

CONNECTIONS BETWEEN CLIMATE POLICY AND FORESTS IN THE  
WESTERN CLIMATE INITIATIVE CAP-AND-TRADE SYSTEM

by

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A thesis submitted to the School of Environmental Studies

in conformity with the requirements for

the degree of Master of Environmental Studies

Queen's University

Kingston, Ontario, Canada

October, 2009

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## Abstract

The Western Regional Climate Action Initiative (WCI) was signed by the governors of Arizona, California, New Mexico, Oregon, and Washington, on February 26, 2007. Upon the release of the September 2008 *Design Recommendations for the WCI Regional Cap-and-Trade Program*, the WCI also included Montana, Utah, and the Canadian provinces of British Columbia, Manitoba, Ontario, and Quebec. A WCI goal is to reduce regional greenhouse gas (GHG) emissions 15% below 2005 levels by 2020. It has previously been recognized that the region's forests can be important carbon sinks and sources, and it has been suggested that the carbon-storage capacity of forests may have economic value. Here, connections between forests and the developing WCI cap-and-trade system design are examined. Qualitative comparative analysis is used to examine characteristics of US states participating in the WCI. Content analysis is used to identify what advocacy groups promote what forest-related WCI cap-and-trade rules. A combination of low per capita GHG emissions, and strong environmental politics, is found to be related to regional climate initiative participation by US states, with important exceptions among WCI participants. Forest industry presence alone does not obviously influence participation. Electric utility and industry groups, including the forestry sector, are found to support an extensive WCI carbon offset system. Forest industry groups are also found to support the carbon neutrality of forest biomass combustion, and oppose regulating forest carbon emissions. Several environmental non-governmental organizations are found to oppose extensive carbon offset use, and oppose the unconditional consideration of biomass combustion as carbon neutral. Forest related aspects of the *WCI Design Recommendations* of September 2008 are found to largely agree with forest industry advocated policies. Some WCI provisions may provide incentives for forest carbon loss, or weaken the GHG emissions cap. Three recommendations are made: consideration should be given to appropriately discounting forest offset projects to address carbon emissions leakage; forest carbon emissions from land conversion should be accounted for; combustion of forest biomass from old-growth forests should not be considered carbon neutral.

## Acknowledgements

I Acknowledge the support of the Queen's University School of Environmental Studies, the Social Sciences and Humanities Research Council of Canada<sup>1</sup>, and of my thesis supervisor Graham Whitelaw.

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<sup>1</sup> This research was funded in part by Joseph-Armand Bombardier Canada Graduate Scholarship Award No. 766-2008-0397.

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## List of Abbreviations

ACESA	American Clean Energy and Security Act
CCAR	California Climate Action Registry
CCX	Chicago Climate Exchange
CDM	Clean Development Mechanism
EIA	Energy Information Administration
ENGO	Environmental Non-Governmental Organization
EPA	United States Environmental Protection Agency
EU ETS	European Union Emission Trading Scheme
GHG	Greenhouse Gas
IBP	International Biological Program
IPCC	Intergovernmental Panel on Climate Change
MGGRA	Midwestern Greenhouse Gas Reduction Accord
NGO	Non-Governmental Organization
QCA	Qualitative Comparative Analysis
RGGI	Regional Greenhouse Gas Initiative
UNFCCC	United Nations Framework Convention on Climate Change
WCI	Western Climate Initiative

# Chapter 1: Introduction

The Western Regional Climate Action Initiative (WCI) was signed by the governors of Arizona, California, New Mexico, Oregon, and Washington, in February 2007 (WCI, 26 February 2007). Upon the release of the September 2008 *Design Recommendations for the WCI Regional Cap-and-Trade Program*, the WCI also included Montana, Utah, and the Canadian provinces of British Columbia, Manitoba, Ontario, and Quebec (Barringer, 23 Sept 2008). (See Appendix A, Map 1.) A WCI goal is to reduce regional greenhouse gas (GHG) emissions 15% below 2005 levels by 2020 (WCI Work Plan 2007, p1).<sup>2</sup> The WCI has recognized that the region's forests can be significant carbon sinks and sources (WCI, Jan 2, 2008). Indeed, it has been suggested there may be “significant economic value” represented by the carbon storage capacity of forests in the Pacific Northwest (Smithwick et al. 2002). The WCI includes a plan for a regional cap-and-trade system for GHG reduction. The WCI defines a cap-and-trade program as follows:

“The state or provincial government sets an absolute aggregate limit (or “cap”) on GHG emissions from a sector or multiple sectors. Tradable emissions ‘allowances,’ or permits, are then distributed in an amount that equals the total emissions permitted by the cap.” It is noted, “These allowances can be distributed by auction and/or be allocated at no cost. Partner governments will specify which entities and facilities must surrender allowances to cover their emissions” (WCI Overview, p1).

The connection between climate policy and forests in the WCI cap-and-trade system design is the research topic of this project. With regard to forests, the focus is on the coniferous forests of western North America, which are found in the WCI jurisdictions of California, Oregon, Washington, and British Columbia. The design of this project uses a nested analysis approach,

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<sup>2</sup>Appendix B compares this target to the Kyoto Protocol target, for the US states that have joined the WCI. For California the target might be considered similar, but several years late. If this target were to be applied to all of Canada, it would still put Canada behind its 2008–2012 Kyoto target of a reduction of 6% below 1990 level. National GHG emissions targets are listed in Annex B of the Kyoto Protocol (UN 1998).

as advocated in Lieberman (2005).<sup>3</sup> The WCI is examined both on a larger scale, in the North American context, and in detail as a policy making process (the smaller-scale analysis being nested within the larger-scale analysis). According to Gerring (2008), “Case-study analysis focuses on one or several cases that are expected to provide insight into a larger population” (p28). In the narrow sense used by Gerring, this research project does not primarily use the Western Climate Initiative as a ‘case study’ to gain insight into a broader population of regional cap-and-trade systems. Rather, data from multiple sources are used to provide insight into the WCI itself.<sup>4</sup>

The participating US states have total greenhouse gas (GHG) emissions of about 871 million metric tonnes of carbon dioxide equivalent (MtCO<sub>2</sub>eq) per year, which is about 13% of US total GHG emissions<sup>5</sup> (WRI), and greater than all of Canada’s 2006 GHG emissions of 747 MtCO<sub>2</sub>eq (Environment Canada 2009). The 2004 GHG emissions for the four Canadian provinces participating in the WCI were 381.8 MtCO<sub>2</sub>eq.<sup>6</sup> The WCI is important to Canada because of the Canadian participation, and because it has been the stated intention of the Government of Canada (2008, p29) to closely watch climate change policy developments in the United States. Moreover, it is one of the stated intentions of the WCI to influence the development of US federal climate change policy<sup>7</sup> (WCI, Feb 26, 2007). Climate policy adopted

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<sup>3</sup> Examples of studies that use a nested approach, or what is called a ‘combined’ approach are given in Ragin (1987). In these studies, aggregate statistics over a large number of cases (for example nation states) are used to form hypotheses, which are then ‘tested’ by the in depth analysis of a smaller number of cases. In Lieberman (2005) qualitative comparative analysis is mentioned as a possible method to be used for the larger-scale analysis.

<sup>4</sup> In many respects the WCI Partners may be more typical of state and provincial jurisdictions in the US and Canada than are RGGI members, and so the issues involved in the development of the WCI may provide insight into the issues involved in setting up a US program, at the federal level, which Canada might join.

<sup>5</sup> For 2007 the US total net emissions were 6,087.5 Tg (million metric tons), with the land-use sink 1,062.6 Tg (EPA 2009).

<sup>6</sup> The 2004 emissions for the Canadian Provinces now Partners to the WCI are: BC (66.84Mt), Manitoba (20.01Mt), Quebec (91.84Mt), and Ontario (203.11Mt), for a total of 381.8 million metric tons (Environment Canada, National Inventory Report, 1990-2004 - Greenhouse Gas Sources and Sinks in Canada).

<sup>7</sup> In the Western Regional Climate Action Initiative document, which establishes the WCI, the signatories commit to, “Advocating regional and national climate policies that reflect the needs and interests of western states, tribes and provinces”(WCI, Feb 26, 2007, p2).

by British Columbia, Ontario, Manitoba, and Quebec has the potential to influence national climate change policy discussion in Canada. This project focuses on a limited aspect of WCI design: cap-and-trade design elements related to forests. However, broader WCI design issues, such as the extent to which carbon offset credits (thus including forest offset projects) can be used for compliance, is one of the most important ways that the WCI may impact forests. This means some background on the overall WCI system is necessary for understanding potential impacts on forests. Topics related to forest ecosystem integrity, such as the relationships between forest carbon ecosystem accumulation and the development of old-growth forest characteristics, are also important for understanding the potential implications of cap-and-trade program elements.

Potential WCI impacts on forests and the WCI GHG cap integrity, and their relationship to the interests of the WCI Partners and stakeholder groups, lead to the following research questions (see Table 1) about the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept. 23, 2008):

Table 1. Research Questions
1. What economic and political factors are related to state participation in the WCI?
2. What policies are supported by what advocacy groups?
3. Which policy interests, of what organizations, or WCI Partners, are most strongly reflected in the WCI cap-and-trade system design recommendations?
4. Does the WCI cap-and-trade system have the potential to promote forest conservation or forest ecosystem restoration?
5. How might the role of forests in the WCI cap-and-trade system affect the integrity of the cap on greenhouse gas emissions?

The subsequent chapters include a literature review, background information on the WCI, development of a conceptual framework, description of methods, presentation of results, and a concluding discussion. The literature review covers the topics of ecological integrity, forest

carbon, and climate policy. The conceptual framework is informed by the literature review. The study then proceeds with the qualitative comparative analysis of regional cap-and-trade system participation, and the content analysis of WCI stakeholder comments. The interpretation and implications of the results are elaborated upon in the discussion chapter.

## **Chapter 2: Literature Review**

This literature review provides context for interpreting the qualitative comparative analysis of WCI participation, and the content analysis of stakeholder comments. It also aims to draw connections with existing theory on environmental policy. Furthermore, West Coast climate and forest policy will be situated in the broader context of Canadian, US and international environmental policy. The literature review is used to design a conceptual framework, which is presented at the end of the literature review.

This literature review is organized into three sections: ecological integrity, forest carbon, and climate policy. In the ecological integrity section, literature is reviewed on forest ecosystems, including the concept of old-growth forest. The forest carbon section includes forest carbon storage, forest fire, and forest product burning; this is placed in the context of GHG emissions from the combustion of fossil fuels. The climate policy section reviews literature on cap-and-trade systems, and forest offsets.

### **2.1 Literature Review Related to Ecological Integrity**

This part of the literature review covers topics with implications for the ecological integrity of forest ecosystems, including concepts of forest succession and forest management, and the concept of old-growth forest. Important components of ecological integrity include the maintenance of biodiversity, and of ecosystem processes which support biodiversity (DellaSala et al. 1996; Grumbine 1997). Forest with old-growth characteristics is important to ecological integrity in part because processes and structure related to old-growth have been associated with maintaining biodiversity (Carey and Curtis 1996; Henjum 1996). Moreover, the quantity of carbon in forest ecosystems can increase with forest age (Harmon et al. 1990; Luysaert et al.

2008). Thus the topics which are addressed in this section are relevant to the topics of forest carbon and climate change policy which are addressed in later sections of the literature review.

The fate of the old-growth coniferous forests of the West Coast of North America has been the subject of public debate in both the Pacific Northwest (Thomas et al. 1988; Rajala 1998; Satterfield 2002; Barringer 2007) and British Columbia (Rajala 1998; Wilson 1998; Ross 2005; Pralle 2006). See Appendix A, Map 3, for a location map. Understanding the emergence of the concept of old-growth is important for understanding the political debate surrounding forests and climate change.

