, Clayoquot sound has a strong status of environmental management through work with private, public, and governmental needs to address resource management (Reed, 2007). In her study, Reed found that First Nations of the region were directly involved with resource management of Clayoquot Sound, specifically within a co-management role (2007).

First Nations' Involvement in Conservation Strategies

As the logging disputes arose in the mid-1980s First Nations and NGOs showed their displeasure through non-violent protests. One of the government solutions to the disputes was to set up an Interim Measures Agreement (IMA) between BC and the First Nations, which allowed for the co-management of the region's resources (Mabee and Hoberg, 2006).

The idea of co-management was proposed, so both the First Nations and the BC Government would have a say in how the resources were used (Mabee and Hoberg, 2006). The ultimate goal of co-managing an area is to achieve a state of equality between the two groups (Mabee and Hoberg, 2006). These types of initiatives have been prevalent in BC due to the historic treaties, as outlined above. BC has been a strong example of how First Nations' and Government's ideologies can be aligned.

Co-management cannot be seen solely as an environmental issue, for First Nations it is also a socio-political issue (Goetze, 2005). When the agreement toward co-management was created this gave the First Nations of the area more governance over "their territories and resources, protection of cultural heritage sites, and pursuit of traditional harvesting activities" (Goetze, 2005). Through the negotiation of resource use this requires the government to recognize First Nations' governance structure, where the Chiefs are responsible for land management and distribution (Goetze, 2005). First Nations Chiefs are responsible for dividing their land equitably, and in a manner that will ensure the sustainability of their tribes (Goetze, 2005). The Interim Measures Agreement (IMA) which resulted in co-management acted as a way to address the

socio-cultural, political, and legal issues and land rights issues faced by the First Nations communities (Goetze, 2005). The co-management process has been successful for the Nuu-chah-nulth First Nations as it has "advanc[ed] their aspirations concerning political and structural equity, or "systematic change," and the protection and practice of indigenous rights" (Goetze, 2005). British Columbia has the chance to share their successes surrounding co-management with the rest of Canada as well as neighbouring countries with a vested interest in First Nations negotiations. Their successes should be shared as such, and failures should be outlined as a process for improvement.

Interim Measures Agreement for Clayoquot Sound

The Interim Measures Agreement (IMA) was a result of the protests in 1993 and negotiated over a period of several months, and was updated in 2008 to extend the co-management practices (Goetze, 2005). The government was initially unwilling to negotiate regarding their involvement with land rights issues with the Nuu-chah-nulth Nation (Goetze, 2005). The persistence in negotiating allowed for the IMA to recognize many key political claims of the Nuu-chah-nulth that are closely related to resource management, their governance structure, Chief authority, and the relationship between the Nuu-chah-nulth governance and the Government of BC (Goetze, 2005). The agreement gave the Nuu-chah-nulth much control of the natural resources of their home (Magnusson and Shaw, 2003). The IMA agreements around resource management led to the formation of the Central Region Board and the Scientific Panel, which included equal representation from First Nations and BC Government (BC Government, 1994; Magnusson and Shaw, 2003). The Board provided cooperative management

of the terrestrial and marine resources, except for ocean fisheries, in Clayoquot Sound (BC Government, 1994). The unique feature of the board was that a double majority was required for any voting matters. This meant that a majority from the government representatives and the Nuu-chah-nulth representatives was required (Goetze, 2005). The IMA give Nuu-chah-nulth the position of "co-managers tangible, determinative authority to make decisions about resource use in Clayoquot Sound" (Goetze, 2005). Finally, the IMA provides a sense of positive interaction between Nuu-chah-nulth, the BC Government, and local communities (Goetze, 2005).

Conclusions

The history of Clayoquot Sound has been varied and shaped through social, political, and environmental tensions. In the 1970s and 1980s when the BC Government was looking to expand their economic activity there was little regard for the environmental goods and services provided from the coastal temperate rainforest.

The biodiversity and range of natural habitat of the coastal temperate rainforest is vast, and becoming increasingly rare. Steps must be made to ensure that the area is protected from further damage that arises through clear-cutting of an area. The protests in 1993 helped bring awareness to the issues facing the area, and non-profit, community, and governmental involvement and interest continued after the UNESCO biosphere reserve designation in 2000. This also allotted the area as a protected zone, showing British Columbia's dedication to protecting their unique ecosystem and its biodiversity. Alternative options have been

implemented to continue to obtain economic benefits from Clayoquot Sound. Utilizing the old growth forest is especially beneficial as a carbon offsetting tool as the dense and large old trees are excellent carbon sinks. Ecotourism is also very important to the region, as it boasts a mild climate, diverse scenery, and many environmental activities that are attractive to tourists. While the region is very small, it benefits from thousands of tourists a year bringing in millions of dollars to the local communities. Fishing and hunting are also popular activities, although not as economically profitable as carbon offsetting or ecotourism. First Nations' involvement in the natural resource management process has been continuous, with the Nuu-chah-nulth community being the most involved due to their close connections to Clayoquot Sound through traditional territory and subsistence activity. A significant achievement for the Government of BC and the First Nations was the agreement that allowed for a co-management of the land in and surrounding Clayoquot Sound. This was significant due to the required levels of cooperation, allowing both parties to have an equal say in the management of the ecological goods and services of the area. Initiatives similar to this should be implemented throughout Canada, with the BC Government providing relevant information for the other Provincial governments.