The ecological concept of old-growth forest, as a stage of forest succession in the coastal temperate rain forest of the West Coast, emerged over the 1970s and 1980s (Franklin and Spies 1991; Hayward 1991). The old-growth stage of forest succession is characterized not only by species composition, but also by ecosystem structure and function; it is understood as dynamic rather than stable, and forest attributes are understood to be influenced not only by prevailing average climate, but also by occasional disturbance, often by wind or fire (Hunter and Parker 1993; Kramer et al. 2001; Wimberly and Spies 2001; Bartemucci et al. 2002; Shaw et al. 2004).

Ecological concepts, from both before and after the development of the concept of old-growth forest, have had their interpretation shaped by politics. Pyne (1982) examines the role of science in the political debate over forest fire management; Rajala (1998) does the same for the relationship between science and the political debate over clear-cutting. Studies by Pralle (2006) and Satterfield (2002) have examined contested characterizations of old-growth forest from different political and cultural viewpoints. These studies provide examples of how ideas related to ecosystem integrity, or environmental quality, can be shaped differently by different advocacy groups. These major studies of forest politics in North America have largely left the issue of climate change unaddressed; however, in a note, Pralle remarks, “In the future, environmental groups might attach forest preservation to the issue of climate change” (p240). A study of how connections between forests and climate change are now being shaped by politics in the WCI

process complements previous work on the political contextualization of concepts related to ecological integrity.

### **2.1.1 Forest Ecosystems and Forest Management**

*“The forestry problem is continually becoming more important, but the relation of bird life to forests and forest succession has received little attention. As agents for scattering seeds of trees and shrubs, birds are very important. Here is where the interests of the avian ecologist and forest ecologist overlap” (Adams 1908, p149).*

*“Since it is our belief that more is to be gained from a study of the living bird than from a series of museum specimens, we refrained from collecting the birds” (Allen and Kellogg 1937, p164).*

The twentieth century in North America saw shifts both in concepts of forest ecology, and in models of forest management. In forest management there was a shift from relatively uncontrolled resource extraction, to models of sustained yield (McDonald 1954; Clary 1987; Drushka 2003) and ecosystem management (Grumbine 1994; Christensen et al. 1996; Thomas 1996). The development of the sustained-yield model was motivated by concerns over timber shortages (Pinchot 1891; Merriam 1938), as discussed later, while the ecosystem management model was motivated by concerns over a broader range of environmental problems, including biodiversity loss.

Early 20<sup>th</sup> century concepts of habitat, such as the life-zone system, which was developed by Merriam and others, seem to have emphasized abiotic factors such as climate (A. 1892; Odum 1945); or to have considered habitats to be relatively uniform (Yapp 1922). Some research on bird habitat, published in the 1940s, still referred to the largely abiotic considerations of the life-zone system (Oberholser 1940; Marshall 1942). Later, there was increased interest in the biome system, which in contrast to the life-zone system, gave more importance to biotic aspects of habitat (Shelford 1945). The concept of an ecological climax community as developed by Frederic E. Clements and others emphasizes the importance of climate, dominant tree species, and climax community stability (Clements 1936; Whittaker 1953). This concept

recognized dominant vegetation as an important aspect of habitat; however, the effect of the dominant vegetation on the rest of the ecosystem seems to have been assumed to be relatively stable and uniform. The climax forest community concept recognized a connection between bird species and dominant tree species (Odum 1945); however the connection between bird species and structural characteristics associated with forest age was not very developed. Aspects of the life-zone and biome systems are often now discussed in terms of abiotic and biotic factors, and it is recognized that both are important (Wimberly and Spies 2001).

The development of ecosystem-based forest management seems to have required a recognition of the importance of biotic aspects of habitat. Without this recognition it would be difficult to consider the idea of an integrated ecosystem. Early in the twentieth century the coastal temperate rain forest does not seem to have been considered highly important wildlife habitat (Munger 1930). There was a tendency for problems of plant ecology and animal ecology to be approached separately (Wheeler 1902; Spalding 1903). However, at least by 1908 a call was being made for a shift from collecting bird specimens to the study of birds in their field environment (Adams 1908; Allen and Kellogg 1937). The ivory-billed woodpecker provides an example of the recognition of a connection between habitat and late-successional forest (McIlhenny 1941; Hamerstrom et al. 1942). The concept of old-growth forest would emphasize dynamic stability under disturbance regimes, habitat heterogeneity, and a more holistic understanding of the connections between species.

### 2.1.2 Environmental Concerns Before the Old-Growth Concept

*“We are confronted in many of our states with peculiarly difficult problems of reforestation. Land that has been the greatest source of wealth to the state is now a wilderness practically worthless until it is clothed again with forests. How this is to be accomplished is one of the most serious economic problems that the present generation is called upon to solve” (Spalding 1903, p210).*

*“Man’s industry in converting the forest into useful products is having a cataclysmic effect on land productivity” (Munger 1930, p331).*

Early in the 20<sup>th</sup> century, forest sustainability was already a concern in North America, but the concern was more with deforestation and timber depletion than with the conservation of old-growth forest and ecological value (Spalding 1903, p210; Drushka 2003).

Problems related to failed forest regeneration became a major subject of ecological research. Difficulties experienced with regeneration are discussed in Issac and Hopkins (1937), and Merriam (1938). The belief that Douglas-fir (*Pseudotsuga menziesii*) forest would regenerate easily after being harvested, which was disappointed by the results being observed, was based in part on faulty theories of seed dispersal (Hofmann 1920; Rajala 1998; Brock 2004). Hagar (1960) noted that a former stand of Douglas-fir had undergone “discouraging” regeneration efforts (p116). Failed redwood (*Sequoia sempivirens*) forest regeneration was observed (Florence 1965). Research in forest ecology seems to have focused on the earliest stages of forest succession (regeneration after disturbance) rather than on later stages (the development of old-growth characteristics). For example, research was done on the regeneration of forests after fire (Larsen 1929). The history of failed forest regeneration on the West Coast has been studied by Rajala (1998) and Brock (2004). As early as 1938 other concerns were already present, including “floods, washouts, [and] silting-up of game-fish streams” (Merriam 1938); however, timber depletion seems to have been the greatest concern. The realization that forest re-establishment was not proceeding as hoped motivated research into forest regeneration, and the call for sustained-yield policies.

In the 1930s there was debate over the relative merits of clear-cutting and selective logging, which centered on issues of forest regeneration (Rajala 1998). Early in the twentieth century, there was also debate over the relative merits of forest fire suppression and prescribed burning (Pyne 1982). To the extent that these issues are related to forest carbon fluxes, it can be said that an interest in forest carbon is not an entirely new concern.

In the first half of the 20<sup>th</sup> Century, concern over the loss of species led to legislation such as the Migratory Bird Convention between Canada and the US, the International Convention for Regulation of Whaling (Vallance 1937; Canadian Press 2008); and the Bald Eagle Protection Act of 1940 (Boyd 1970). Forest conservation and species conservation were generally addressed as separate issues. Early bird (Means 1998) and whaling conventions (US Department of State 1949) regulated hunting, not habitat destruction.

### **2.1.3 Calls for Sustained Yield**

*“For purposes of simplification, the forest is considered as a producer of wood substances only” (McDonald 1954, p389).*

*“The cases where a forest reaches its highest usefulness by simply existing are rare” (Pinchot 1891, p12).*

In the 1891 report *Government Forestry Abroad*, Gifford Pinchot used the language of sustainability, arguing that the state has “the obligation to hand down its forest wealth unimpaired to future generations” (p11). Pinchot’s concerns focused on timber value. In the paradigm of sustained yield, forests were still primarily regarded as areas for timber production. Pinchot promoted transition to a sustained-yield model. Later, Merriam (1938) does the same. The growing interest in sustained yield policies is documented in *Science News-Letter* (1934). However, these calls for sustained yield management did not involve any special concern for old-growth conservation.

In *The Challenge of Reforestation: Ecological Experiments in the Douglas Fir Forest, 1920-1940* (2004), Brock recounts efforts to implement a sustained-yield forest management model, as does Rajala in *Clearcutting the Pacific Rain Forest: Production, Science, and Regulation* (1998). Attempts to establish a sustained-yield model included early fire suppression, and reforestation efforts (Pyne 1982; Rajala 1998).

#### **2.1.4 Emergence of the Old-Growth Forest Concept**

***“During the past 2 decades the concept has developed of old growth as a unique forest resource with inherent value resulting from ecological functions and composition of the forest”(Hayward 1991, p111).***

In the titles of scientific journal articles, there is a transition from the term “climax forest” to the term “old-growth forest.” Some of this transition seems to take place over the period 1970-1980. This shift in terminology is consistent with the observation in Franklin and Spies (1991) and Hayward (1991) that the concept of old-growth emerged over the 1970s and 1980s. The term old-growth forest was used earlier as well (Jacot 1935; Merriam 1938), but not with the same ecological meaning that it would acquire later. The emergence of the concept of old-growth can be related to research into forest ecosystems, some of which was done in association with the International Biological Program (as discussed later in this chapter). Research on the spotted owl (*Strix occidentalis*) has also paralleled a growing understanding of old-growth forest ecosystems.<sup>8</sup>

**The Emergence of Second Growth.** Interest in old-growth forest ecosystems may have been related to the regeneration of forests that had been cut around the beginning of the twentieth century. With this regeneration there was new growth, with which old-growth could be

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<sup>8</sup> Thomas (2000) notes that a spotted owl study, contracted for in 1974 “coupled with the requirements of the ESA [Endangered Species Act] and the NFMA [National Forest Management Act], and after much additional research, would dramatically change the complexion of forest management in the Pacific Northwest” (p4).

contrasted. As noted in Brock (2004), we are just now seeing the results of reforestation efforts that were made eighty years ago. Until there was an abundance of second growth to be contrasted with old-growth, many questions about the quality of regenerated forest relative to old-growth may have remained unasked.

**Lack of Application of the Climax Forest Concept to the Pacific Northwest.** Whittaker (1953) proposed moving ecological theory beyond the traditional concepts of climax communities. The concept of old-growth forest is an example that fits Whittaker's (1953) proposal of a "climax pattern hypothesis." According to Whittaker, this hypothesis was both a "synthesis of," and "an advance beyond," various climax theories (p60). Even in Clements (1936) it is noted that coniferous forest climax communities were more difficult to identify than some other types, since in the later stages of succession the change in composition of tree species was not as marked as in mixed or deciduous forests.

The climax forest concept may not have been especially useful for describing late-successional coniferous forests in the Pacific Northwest. In coniferous forests, transition to late-successional stages may be marked better by the emergence of structural characteristics, such as snags, coarse woody debris, and small forest gaps, and a multi-layer canopy, rather than a change in dominant tree species (Franklin and Spies 1991). That the climax forest concept was not completely adequate for describing the late-successional coniferous forests of the West Coast may have contributed to the development of the concept of old-growth.

**Growing Environmental Concerns.** The extinction of the passenger pigeon (Hodge 1912), the total or near extinction of the ivory-billed woodpecker (Jackson 2006), and the decline of the California condor (Wilbur 1973), all raised concern about species loss. The influential book *Island Biogeography* (MacArthur and Wilson 1967) focused on the importance of habitat area,

and the distance between “islands” of habitat (whether actual islands, or patches of forest, caves, or lakes— which are islands in seas of land). In *Island Biogeography*, there are maps of the progress of deforestation in Wisconsin, due to the clearing of land. In these maps, land is simply divided into forest and non-forest. Studies, which took place later, on spotted owl habitat in Oregon would divide the landscape into old-growth and younger growth (Forsman et al. 1977, 1984). As further indicated in Loucks (1970), which theorized on the relationship between biodiversity and succession in ecosystems, a major question in ecology becomes: How do ecosystems maintain diversity of species? This question relates to whether providing incentives for carbon accumulation in old-growth forest ecosystems may also promote conservation of biodiversity, which for this project, is largely represented by the spotted owl as an indicator species.

**The International Biological Program.** The International Biological Program (IBP) has been recognized as having made an important contribution to the development of ecosystem science (Slocombe 2004). By 1961 the IBP was being discussed by the International Council of Scientific Unions. One of the problems to be addressed was the extinction of species due to human factors (*Science* 1961). An outline for the IBP was presented at Morges, Switzerland, May 21-22, 1962. Projects which were planned included, among others, a general survey, studies of photosynthesis and nitrogen cycling, and research into methods of ecosystem conservation (Stebins 1962). By 1970 a proposal was made for a study of the coniferous forest ecosystem of the western US, as part of the US contribution to the IBP. The research goal outlined in the proposal was “a complete understanding of the forest ecosystem” which would “provide a basis for more intelligent management and use of these lands” (Gessel 1970). By 1974 studies conducted as part of the IBP were contributing to research on old-growth forest (Sherwood 1974; Pike et al. 1975). The interest in forest ecology research, for motivations of both conservation and economic productivity, contrasts with an earlier concern with more limited

aspects of forest ecology related to forest regeneration for the purpose of timber production. This new research seems to have helped make a transition from a sustained-yield model to an ecosystem model of forest management possible.

**Spotted Owl Research.** Before the 1970s, very little was known about the ecology of the spotted owl (Marshall 1942; Forsman 1975; Forsman et al. 1977). At the time of a 1960 study, it seems not to have been widely recognized that the spotted owl was in decline, as it is noted that, “The spotted owl possibly is a rather common bird” (Hagar 1960, pp123-124).

The northern spotted owl (*Strix occidentalis caurina*) was declared threatened by the state of Oregon in 1975 (Noon and McKelvey 1996, p136). In 1977 a study on the relationship between spotted owl habitat and old-growth forests in Oregon was published (Forsman et al. 1977). Spotted owl habitat has been found to depend on large trees, older than 150 years (Noon and McKelvey 1996, p136). Since 1983 the northern spotted owl has been used by the US Forest Service as an indicator species of old-growth forest ecosystem integrity<sup>9</sup> (Noon and McKelvey 1996). Spotted owl research seems to have contributed to the development of the old-growth forest concept. The understanding of spotted owl habitat that has developed does not fit well into a concept of stable climax forest communities defined by dominant tree species. The value of forest as spotted owl habitat is determined by other attributes as well, such as those associated with stand age.

### **2.1.5 Ecological Definitions of Old-Growth Forest**

In assessing the potential impacts of the Western Climate Initiative on forest ecosystem integrity, this study relies on the ecological definition of old-growth forest. A general definition of old-growth forest is given in Franklin and Spies (1991): “Old-growth forests are later stages

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<sup>9</sup> The marbled murrelet (*Brachyramphus marmoratus*) is another species that has the potential to act as an indicator species of old-growth forest in western North America (Abate 1992); moreover, since its range extends further to the north than the spotted owl’s (Piatt 1993) it is applicable to Alaskan and Canadian coastal temperate rainforest.

in forest development that are often compositionally and always structurally distinct from earlier successional stages” (Franklin and Hemstrom 1981 cited in Franklin and Spies 1991). This differs from a definition of climax forest because of the emphasis on structural, rather than compositional factors. In Booth (1989) there is a reference to “Classic Old Growth”: “These forests are older than 250 years, with big trees, big downed logs, and big standing snags” (Booth 1989, p142). A general definition may refer to the age of trees; however, structure, species composition, and ecosystem function are more critical to ecological definitions of old-growth forests than age alone.

Ecological understandings of old-growth forest can incorporate structure, function, species composition, and disturbance regime (Franklin and Spies 1991). In Hayward (1991) a definition of old-growth based on population dynamics, relying on the age structure of populations of trees, is proposed. There is not a fixed age that is universally used to define old-growth forest. Franklin and Spies (1991) notes that the age associated with the development of old-growth forest will depend on forest type and history. Likewise, Hayward (1991) remarks, “Because of variation in disturbance patterns, [...] tree mortality, and numerous other factors, forests develop at different rates. Thus, age should not be the driving factor in formulating old-growth definitions” (p113). In the ecological sense, old-growth characteristics develop over a range of ages, rather than at a particular age.

The appropriate definition of old-growth varies with forest type and region (Franklin and Spies 1991). For example, a shift from Douglas-fir to a mixture of Douglas-fir, western hemlock and other shade tolerant species marks a transition to old-growth forest at mid and low elevations in western Oregon and Washington (Franklin and Spies 1991 citing Franklin and Hemstrom 1981).<sup>10</sup> As noted in Hayward (1991), “The old, temperate, rain forests of the Pacific Northwest and southeastern Alaska represent the type of ecosystems most commonly associated with the concept of old growth” (p111). While the ecosystem climax concept was developed in

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<sup>10</sup> The emphasis on mixed stands contrasts with a model of forest succession where dominance by western hemlock was considered the final stage of succession (Munger 1940).

other ecosystem types, and then transferred to the forests of the Pacific Northwest (Clements 1936), the concept of old-growth forest developed on the West Coast, and efforts have been made to export it elsewhere (Franklin and Spies 1991; Hayward 1991).

One reason that old-growth attributes are ecosystem specific is that they are associated with disturbance regimes (Franklin and Spies 1991). This contrasts with the climax forest concept, where climate was attributed primary importance. Small gap disturbances have been recognized as important to the development of old-growth attributes in some forest types (Bartemucci et al. 2002). Frequency, intensity, and type of disturbance may alter the development of old-growth forest attributes.

### **2.1.6 Forests and Climate Change**

Recent evidence related to forest fire (Westerling et al. 2006), tree mortality rates (van Mantgem et al. 2009), and the effects of the pine beetle epidemic in British Columbia (Kurz et al. 2008) suggests that climate change is already altering the forests of western North America. The effects that climate change may have on tree growth could show regional variation. For example, in some areas Douglas-fir tree growth may be limited by moisture availability, and in others by the length of the growing season which is determined by snow pack. Climate change could slow growth in dry areas, but increase growth in subalpine areas (Littell 2008). In Alaska warming and the melting of permafrost may lead to a transition to less black spruce and more white spruce (Wirth et al. 2008). An important implication for the WCI is that the assuming that land-use sinks will be maintained, and can be used on a region-wide level to offset fossil fuel emissions may be optimistic. A detailed consideration of how forest ecosystems might react to climate change is largely beyond the scope of this thesis project, in part because the WCI GHG emissions reduction goal for the year 2020, which is under consideration, is relatively near-term.

### **2.1.7 Summary of Literature Review on Ecological Integrity**

In summary, ideas related to forest ecology and forest management changed significantly over the 20<sup>th</sup> Century. Old-growth forests are high in ecosystem carbon, and valuable as habitat. This means that there may be potential for the concurrent conservation of forest carbon, and forest ecosystem biodiversity in some cases. However, simply increasing the quantity of forest biomass may not directly address issues of biodiversity conservation. Habitat restoration is complex, research still on-going, and restoration would be experimental. As well as quantity of forested landscape, the maintenance of old-growth forest characteristics, and of disturbance regimes is important.

## **2.2 Literature Review Related to Forest Carbon**

Forest carbon is important as a link between climate change mitigation policy and forest ecosystems. This section covers topics related to forest carbon, including forest carbon storage and sequestration, and causes of forest carbon emissions, such as forest harvesting, forest fires, and the burning of forest products. Forest-related carbon sinks and sources are also placed in the context of fossil fuel emissions, which are the principal cause of anthropogenic global warming.<sup>11</sup> The goal of this literature review section is to provide a general overview of carbon flux and storage, and how they relate to the policy design issues which are debated. The relative magnitudes of forest sinks and sources, and fossil fuel emissions, place limits on what can be accomplished through policy measures such as forest conservation, forest offset projects, or forest-based renewable energy use.<sup>12</sup>

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<sup>11</sup> Background on the science of climate change is available in the 2007 IPCC report.

<sup>12</sup> The term “renewable” is somewhat ambiguous. In the same way that a can or newspaper being “recyclable” does not necessarily imply that it will be recycled, a resource being “renewable” does not necessarily imply that it is being renewed, or that if it is renewed there is not a significant time delay between carbon release and carbon reabsorption.

At the global level, deforestation has accounted for approximately one third of warming due to carbon dioxide emissions since the middle of the eighteenth century (Weaver 2008, pp91-92). The IPCC report *Climate Change 2007* attributes 17.4% of current anthropogenic GHG emissions to forestry<sup>13</sup>—as compared to 19.4% from industry and 13.1% from transport (p36). In developing countries clearing forests for agricultural land is an important cause of current deforestation, whereas this is less the case in North America.<sup>14</sup> Temperate forest cut by logging companies in Canada and the U.S. is often not converted to other uses such as agriculture or urban development. However, because of past of forest harvesting and land clearing, forests in some WCI jurisdictions (for example, the Pacific Northwest) are currently in ‘carbon debt,’ relative to historic conditions, although not always running a yearly ‘carbon deficit’ (see below). Old-growth forests in the Pacific Northwest store large quantities of carbon (Smithwick et al. 2002), perhaps more than any other forest ecosystem type (Luyssaert et al. 2008). The forest regions of Oregon have been estimated to hold 2765 million metric tons of carbon, in total, or an average of 337 metric tons per hectare (Law et al. 2004).<sup>15</sup> Oregon has approximately 8.2 million hectares of forested land, and in the year 2000 net productivity (accounting for forest fire emissions and harvest removals) equalled about 52% of Oregon’s fossil fuel emissions (Law et al. 2004). The conversion of old-growth forests into young forests results in a net emission of CO<sub>2</sub> for long time intervals (Harmon et al. 1990). A recent review of studies on the carbon balance of old-growth forests has found that most temperate forests over

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<sup>13</sup> The IPCC definition of forestry includes deforestation, which may include cutting and burning forest to clear agricultural land.

<sup>14</sup> Carr et al. (2005) claims that “forest impacts in early stages of development are low, become accelerated during development, and are again attenuated at later stages of development when primary resource extraction is moved to a new developing region” (p97). (Relative to the US, Canada may be considered such a developing region.) According to Mahli et al. (2002), “In North America and Europe, there has been a gradual abandonment of agricultural lands and regrowth of forests that have resulted in a carbon sink” (p1578).

<sup>15</sup> 2765 million metric tons is nearly 230 years worth of carbon emissions at Oregon’s 2007 GHG emissions levels, which were about 11.87 million metric tons of carbon from fossil fuel combustion (EPA 2009). Harmon et al. (1990) estimates that forest harvesting in Washington and Oregon has contributed 1.5 billion metric tons of carbon to the atmosphere over the last 100 years. Splitting this quantity evenly between Washington and Oregon would mean that a substantial proportion of Oregon’s forest carbon has been lost, and that much of the carbon emitted from Oregon over the last 100 years has been from forests.