Climate change has the potential to significantly impact the biodiversity of Clayoquot Sound. Climate models project a large increase in mean annual temperature, and increase of approximately 100 additional millimetres of rain per year, and a decrease in annual precipitation in the form of snow. The compilation of the effects of climate change could be potentially very damaging for the coastal temperate rainforest; therefore, this area must

continue to be protected by First Nations, non-profits, and the Provincial and Federal Governments. The case study of Clayoquot Sound shows that environmental awareness about a region or specific issue is key in helping work towards preservation. When people are able to come together in peaceful protest many new agreements and regulations can be made to solve the problem. It is vital to include First Nations in the recommendation proves for ecological goods and services as they have lived off the land for much longer than we have, and are able to sustainably manage the resources. Overall, British Columbia is doing a commendable job in protecting the coastal temperate rainforest but needs to ensure future commitments are set and followed in order to preserve the forest. As the last remaining intact coastal temperate rainforest it is vital that the area is kept pristine and used as a strong example of successful environmental policies and sustainable standards.

References

British Columbia Government (1994). *Interim Measures Agreement on Clayoquot Sound between the Central Region Chiefs of the Nuu-chah-nulth Tribal Council and the Province of British Columbia.* Victoria: Ministry of Aboriginal Affairs.

British Columbia Government (2003). *British Columbia's Forests: A Geographical Snapshot*. National Library of Canada Cataloguing in Publication Data.

British Columbia Ministry of Forests, Lands and Natural Resources Operations (N.D.). *Clayoquot Sound.* Retrieved From: http://www2.gov.bc.ca. [Accessed on: 1 December 2015].

British Columbia Treaty, (2009). *Six-Stage Treaty Process.* Retrieved From: http://www.bctreaty.net/files/sixstages-13.php. [Accessed on: 2 December 2015].

Bunnell, F. L. (2008). Indicators for sustaining biological diversity in Canada's most controversial forest type-coastal temperate rainforest. *Ecological Indicators, 8*(2), 149-157. 2006.11.007

Bunnell F.L., Dunsworth G.B. (Eds.) (2009). *Forestry and biodiversity: Learning how to sustain biodiversity in managed forests*. Vancouver: UBC Press.

Dodds, R. (2012). Sustainable tourism: A hope or a necessity? the case of Tofino, British Columbia, Canada. *Journal of Sustainable Development, 5*(5), 54-64.

Goetze, T. C. (2005). Empowered co-management: Towards power-sharing and indigenous rights in clayoquot sound, BC. *Anthropologica, 47*(2), 247-265.

Hoberg, G., & Morawski, E. (1997). Policy change through sector intersection: Forest and aboriginal policy in clayoquot sound. *Canadian Public Administration, 40*(3), 387-414. 1997.01516.

Lavallee, L., & Suedfeld, P. (1997). Conflict in clayoquot sound: Using thematic content analysis to understand psychological aspects of environmental controversy. *Canadian Journal of Behavioural Science/Revue Canadienne Des Sciences Du Comportement, 29*(3), 195-210.

Mabee, H. S., & Hoberg, G. (2006). Equal partners? assessing comanagement of forest resources in clayoquot sound. *Society & Natural Resources, 19*(10), 875-888.

Magnusson W., Shaw K. (Eds.) (2003). *A political space: Reading the global through Clayoquot Sound*. Montreal: McGill-Queen's University Press.

Natural Resources Defense Council (NRDC) (N.D.). *What is Clearcutting?* Retrieved from: http://www.nrdc.org/land/forests/fcut.asp. [Accessed on: 1 December 2015].

Norden, A. (2011). In Tansey J., Sustainable Prosperity., University of British Columbia. and Canadian Electronic Library (Firm). (Eds.), *Great bear markets: The interface of finance, forestry and conservation in BC's great bear rainforest*. Vancouver, B.C.: ISIS Research Centre.

Pacific Carbon Trust (2014). *Annual Report 2013/2014.* Retrieved from: http://www.pacificcarbontrust.com. [Accessed on: 25 November 2015].

Price, K., Roburn, A., & MacKinnon, A. (2009). Ecosystem-based management in the great bear rainforest. *Forest Ecology and Management, 258*(4), 495-503. 2008.10.010

Reed, M. G. (2007). Uneven environmental management: A canadian perspective. *Environmental Management, 39*(1), 30-49.

Reed, M., & Massie, M. (2013). Embracing ecological learning and social learning: UNESCO biosphere reserves as exemplars of changing conservation practices. *Conservation and Society, 11*(4), 391-405.

Shanley, C., *et al.* (2015). Climate change implications in the northern coastal temperate rainforest of North America. *Climatic Change, 130*(2), 155-170.

Sierra Club BC (2009). *State of British Columbia's Coastal Rainforest: Mapping the Gaps for Ecological Health and Climate Protection*. Retrieved from: www.sierraclub.ca/bc. [Accessed on: 15 November 2015].

Tindall, David (2013, August 12). Twenty Years After the Protest, What We Learned from Clayoquot Sound. *The Globe and Mail.* Retrieved from: http://www.theglobeandmail.com. [Accessed on: 7 October 2015].

Walter, P. (2007). Adult learning in new social movements: Environmental protest and the struggle for the Clayoquot Sound rainforest. *Adult Education Quarterly, 57*(3), 248-263.