200 years old are carbon sinks, contrary to a common assumption that old-growth forests are carbon neutral (Luyssaert et al. 2008).<sup>16</sup>

### **2.2.1 Forest Fire**

Temperate forests can lose carbon through decomposition, and to disturbances such as storms and fires (De Deyn 2008). Forest fires can turn carbon sinks into carbon sources, and this effect may last for many years (Irvine et al. 2007). As early as a 1985 report published by the Department of Environment (now Environment Canada) it has been suggested that global warming could lead to bigger forest fires (Simpson et al. 2007, pp43–44). A proposed mechanism for an increase in the frequency of forest fires is earlier snowmelt combined with increases in summer drought (Weaver 2008, p17). In the mountains of the western US, a strong correlation between warming and an increase in wildfires has been found, suggesting that, in some areas, for this forest type, climate change is likely an important cause of the changes in fire activity (Westerling 2006 et al.).<sup>17</sup>

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<sup>16</sup> This may simply mean that it is taking these forests longer than originally thought to reach carbon neutrality, or that forests are responding to the effects of increased atmospheric CO<sub>2</sub> or nitrogen deposition.

<sup>17</sup> According to Westerling et al. (2006), an alternative explanation is that recent fire activity increases have been due to land-use factors, such as forest fire suppression, or re-growth after intensive forest harvesting which have led to an accumulation of flammable biomass. The relative impacts of climate change and land-use history on changes in forest fire activity likely varies with region.

### 2.2.2 Forest Biomass Combustion

Although climate change legislation often considers biomass combustion to be carbon neutral, Johnson (2009) argues this “defies common sense” (p165) and is inconsistent with Intergovernmental Panel on Climate Change (IPCC) guidelines. It is important to consider the carbon debt incurred when natural ecosystems are converted to biofuel production (Fargione 2008). In the Pacific Northwest, such a carbon debt is incurred when old-growth forests are converted to young forests<sup>18</sup> (Harmon et al. 1990; Smithwick et al. 2002). There is a delay between removing and burning biomass from a forest stand, and re-growth equal to the removed quantity.

Carbon neutrality over a given time interval has been expressed as the proportion (between 0 and 1) of carbon from fossil fuel emissions that is offset when biomass is substituted for fossil fuels. In a study which compares soil carbon loss, due to forest biomass combustion, to carbon savings, due to substitution for fossil fuels, Schlamadinger et al. (1995) models that the carbon neutrality “of bioenergy from logging residues in temperate and boreal forests lies between 0.49 and 0.82 after 20 years and between 0.75 and 0.88 after 100 years” (p221). The assumptions made in calculating these estimates, including that biomass is replacing coal or oil, would perhaps make these values high-end estimates not obtained in much of the WCI.

Rabl et al. (2007) argues that if biomass combustion is declared to be unconditionally carbon neutral it “would equalize the climate impact of burning a forest and preserving it, which is obviously wrong” (p281). In a 2004 memo from the Department of Environmental Protection for the state of Maine, it is noted that, “While the concept of allowing biomass burning to claim some level of carbon neutrality has appeal from a policy standpoint [...] the issue is extremely complex” (Gallagher 2004, p1). This does not mean that the sustainable use of forest-derived biomass has no potential for contributing to GHG emissions reductions, but it does seem that

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<sup>18</sup> Some of this carbon is emitted to the atmosphere through burning, and some through the decay of short-lived forest products, like paper.

claims of the complete carbon neutrality of forest biomass combustion are likely relying on unstated assumptions.

### 2.2.3 Forestry and Fossil Fuels

Rising atmospheric CO<sub>2</sub> concentrations are caused primarily by the burning of fossil fuels (IPCC 2007; Weaver 2008). Putting forest carbon stock<sup>19</sup> and carbon sink capacities into perspective requires an understanding of the relative magnitude of fossil fuel emissions.

The full accounting of GHG emissions associated with a forestry operation would require the inclusion of fossil fuels burned in harvesting, transportation, and processing, as well as consideration of the lifespan of the products produced (Lindenmayer et al. 2008, p71). Many of the changes in the forestry industry over the 20<sup>th</sup> century have evidently involved potential for increasing fossil fuel use. Many of these changes are described in Rajala (1998), which chronicles the industrialization of West Coast forestry. Transportation has made transitions from water, to rail, to road. Cross-cut saws have been replaced by chain-saws, and in many cases by buncher-fellers. Skidding has changed from being animal powered, to fossil fuel powered. Each step has seemed to involve greater potential for energy consumption. In general, fossil fuel emissions associated with the forestry industry are not considered forestry sector emissions, but rather transportation sector or industrial sector emissions.

When burned, wood, and various types of fossil fuel emit different quantities of CO<sub>2</sub> per unit of energy produced. Emissions coefficients, in pounds CO<sub>2</sub> per million Btu are approximately as follows: 205 for bituminous coal, 139 for liquified petroleum gases, 117 for

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<sup>19</sup> The WCI document *Summary of Major Design Options Under Consideration* (Jan 2, 2008) states, “Carbon stock is the carbon contained in forest biomass, including above and below ground biomass, at a specific point in time” (p37). The same WCI document refers to examples of existing protocols which have been used to measure how much carbon is in a forest. For example, the WCI refers to IPCC, UNFCCC, and Kyoto Protocol, and CCAR guidelines for carbon modeling, and measuring (p39). The following websites are referenced: <http://www.ipcc-nggip.iges.or.jp/public/gpplulucf/gpplulucf.htm> ; <http://www.ipcc-nggip.iges.or.jp/public/2006gl/index.htm> ; [http://unfccc.int/kyoto\\_protocol/items/2830.php](http://unfccc.int/kyoto_protocol/items/2830.php) ; and *Forest Sector Protocol*, Version 2.1, The California Climate Action Registry, September 2007, available at: <http://www.climateregistry.org/PROTOCOLS/FP/>.

natural gas, and 195 for wood and wood waste (EIA Voluntary Reporting Program). It is expected that directly putting a price on carbon emissions in the US would impact the coal industry most strongly (Goulder 1992). This suggests that coal production could be an important disincentive for regional cap-and-trade system participation. It seems likely that putting a price on carbon could encourage fuel switching from coal to natural gas (Jorgenson et al. 1992).<sup>20,21</sup> However, since natural gas production costs would also increase with a price on carbon, it is difficult to hypothesize how natural gas production in a jurisdiction may be an incentive or disincentive for that jurisdiction to join a regional cap-and-trade initiative. If forest product burning is considered carbon neutral, pricing carbon could be possibly expected to increase demand for wood as a fuel.

#### **2.2.4 Carbon and Ecological Value**

Although old forests can be vast carbon reservoirs (Harmon et al. 1990), and can be carbon sinks (Luyssaert et al. 2008),<sup>22</sup> and despite the “significant economic value that carbon storage could represent” in the Pacific Northwest (Smithwick et al. 2002, p1315), using incentives for carbon storage to promote the conservation of ecologically important habitat presents challenges. Forests with old-growth characteristics tend to be high in ecosystem carbon, but efforts to restore old-growth characteristics may not always have the immediate effect of increasing forest carbon; for example, actions which may have the potential to restore spotted owl habitat could potentially involve temporary reduction of forest carbon-stock, as in the case

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<sup>20</sup> Jorgenson et al. (1992) notes that, “A carbon tax, levied on fossil fuels in proportion to the amount of carbon dioxide they produce during combustion, would stimulate firms and households to reduce fossil fuel use and shift the fuel mix toward less-carbon-intensive fuels, such as natural gas”(p393).

<sup>21</sup> In the UK, “Between 1990 and 1998, carbon dioxide emissions from power stations were reduced by 7.5%, mainly by closing old, inefficient, coal-burning plant[s] and installing more-efficient gas-burning technology”(Whittington 2002, p1654).

<sup>22</sup> UNFCCC definitions state that *reservoir* “means a component or components of the climate system where a greenhouse gas or a precursor of a greenhouse gas is stored” and that *sink* “means any process, activity or mechanism which removes a greenhouse gas, an aerosol or a precursor of a greenhouse gas from the atmosphere (UN 1992, Art. 1.7 and 1.8). Thus the size of a forest carbon *reservoir* is indicated by the quantity of carbon in a forest ecosystem, and the size of a forest carbon *sink* is indicated by the rate at which carbon is being removed from the atmosphere.

of prescribed burning (Bond et al. 2002) or thinning (Lee and Irwin 2005). Moreover, using carbon credit for forest conservation offset projects for compliance under cap-and-trade systems seems to be unprecedented<sup>23</sup>; as noted in the climate policy section, forest conservation offset projects are not permitted under the CDM, or RGGI (RGGI Model Rule 2008, p91).

### **2.2.5 Summary of Literature Review Related to Forest Carbon**

A survey of available literature indicates that the quantification of carbon sinks and sources related to forest management depends on timescale. As noted, an intense fire season can turn Oregon's forests into a carbon source for that year. However, averaged over several years, Oregon's forests have recently been a carbon sink. At an even longer timescale, over the last hundred years, forest harvesting has made forests a net source of emissions. Likewise, the extent to which burning forest products can be considered carbon neutral depends on timescale. Given the complexities associated with land-use and forest carbon, it should be no surprise that there is ample opportunity for confusion and contradiction in political debate.

The quantification of carbon sinks and sources also depends on spatial factors. For example, the effect of a forest conservation project will depend on how much it induces the shifting of forest harvesting (and forest carbon losses) to outside the spatial boundaries of the project. Likewise, the designation of forest carbon sinks as offset projects may leave forest carbon sources, which are excluded from the boundaries of the offset system, unaccounted for by any policy measures. Such effects are addressed in the literature review section on climate policy, especially with respect to GHG emissions leakage from carbon offset projects, and with respect to the determination of cap-and-trade system scope.

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<sup>23</sup> Schrope (2009) provides an account of the status of UNFCCC negotiations related to the reduction of deforestation and forest degradation, and attempts to include incentives for avoided deforestation.

## 2.3 Literature Review Related to Climate Policy

*“...every political decision of any importance is intertwined with questions of social causality on which very diverse positions can be defended with a certain degree of plausibility” (Elster 2009, p57).*

Climate policy is reviewed in two sections: The first section provides background on cap-and-trade systems (including forest offsets), and the second section provides a more general policy context for the WCI.

### 2.3.1 Background on Cap-and-Trade Systems and Carbon Offsets

**Cap-and-Trade Systems, Offsets, and Forests.** Pacala and Socolow (2004) lists changes in forest management<sup>24</sup> as one of a series of possible GHG emissions reduction measures, several of which are needed to avoid dangerous anthropogenic warming. A role for forests in slowing the atmospheric accumulation of CO<sub>2</sub> is well established as an idea, with land-use change being included in national GHG inventories as part of the Kyoto Protocol (UN 1998, Art. 3.3), and as formalized in the Marrakech Accords (Boyd and Schipper 2002; Dessai and Schipper 2003).<sup>25</sup> Guidelines for measuring forest carbon stock have been developed (Brown 2002; Pearson et al. 2007), but various accounting issues (as discussed below) can make the crediting of increases in forest carbon-stock challenging or questionable (van Kooten 2003; Murray et al. 2004).

If effective connections can be made between climate policy and forests, the WCI region would seem to have one of the best opportunities for accomplishing this goal. The WCI contains

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<sup>24</sup> “Although there is potential to avoid carbon emissions through changes in forest harvesting (e.g. conventional to reduced-impact logging), the magnitude of these potential savings has not been estimated to date”(Brown and Swingland 2002, p1597).

<sup>25</sup> It seems that including land use for *compliance* under Kyoto is optional, and that Canada has opted not to: “The addition of managed forests and croplands as sinks was optional to the parties (although afforestation, reforestation and deforestation were mandatory) and, in 2007, Canada decided to account only for cropland management in its national GHG inventory. Forest fires and insect infestations had made forest sinks less attractive as an offsetting measure. Should there be a second commitment period, managed forests and croplands will have to be included in the inventory”(Williams 2009, p5).

some of the most economically important forest land in North America. In every year between 1988 and 2008, British Columbia has accounted for between 50% and 66% of Canada's softwood lumber exports to the US in dollar value. British Columbia, Ontario, and Quebec have together made up between 79% and 93%, with Alberta and New Brunswick accounting for the majority of the rest. (Figures calculated from BC Stats 2009.)<sup>26</sup> Between 2004 and 2008, Washington State has exported (from the US) between \$414 and \$507 million worth of 'coniferous wood in the rough' (US Census Bureau). For the year 2000, Washington and Oregon had the 3<sup>rd</sup> and 8<sup>th</sup> largest wood pulp mill capacities, respectively, among the 50 US states (from statistics in Smith 2003 et al.).

Van Kooten and Hauer (2001) have argued that "forest management strategies can, at most, contribute some 7.5 percent of Canada's required Kyoto CO<sub>2</sub>-emissions reduction target. To do so requires tree-planting subsidies, which are inefficient locally and globally. In the arena of land use change and forest strategies, Kyoto's Clean Development Mechanism (CDM) offers a more efficient alternative to domestic strategies" (p267). This would perhaps indicate, that for the WCI region forest industry to significantly benefit from the sale of carbon offsets, offsets would have to be geographically restricted, so that WCI jurisdiction offsets would not be undersold by less expensive projects outside the WCI region.

**Cap-and-Trade Systems Preceding the WCI.** Successful schemes to reduce sulphur oxides, ozone depleting chemicals, and reduce lead content in motor fuel have suggested the potential effectiveness of cap-and-trade schemes (Chameides and Oppenheimer 2007). One difference between these previous systems, and cap-and-trade systems designed to reduce GHGs is that the latter have made use of carbon offset mechanisms. Another difference is that GHG cap-and-

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<sup>26</sup> BC Stats is to the Government of British Columbia what Statistics Canada is to the Government of Canada. I.e. "BC Stats" is an entity that compiles statistics, rather than a collection of "statistics about BC."

trade schemes have treated some types of emissions differently than others: carbon dioxide originating from combustion of biomass has often been considered ‘carbon neutral’ (Johnson 2009). Moreover, the scope of GHG cap-and-trade systems has not been economy wide, and has been probably far less comprehensive than the systems that led to reductions of sulphur oxides, ozone depleting chemicals and motor fuel lead (Stavins 1998).

Two important cap-and-trade systems for global warming gases that have preceded the Western Climate Initiative are the European Union Emissions Trading Scheme (EU ETS) and the Regional Greenhouse Gas Initiative (RGGI). Precedents for the registration and sale of carbon offsets have been set by the CDM which was developed in conjunction with the Kyoto Protocol, and the Chicago Carbon Exchange (CCX), which has served the voluntary offsets market. Some types of CDM offset projects have been used as a source of offset credits for the EU ETS. RGGI requires that offset projects be located in a “state or United States jurisdiction” (RGGI Model Rule, p91), which would rule out the use of CDM offsets.<sup>27</sup> These systems provide useful context for understanding the development of the Western Climate Initiative cap-and-trade system. While both the EU ETS (Johnson 2009) and RGGI (RGGI Model Rule 2008) have included provisions for considering biomass combustion carbon neutral,<sup>28</sup> the WCI design recommendations of September 2008 suggest a possible role for forest offsets that goes far beyond that of either the EU ETS or the RGGI.

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<sup>27</sup> The RGGI Model Rule defines *a state* as, “A State, the District of Columbia, the Commonwealth of Puerto Rico, the Virgin Islands, Guam, and American Samoa and includes the Commonwealth of the Northern Mariana Islands” (RGGI Model Rule, p18).

<sup>28</sup> “Eligible biomass includes sustainably harvested woody and herbaceous fuel sources that are available on a renewable or recurring basis (excluding old-growth timber) [...]” (RGGI Model Rule, p13).

**The European Union Emissions Trading Scheme.**<sup>29</sup> In other trading systems, the types of forest projects that have been permitted as offsets has varied. Under the CDM, afforestation and reforestation projects could qualify, but not forest conservation programs: “The Kyoto signatories expressly limited land use and forestry projects that can get credits to those involving afforestation (tree planting on non-forested land) and reforestation (tree planting on previously forested land)” (Eizenstat 2006, p1). Credits from forest offset projects credits [at least those from the CDM] cannot be used for compliance under the EU ETS (Eizenstat 2006; Streck et al. 2009).

**The Regional Greenhouse Gas Initiative and the Midwestern Greenhouse Gas Reduction Accord.** Because of their recent formation, there is a lack of academic sources that directly address the RGGI, or the WCI. For example, a recent article in the American Journal of International Law, which mentions the two initiatives, refers readers to the corresponding websites for further information<sup>30</sup> (Crook 2008). The conditions attached to offsets under the RGGI have been described as quite stringent (Latham & Watkins) and in particular as more stringent than for EU ETS (Barringer and Galbraith, September 15, 2008). In particular, according to the RGGI Model Rule<sup>31</sup> of December 31, 2008, the use of offsets is limited to a maximum of 10% of the compliance obligations for any entity regulated under RGGI (RGGI

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<sup>29</sup> In 2005 the per capita GHG emissions for the 27 nations of the European Union were 10.5 metric tons of CO<sub>2</sub> (European Environment Agency). In 2006, US per capita GHG emissions were approximately 20 metric tons per person (EIA Frequently Asked Questions). Canada’s per capita emissions in 2006 were approximately 23 metric tons per person (Calculated from Environment Canada 2009 GHG emissions data and Statistics Canada population data).

<sup>30</sup> <<http://www.rggi.org>> and <<http://www.westernclimateinitiative.org>>

<sup>31</sup> The RGGI Model Rule is the template according to which legislation at the state level is implemented. The RGGI, like the WCI, is a regional initiative, but it is implemented at the state level. There is no ‘regional’ level of government between state and federal level.

2008).<sup>32</sup> The types of offsets available under the RGGI also seem more limited than those available under the EU ETS (Fairfield 2007), with what seems to be the exception of forest offsets, which are not allowed under the EU ETS (a mentioned above). In the RGGI, one of the five categories for offset projects is, “Sequestration of carbon due to afforestation” (RGGI Model Rule, p91). In the RGGI Model Rule, only US jurisdictions are mentioned as the possible home of forest offset credits (RGGI Model Rule, p91), which would rule out the use of CDM offsets. The scope of the proposed WCI system is broader than the current scope of the RGGI which has begun with a scope restricted to electricity generation.

State participation in the three regional climate change initiatives has been obtained from the official websites of the initiatives, and is shown in Table 2.

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<sup>32</sup> The mention of the 3-10% offset rule seem to possibly not be in the RGGI Model rule itself, but perhaps elsewhere. A December 20, 2005 memorandum of understanding states that, “In each compliance period, a source may cover up to 3.3% of its reported emissions with offset allowances” (p5); in this memorandum an increase to 5% is allow if a price trigger is met. Regional Greenhouse Gas Initiative. Memorandum of Understanding. The memorandum is signed by Connecticut, Delaware, Maine, New Hampshire, New Jersey, New York, and Vermont. It seems this limit has since been raised.

Table 2. Participation in North American Regional Climate Initiatives (as of September 23, 2008)	
Regional Climate Initiative	Participating States and Provinces
Regional Greenhouse Gas Initiative	Connecticut, Delaware, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Rhode Island and Vermont (Source: RGGI).
Western Climate Initiative	Arizona, British Columbia, California, Manitoba, Montana, New Mexico, Ontario, Oregon, Quebec, Utah, Washington (Source: WCI).
Midwestern Greenhouse Gas Reduction Accord	Iowa, Illinois, Kansas, Manitoba, Michigan, Minnesota, Wisconsin (Source: MGGRA).
Memberships for the common date of Sept 23, 2008. Currently, MGGRA membership is as of November 15, 2007. WCI membership as of Sept 23, 2008. On June 8, 2009, members of the Midwestern Greenhouse Gas Reduction Accord released their Advisory Group’s draft final recommendations for a regional cap-and-trade program. The Accord includes six U.S. states—Illinois, Iowa, Kansas, Michigan, Minnesota, and Wisconsin—and the Canadian province of Manitoba. <a href="http://www.pewclimate.org/node/6572">http://www.pewclimate.org/node/6572</a> . The RGGI ( <a href="http://www.rggi.org/docs/rggi_press_9_29_2008.pdf">http://www.rggi.org/docs/rggi_press_9_29_2008.pdf</a> ) mentions the first RGGI auction (not all states involved) taking place Sept 25, 2008– and mentions 10 states. Manitoba joined the WCI June 12, 2007 (Government of Manitoba, June 12, 2007). The premier of Manitoba signed the MGGRA on Nov. 15, 2007 (Pew Center), while remaining a WCI partner.	

A map showing the US states which are members of the three regional climate initiatives is shown in Appendix A, Map 2.

**The Clean Development Mechanism.** The Clean Development Mechanism (CDM), one of the compliance mechanisms under the Kyoto Protocol, has been given much attention (Moura Costa et al. 2000). It has also been subject of much criticism, and it has been speculated that its future may be limited (Gronewold 2009). It seems that the establishment of the credible use of forest-based offsets under the CDM has been slow.<sup>33</sup> (As mentioned, the EU ETS, which is a major

<sup>33</sup> The CDM website gives 1782 as the number of registered CDM projects. Of these only 8 are afforestation or reforestation projects. (Site Visited Aug 21, 2009.) <http://cdm.unfccc.int/Projects/index.html>

source of demand for CDM offsets, does not accept CDM forest offset credits.) The Kyoto Protocol mentions the need for offset verification, but as of recently this was “not yet matched by any official set of rules, regulations or guidelines” (Moura Costa et al. 2000, p2).

Concern by environmental NGOs about CDM offsets has led to the Gold Standard voluntary offset certification. Gold Standard was founded by the World Wildlife Fund, SouthSouthNorth and Hello International. “Its aim was to answer concerns about an unregulated market and a feeling that the Clean Development Mechanism (CDM), which certifies projects under the Kyoto Protocol, wasn’t stringent enough”(Saunders 2008, p1).

Although CDM credits are not eligible for use in the RGGI, they are allowed in the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (WCI, Sept 23, 2008, p11 §9.8).

**The Chicago Carbon Exchange.** The Chicago Carbon Exchange (CCX) began operation in December 2003 (Goodell 2006). As for the CDM, CCX offsets has been subject to much criticism. The CCX has traded offset credits for carbon sequestration in agricultural soil due to no-till farming practices. The RGGI, in its December 2008 Model Rule, does not permit the use of offsets from no-till farming projects. In the first years of the CCX’s operation, “...criticisms from environmentalists have only grown. This is particularly the case with CCX’s standards for using agricultural offsets, in which carbon is sequestered in farmland soils and then sold for emissions credits. Agricultural offsets are notoriously difficult to measure and quantify [...]” (Goodell 2006, p5).

**The California Climate Action Registry.** The California Climate Action Registry (CCAR) has been developed in conjunction with climate change legislation in California. Under the

California Climate Action Registry, protocols for forest offset projects are such that, “All projects must promote and maintain California’s native forests” and also, “All forest management projects must utilize natural forest management practices (i.e. managed forests must have mixed ages and species), so the attainment of climate benefits is not achieved at the expense of other local environmental issues such as water quality, biodiversity and species habitat” (CCAR). Given these requirements, it might be expected that the standards developed by the CCAR would be among those most likely to be favoured by environmental NGOs. Recently, the CCAR protocols for forest offset projects have been under revision.<sup>34</sup>

It seems that environmental sustainability requirements for CCAR forest offset projects have gone beyond those set out in the CDM, and likely the CCX as well. Given the variations in the protocols for carbon offsets, it should not be surprising if different stakeholder groups have different preferences with regard to the protocols for offsets that should be adopted by the WCI.

### **2.3.2 Standard Concerns with Offsets and Cap-and-Trade Systems**

On the one hand, it might seem that forest conservation projects could have the potential to both protect wildlife habitat, and also to sequester carbon; on the other hand offset projects seem to present inherent challenges in accounting for what carbon might be sequestered in ecosystems. Optimism has been expressed that forest-based carbon offsets have the potential to achieve co-benefits including biodiversity conservation, and social and economic goals (Brown 2002). It has been argued that, “Offsetting emissions by storing carbon in soils, forests, and other

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<sup>34</sup> Recently, the CCAR protocols for forest offset projects have been under revision: “In December 2008 the California Air Resources Board (ARB) held a workshop to discuss revisions to the California Climate Action Registry’s Forest Protocol, which specifies accounting procedures to be followed to verify reductions in GHG from voluntary forest-related projects. The protocol was adopted by the CCAR in 2005, and by the ARB in 2007 as part of it “voluntary early action measures” under the SB 32 GHG reduction process. For approximately the last year a workgroup formed by the CCAR has been examining possible improvements to the protocol; the workgroup is made up of representatives of private landowners, public landowners, environmental groups, scientists and academics, regulators, and third-party emission reduction verifiers. It is anticipated that a revised protocol will be forthcoming in March 2009, and thereafter subject to adoption by CCAR and ARB in April 2009”(Clarke 2009).

forms of biomass in the United States has the potential to offset 10 to 20% of U.S. emissions in 2025 at relatively low cost” (Chameides and Oppenheimer 2007, p1670). Similarly it has been suggested that, “Activities in tropical forest lands provide the lowest cost methods both of reducing emissions and reducing atmospheric concentrations of greenhouse gases” (Brown 2002, p1593). However, the following comment by University of Victoria climatologist Andrew Weaver is sobering: “We are fooling ourselves if we think we can deal with global warming by planting trees” referring to the fact that this storage is temporary (Weaver 2008, p17). A more detailed critique of the concept of carbon offsets, including planting trees is provided by the journalist Monbiot in the book *Heat: How to Stop the Planet from Burning* (2006, pp210-212). Even to attribute short-term transitional benefits to afforestation and reforestation projects may require optimism (Livingstone and van Kooten 2004). On the other hand, observations that conserving intact forests could have climate benefits, such as “The importance of preservation of Russian forests is obvious; they can provide a significant sink for atmospheric carbon” (Kolchugina and Vinson 1995), are not uncommon. Moreover, when new forests replace older ones, carbon storage can remain below the baseline set by the original forest for long periods of time (Harmon et al. 1990). Although forest conservation is recognized as an important climate mitigation measure, the promotion of forest conservation through crediting carbon storage or sequestration has been slow to be established (as shown, for example, by the use of afforestation credits in the CDM and by RGGI, but not forest conservation offset projects). Conservation of high biomass carbon sinks cannot be a replacement for reduced fossil fuel combustion, but retaining the remaining old-growth forests of the Pacific Northwest and British Columbia could be a helpful source of avoided emissions nonetheless.

There are several different concerns that have been associated with cap-and-trade systems, and carbon offsets: these include leakage, additionality, permanence (Binkley et al.

2002, p69; Brown and Swingland 2002, p1598), and measurement<sup>35</sup> (Brown and Swingland 2002, p1598).

**CO<sub>2</sub> Emissions Leakage.**<sup>36</sup> A cap-and-trade system is said to be affected by leakage if reductions that take place in the regulated sectors are displaced into unregulated sectors, potentially negating emissions reductions (Brown and Swingland 2002; Murray et al. 2004).<sup>37</sup> For example, in the absence of preventative measures, electricity purchasers might choose to buy cheaper, and higher emissions energy sources from outside the WCI system; or manufacturers might have an incentive to leave the WCI region (taking associated GHG emissions with them), if they find it less expensive to do business elsewhere. A forest carbon offset project would result in leakage if it meant displacing logging, or land conversion, to a different location (Brown and Swingland 2002; Murray et al. 2004).

**Additionality, Permanence and Measurement.** An offset project is additional if it would not have occurred otherwise (Revkin 2007; Galst 2008; Saunders 2008). According to the CDM protocol for offset projects: “The projects must qualify through a rigorous and public registration

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<sup>35</sup> Similarly, Benndorf et al. (2007) notes that, “Drawbacks of emission-oriented approaches [to land-use emissions control] include: inadvertently providing perverse incentives; risk of interfering with, or not supporting, sustainable development; and complexity and expense due to inventory, monitoring and verification requirements.”; “The major disadvantage of cause-oriented [sector specific regulations] commitments, particularly non-quantified ones, is the lack of any guarantee that the policies and measures will be sufficiently well designed and implemented to achieve the intended goals” (Benndorf et al. 2007).

<sup>36</sup>For the purpose of this project, leakage is considered the most fundamental of the problems associated with offsets. Whereas we might imagine setting reasonable baselines for additionality, using accurate measurement protocols, and accounting for permanence through something like the discount or insurance provisions of RGGI, it seems difficult to imagine a world without the market forces which may result in emissions leakage. And so this project gives offsets a broad benefit of the doubt.

<sup>37</sup> According to Brown and Swingland (2002), “Leakage is defined as the unanticipated decrease or increase in GHG benefits outside of a project’s accounting boundary, as a result of the project activities. Potential leakage results from two effects: market effects, when project activities change supply and demand equilibrium; and activity shifting, when the activity causing carbon emissions in the project area is displaced outside the project’s boundary. Identification and quantification of leakage remains one of the most challenging technical issues related to the development of carbon projects”(p1601).

and issuance process designed to ensure real, measurable and verifiable emission reductions that are additional to what would have occurred without the project”(CDM). It has been argued that determining emissions reductions which are additional relative to a business-as-usual baseline is inherently problematic (Repetto 2001).

Permanence, or rather the issue of non-permanence, is an important consideration for forest offset projects. For example, a forest might burn, or be disturbed by windthrow or pests. It has been noted that, “The question of nonpermanency is particularly relevant to agricultural soils that can be used to sequester carbon” (Thomassin 2003); this statement applies as well to carbon stored in forests. While it might seem convenient to consider some forms of carbon storage ‘permanent’, and hence eligible for full carbon-storage credit, and some forms of carbon emissions ‘temporary’ (as from biomass), and therefore ‘carbon neutral’, it is important to emphasize that such terms as ‘permanence’ or ‘carbon neutrality’ are relative to the time scale being used. For example, different types of coal take different lengths of time to form, carbon may be stored in peat for thousands of years, and forest ecosystems can store carbon in trees for decades or centuries: there is a continuum from ‘permanent’ to ‘temporary.’

Measurement and monitoring are also considerations. It has been noted that “...trades of sequestration services are complicated because of the time involved in growing trees, and because of the difficulties of monitoring” (Wilman and Mahendrarajah 2002, p405). This is one reason that it might be expected that ENGOs would be wary of offsets, and would like to see their use limited. It has been noted that, “Ensuring the integrity of a [U.S. cap-and-trade] system will require rigorous monitoring, auditing, and registration” (Chameides and Oppenheimer 2007, p1670).

**Offset Discounting.** On 26 June 2009, the U.S. Congress passed the American Clean Energy and Security Act (ACESA), in a vote of 219 to 212 (*New York Times*, 26 June 2009). Early drafts of this bill contained a provision requiring the purchase of 1.25 offset credits for each ton of CO<sub>2</sub> offset (RAN 2009). The draft legislation stated that, “Covered entities are permitted to hold 1.25 offset credits in lieu of an emission allowance” (Pew Summary of ACESA draft, p25). Based on economic modeling of forest offsets, Murray et al. (2004) concludes that, “Empirical estimates for the United States show leakage ranges from minimal (<10%) to enormous (>90%), depending on the activity and region”(p109). Thus, depending on the type and location of forest offsets, according to the modeling done by Murray, it seems that even a discount rate of 1.25 may not be adequate. (As mentioned the RGGI includes a discount rate to account for the potential temporary nature of forest offset projects, however it does not do so to account for the potential effects of leakage.)

Discounting the value of offset credits is one way of dealing with the potential short comings of carbon offsets. Offset discounting provisions are not mentioned in the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept. 23, 2008).

### **2.3.3 The Climate Policy Context of the WCI**

It has been argued that in developing climate policy, “The primary obstacles to effective action are political, not economic or technical” (Harvey 2004, p159). It has been suggested that the failure to implement effective climate change policy in the US has been due to the framing of the issue as a non-problem (McCright and Dunlap 2003), that is to say, keeping it off the policy agenda. It seems that climate change policy may have entered into a new phase, where the questions are not, ‘Is climate change real?’ or ‘Should we take action?’ but rather ‘Who pays for what?’

At the international level, the United Nations Framework Convention on Climate Change (UNFCCC) is the core of the climate change governance regime. The Kyoto Protocol, a convention under the UNFCCC, is significant for specifying the inclusion of deforestation, afforestation, and reforestation in national GHG inventories (UN 1998, Art. 3.3). In the UNFCCC, responses to climate change are placed in the two general categories of mitigation and adaptation. Each party of the convention commits to taking “measures on the mitigation of climate change, by limiting its anthropogenic emissions of greenhouse gases and protecting and enhancing its greenhouse gas sinks and reservoirs” (UN 1992, Art. 4.2(a)). Following a commitment to “adaptation to the effects of climate change,” the convention mentions the need for “the protection and rehabilitation of areas [...] affected by drought and desertification, as well as foods” (Art. 4.1(e)). The removal of CO<sub>2</sub> from the atmosphere by forests could be potentially be termed the remediation of GHG emissions; however, in the terminology of the convention, as quoted above, removal of CO<sub>2</sub> from the atmosphere is referred to as mitigation. Likewise, within the terminology established by the convention, environmental protection, enhancement, and rehabilitation meant to address climate change may be considered subcategories of mitigation and adaptation.

For the most part, at the federal level in Canada, climate change legislation has been ineffective (Simpson et al. 2007; Weaver 2008); the same can be said for the US (Rabe 2002;

Zasloff 2008). Accomplishments relate more to climate change research, than policy implementation (Weaver 2008). In Canada this has been a trend in environmental policy: the 1990 Canadian federal Green Plan emphasized research and education, and did little to regulate (Hoberg and Harrison 1994). Some climate change legislation at the state (Rabe 2002; Klyza and Sousa 2008, p283) and provincial level (Muldoon 2009, p99) has been emerging.

In the 2008 federal election in Canada (Chase 2008) and the 2008 presidential election in the United States (Bumiller and Broder 2008; Revkin 2008), climate change made an appearance as an election issue; however, studies of elections over the period 1984-2004 in both the US and Canada show the environment to be outranked by other issues (WPCF 1984; Abbe et al. 2003; Clarke et al. 2005). This suggests the electoral process is limited to the extent that it gives the public a voice on environmental issues. It has been noted that in the US the environment has been a very partisan issue (Nelson 2002; Klyza and Sousa 2008).

In the absence of substantial climate change legislation, the role of the courts in both Canada and the US has been limited: there are few relevant laws to interpret or enforce; however, in both the US (Klyza and Sousa 2008, pp276-280) and Canada lawsuits have been launched over federal failure to address climate change. The US Supreme Court ruling in the case *Massachusetts v. The Environmental Protection Agency* has bolstered the authority of the new administration in the US to regulate GHG (Zasloff 2008, p138); in Canada an initial lawsuit which attempted to require the federal government to draw up a climate change plan failed (Ecojustice 2008). Recently a lawsuit has been launched against the state of New York, for its administrative implementation of RGGI (Galbraith 2009). In general, the role of the courts in the formulation of environmental policy has been more limited in Canada than in the US (Howlett 2000).

Public participation in the policy process may take a variety of forms (Rowe and Frewer 2005), and it has been important to advancing environmental regulation in North America (Green 1997; Muldoon 2009, p228). It has been suggested that, "Participation in rule making

may [...] serve as an effective democratic surrogate for the electoral connection that binds lawmakers in legislatures to the popular will” (Furlong and Kerwin 2005, p369). Advocacy groups commonly use letter writing campaigns (Hojnacki 1998); and such campaigns have long been used for environmental advocacy (Barrow 2002). A public comment period may seem to offer a relatively pluralistic venue: this phase can potentially involve input from the public, NGOs, industry associations and others groups. This allows for an examination of what advocacy groups favour what policy measures, and how their arguments are made.

### **2.3.4 WCI Participation: The Example of British Columbia**

Despite climate change being a global problem, different jurisdictions may have different incentives for developing climate policy. A review of factors that are possible incentives for the development of climate change policy in British Columbia is helpful for indicating candidates for factors that may be incentives or disincentives for participation in regional climate initiatives in North America.

One possible explanation for British Columbia’s early implementation of a carbon tax, and early participation in the WCI<sup>38</sup>, may be found in the environmental risks that British Columbia could face due to global warming. British Columbia’s climate policy leadership might be seen as a way of reducing a variety of future environmental risks. The pine beetle epidemic has been connected to global warming and “[c]limate change has contributed to the unprecedented extent and severity of this outbreak” (Kurz et al. 2008, p987, citing Carroll et al. 2004). Westerling et al. (2006) has found that increased forest fire activity, in the Western US,<sup>39</sup> has been associated with earlier snowmelt, a trend that would be expected to continue with global warming. The Pacific salmon (*Oncorhynchus* spp.) fishery has been identified as “the

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<sup>38</sup> British Columbia was the first Canadian province to become a Partner of the Western Climate Initiative. Of course, unlike the BC carbon tax, which has already been implemented, the first compliance period for the WCI is not scheduled to begin until January 1, 2012.

<sup>39</sup>British Columbia sites were included in this study.

most valuable commercial fishing activity on the West Coast” (Emery 1997, p1), and it has been suggested that “increased frequency of adverse river conditions in recent years is consistent with climate change and if it continues may pose the single greatest threat to long-term sustainability of Fraser sockeye populations” (Pacific Salmon Commission 2008, p7). British Columbia’s fishery and forestry sectors are important politically, meaning that environmental risks posed to these industries would seem to have the potential to motivate the development of climate policy. As a coastal province, British Columbia is at risk due to rising sea levels.<sup>40</sup> And so, a brief summary of the environmental risks posed to British Columbia by climate change suggests that global warming mitigation could have important long-term benefits. An expected limitation of this explanatory factor is that British Columbia, acting on its own (or as a member of the WCI) has an extremely limited capacity to control global atmospheric GHG levels; moreover, any environmental benefits due to this reduction would principally be felt in the longer-term.

Another possible factor motivating (or at least making feasible) the development of climate policy in British Columbia relates to economics. It seems plausible that putting a price on carbon emissions could have economic benefits for British Columbia. The current carbon tax seems to apply to most types of fossil fuel, but not to biofuels.<sup>41</sup> If a price on carbon were extended across the WCI region (but not to forest carbon<sup>42</sup>), it could benefit two of British Columbia’s major exports: natural gas and hydroelectricity. One expected effect of a price on carbon could be a reduction in fossil fuel use, another could be to shift demand away from coal, and towards natural gas, hydroelectricity, and forest biomass as energy sources. As it is currently applied, the economic effect of British Columbia’s carbon tax appears to be minimal:

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<sup>40</sup> “The anticipated changes in sea level could have significant consequences for areas currently protected by dikes (such as the Fraser and Squamish deltas), where coastal erosion is already an issue (eastern Graham Island, Haida Gwaii), or where development and harbour infrastructure is close to present high tide limits” (BC Ministry of Environment 2008, p2).

<sup>41</sup>In general, the BC Carbon Tax Act of 2008 does not include biofuels in its definition of fuel. It is notable that the BC carbon tax does apply to the commercial sale of peat (BC Carbon Tax Act, 2008).

<sup>42</sup> It has been one of the goals of the BC pulp and paper industry to, “Establish BC carbon policy that improves the competitiveness of the BC pulp and paper industry by recognising the fundamental value of biomass and its carbon neutrality” (Pulp and Paper Task Force 2007, p2).

First, because the tax is low. Second, because it is revenue neutral. Third because it is not economy wide. Given British Columbia's limited capacity to act alone, and the limited extent of the carbon tax, both the environmental and economic benefits of the tax may be either minimal, or realized only in the future. However, if the implementation of the tax were to encourage a regional pricing of carbon emissions (and not forest carbon emissions), the economic benefit for some of British Columbia's major exports (hydroelectricity, natural gas, and forest products) could be important.<sup>43</sup>

Like British Columbia, other jurisdictions which have joined a regional climate initiative, including the WCI, the RGGI, or the Midwest Accord, may have combinations of factors (related to environmental risks, energy resources, or politics) which may have motivated this participation.

### **2.3.5 Climate Change Policy Co-Benefits**

The concept of co-benefits is important to the connection between climate change policy and forests. One example of a co-benefit of climate change regulations would be if forest conservation, with the goal of climate change mitigation, were to have the co-benefit of conserving valuable wildlife habitat. Another example of a co-benefit would be if reduced combustion of fossil fuels were to reduce air pollution,<sup>44</sup> and have health benefits. No-till farming practices may not only conserve carbon but also have the 'co-benefit' of reducing soil erosion (Post 2004 et al., p901).

It has been noted that: "Given the [...] United Nations Framework Convention on Climate Change's (UNFCCC's) high profile within the public and private sectors, there is some potential for using it to help advance CBD [Convention on Biodiversity] objectives and provide the much-needed economic incentives for conservation, through some of the market-based

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<sup>43</sup> It may be worth considering the scenario that climate policy could be so good for BC's economy that it could cause BC's carbon emissions to rise.

<sup>44</sup> "Air pollution growth will slow as a co-benefit of slower fossil fuel growth" (Hansen and Sato 2001, p14781).

mechanisms presented under the Kyoto Protocol. Significant potential lies in the fact that many ‘natural’ forests and certain other ecosystems are both major stores of carbon and areas of valuable biodiversity” (Koziell and Swingland 2002, p1807).

The preamble of the *Western Regional Climate Action Initiative* (WCI, Feb. 26, 2007), which was signed by the Governors of the original WCI Partners on 26 February 2007, states that the Western Governors Association has “declared that action is needed to reduce GHG emission and that many of these actions can have significant economic and environmental benefits for the Western States, including increased energy efficiency, increased renewable energy generation, improved air quality, cost savings, job growth, increased state revenues, and reduced water pollution”(WCI, Feb 26, 2007). That is to say, right from its inception, the potential co-benefits of enacting climate change policy are part of the motivation for the WCI. While the benefits of mitigating climate change itself may only be felt in the longer-term, other benefits of climate change policy may help balance costs and benefits in the more near term. Achieving environmental benefits (such as slowing deforestation in California), other than just climate change mitigation, is also one of the goals for the CCAR forest protocol.<sup>45</sup>

Another motivation for seeking environmental co-benefits from climate change policy may arise from the fact that at the Earth Summit in Rio, an international convention on climate change was achieved (the UN Framework Convention on Climate Change), but no international convention on forest conservation was arrived at (Sayer et al. 2000; Howlett and Rayner 2006). While an international climate change regime was established, a void was left with regard to forest conservation. This left the goal of forest conservation up to other means: through international consumer boycotts, forest certification schemes (such as the Forest Stewardship Council), and through related conventions such as the Convention on Biodiversity (Pralle 2006)

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<sup>45</sup> “Senate Bill 812 modified the Registry’s enacting legislation to include a greenhouse gas (GHG) accounting framework for the forest sector in a manner that creates benefits for the climate while also benefiting the local environment (e.g. California’s native forests, biodiversity, water quality and species habitat)”(CCAR, p1). California Climate Action Registry Forest Protocols Overview. Accessed Aug 21, 2009. [http://www.climateregistry.org/resources/docs/protocols/project/forest/04.06.14\\_Final\\_Forest\\_Protocols\\_Board\\_Overview.pdf](http://www.climateregistry.org/resources/docs/protocols/project/forest/04.06.14_Final_Forest_Protocols_Board_Overview.pdf)

and the UNFCCC. Within the US, efforts have been made to protect old-growth forests through the Endangered Species Act, and with the Northwest Forest Plan (Noon and Blakesley 2006; Pralle 2006). Within the US, in the WCI region, the populations of an indicator species such as the northern spotted owl have continued to decline, despite the protections of the Northwest Forest Plan and the Endangered Species Act (Noon and Blakesley 2006). This may have led to an interest in finding additional means of promoting forest conservation, and forest ecosystem restoration, including through environmental co-benefits from climate change regulation.

### **2.3.6 Climate Change as a Regional Issue**

Perhaps the most remarkable thing about the WCI, and other regional climate initiatives, is that they seem to be attempts at solving a global problem at a regional level, which may appear contradictory.

Vasi (2007) looks at factors that may have contributed to municipalities making climate change commitments, and focuses on social factors, such as the presence of environmental NGOs, and levels of education. However, in general, climate change has been considered a global issue: Harrison (2007) notes, “Until very recently, most political scientists who have studied climate change have done so from an international relations perspective” (p2). Climate change governance has longest been approached at the global level, through the UNFCCC, while forest protection has taken place at the regional level through legislation such as the Northwest Forest Plan in the US (Stokstad 2005), and the Forest Practices Code in British Columbia<sup>46</sup> (van Kooten and Wang 1998).

One proposed explanation for the lack of action on climate change has related to it being a global problem (or a least a large problem— where local action has little direct local effect, but the sum of local actions has a large cumulative effect). Using a term coined by Hardin (1968),

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<sup>46</sup> At the Earth Summit in Rio, attempts to arrive at a global forest convention failed (Conca 2002).

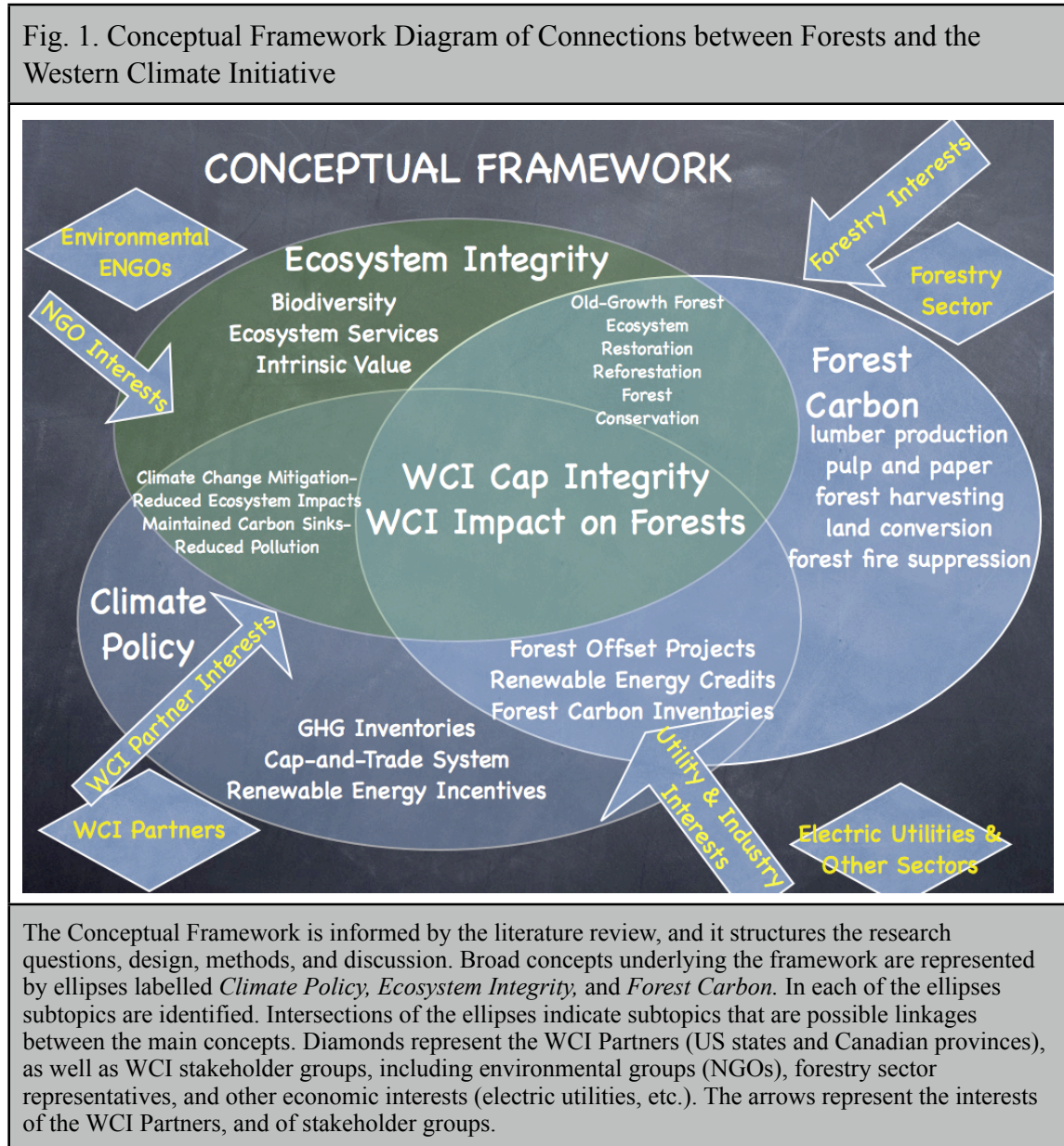
Harrison and Sundstrom (2007) have called climate change an example of a global “tragedy of the commons” (p1). In contrast to climate change, forest conservation has generally been thought of as a more regional issue. It has been pointed out that no global treaty deals with forest conservation, and it has been argued that this type of issue is not always best addressed through global environmental treaties (Sprinz 2001, p273). It has been claimed that some biodiversity and some climate-related forest values have global benefits, while most others are national and local (Sayer 2007, xv). Pralle (2006) observes that certain issues such as jobs and water quality have more political importance locally, while others such as biodiversity and claims that tropical forests are the “lungs of the earth” (p22) have more importance internationally. On the other hand, many of the ‘externalities’ associated with intensive forest harvesting, including effects on drinking water quality, and on fish habitat, are most visible locally or regionally. Foley et al. (2005) notes that, “Land use has generally been considered a local environmental issue, but it is becoming a force of global importance” (p570). As a connection, through the carbon cycle, between the global and the regional, forest issues might be thought to have the potential to motivate climate policy action at the regional level.

A distinction has been made between mitigation, which reduces the causes of an environmental problem, and adaptation which reduces or compensates for the consequences (Sprinz 2001, p274). It has been noted that both are necessary (Shiva 2008), and that effective climate policy requires both mitigation and adaptation (Weaver 2008, pp187-188). However, it has been suggested there is a danger regional self-interest might promote regional adaptation, at the expense of global mitigation (Dyer 2008).

A consideration of the particular circumstances of British Columbia, and general concerns related to ‘the tragedy of the commons,’ both indicate that it is worth looking for regional economic motivations in the development of regional climate initiatives such as the WCI.

## 2.4 Conceptual Framework of Climate Policy Connections

According to Palmer et al. (1974), “A conceptual framework [...] is a speculative statement of how concepts might behave under various circumstances”(p9). A conceptual framework of connections between forests and the WCI design has been developed, and is informed by the literature review. It is represented by the diagram below (Figure 2).



The broad concepts that underlie this framework, represented by the ellipses in the diagram, are *Climate Policy*, *Ecosystem Integrity*, and *Forest Carbon*. Within each of the ellipses related subtopics are identified. In the intersections of the ellipses, subtopics indicate possible linkages between the main concepts. Diamonds represent the WCI Partners (US states and Canadian provinces), as well as WCI stakeholder groups, including environmental (NGOs), forestry sector representatives, and other economic interests (electric utilities, etc.). The arrows represent the interests of the WCI Partners, and of stakeholder groups. These entities are expected to attempt to ‘push’ certain elements into the WCI system design (represented by the centre of the diagram). Understanding these various interests is the first aim of studying data sets of stakeholder comments, and of analyzing WCI Partner characteristics. Gaining understanding into what these interests are does not imply understanding how they may or may not have influenced the *WCI Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept 23, 2008). That being said, obtaining a clear picture of who wants what is an important step towards understanding the WCI design, and its implications.

## Chapter 3: Background on the Western Climate Initiative

To aid in the design of a cap-and-trade system for the reduction of GHG emissions, five WCI subcommittees were established: Reporting, Scope, Electricity, Allocation, and Offsets (WCI Work Plan, 2007, p1). Two of the subcommittees which have addressed issues related to carbon storage in forests are the Scope Subcommittee (WCI, March 3, 2008), and the Offsets Subcommittee (WCI, April 3, 2008).

The WCI has recognized that the region's forests can be significant carbon sinks and sources. It is noted in WCI *Scope Subcommittee Summary of Major Design Options Under Consideration* (Jan 2, 2008) that "forestry provides an opportunity to increase the sequestration of carbon" (WCI 2 January 2008, p38), and also that, "In the event of forest fires, insect and disease, or unsustainable harvesting practices, forests can act as significant carbon sources" (WCI January 2008, p37). The same WCI document estimates that, in the WCI region, forests are a carbon sink "on the order of 11% of gross emissions in 2005" (WCI, Jan 2, 2008, p38). This estimate is based on figures for Arizona, California (2004), New Mexico, Utah, Washington, and British Columbia<sup>47</sup> (WCI, Jan 2, 2008, p40). In contrast, it has been estimated that "the conversion of 5 [million] hectares of old-growth forests to younger plantations in western Oregon and Washington in the last 100 years has added 1.5 [billion metric tons] of carbon to the atmosphere" (Harmon et al. 1990, p699).<sup>48</sup>

The WCI Work Plan (October 2007) identifies the forestry sector as a candidate for inclusion in the scope of the cap-and-trade system design. In the WCI process, sinks and sources in the forestry sector are defined by "[c]hange in carbon stock on the land" (WCI, Oct 29, 2007,

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<sup>47</sup> For a certain interval of time, as mentioned in Kurz et al. (2008), the pine beetle epidemic turned BC's forests into a carbon source.

<sup>48</sup> Total WCI US emission approximately 871 million metric tons (WRI). 11% of 871Mt is 95.81 Mt, or about 6% of the quantity of carbon that Harmon et al. (1990) refers to having been lost from forests in Oregon and Washington over the last 100 years.

p19).<sup>49</sup> This definition “does not include the processing of timber into products, or the use of forest biomass for energy production. The long-term fate of harvested wood products could be included as part of this design element, but doing so is challenging, particularly at the land owner level” (WCI January 2, 2008, p37).<sup>50</sup> It is noted that including forest carbon in the scope, “Requires protocols to measure changes in carbon stock relative to baseline conditions overtime” (WCI, Oct 29, 2007, p19).<sup>51</sup> It seems that change in carbon-stock on land at the landowner level is the only point of regulation that is seriously considered in the WCI cap-and-trade system design process.

WCI documents identify several challenges with including the forestry sector in the scope of the cap-and-trade system. One of the difficulties identified is the measurement of forest carbon. The WCI *Summary of Major Design Options Under Consideration* (Jan 2, 2008) notes,

“Protocols have [...] been developed for measuring changes in carbon stock at the land owner or entity level. To apply these methods, landowners would be required to conduct periodic inventories to determine their carbon stock over time. As these methods typically rely on characterizations of samples of areas within forest lands, and are measuring biological activities, the resulting emission/sink estimates are generally considered to be less precise than emissions calculations for fossil fuel combustion emissions” (WCI, Jan 2, 2008, p39).

Another difficulty in accounting for forest carbon is emission leakage. The WCI notes, “Important components of the forestry sector are highly vulnerable to emission leakage. The market for wood products is international in scope, and highly competitive. In response to reduced commercial forest production in one region, production could increase in another region” (WCI, Jan 2, 2008, p40); and that, “Land conversion, from forest lands to urban development for example, may be vulnerable to leakage if alternative locations for development

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<sup>49</sup> The forestry sector includes, “Forested lands owned privately and publicly” (WCI Work Plan, October 2007, p19).

<sup>50</sup>To include both changes in carbon stock on land *and* emissions from forest biomass combustion would be double counting.

<sup>51</sup> Provisions accounting for carbon lost when forested land is converted to agricultural or urban uses would not necessarily require the same degree of monitoring that is implied in early WCI documents.

are available. However, given the size of WCI jurisdictions, such leakage has the potential to be small” (WCI, 2 Jan 2008, p40).

In the *Summary of Major Design Options Under Consideration* (WCI, January 2, 2008), the WCI Scope Subcommittee specified those sectors which it considered feasible for inclusion in a regional cap-and-trade program. These sectors include: “the electric sector,” “large stationary combustion sources,” “liquid transportation fuels,” “residential and commercial natural gas combustion,” “residential and commercial stationary combustion of fuel oil and other liquid fuels,” “industrial process and waste management emissions,” and “fossil carbon content of fuels” (WCI, Jan. 2, 2008, p1).

The same document also specified sectors which the Scope Subcommittee considered not feasible for near term inclusion in the scope of a regional cap-and-trade program: “The factors indicating that these elements are not good candidates for inclusion under the cap-and-trade program are: inability to measure or calculate emissions reliably at the entity level; administrative challenges due to the large number of regulated entities; and significant vulnerability to emissions leakage”(WCI, 2 January 2008, p2). The sectors deemed not feasible for inclusion are: “emission sources at fossil fuel production facilities for which it is difficult to measure or calculate emissions at the entity level,” “passenger cars,” “light duty trucks and medium duty vehicles regulated at the manufacturer level,” “large transportation fleets,” “agriculture emissions and sinks,” “forestry emissions and sinks,” and “high-GWP [global warming potential] gases regulated at the point of manufacture” (WCI, Jan. 2, 2008, p1).

The January 2, 2008 document states, “While the sectors and sources included in these design elements may ultimately not be recommended for inclusion under the cap-and-trade program, these sectors and sources may be appropriate for inclusion in an offset program, or may be addressed through other policies or measures” (WCI Jan 2, 2008, p2).

**Points of Regulation.** In the WCI stakeholder process the most appropriate points of regulation for emissions from electricity generation and transportation fuels are discussed. The WCI suggests factors that should be considered: the point of regulation should involve a lower number of entities for the sake of administrative feasibility, and the point of regulation should come close to the point of GHG emissions. In the case of land-based emissions, there is not an in depth discussion over the best point of regulation. It is decided from early in the stakeholder process that the point of regulation for consideration is the carbon stored in individual forest stands.

**Biomass Combustion.** The WCI document *Summary of Major Design Options Under Consideration* (Jan 2, 2008) notes, “If the amount of biomass that grows is the same as the amount of biomass removed for products or energy, the managed forest is presumed to result in no net emissions from changes in carbon stocks” (WCI, Jan 2, 2008, p37). In later WCI documents the condition of biomass replacement is essentially removed. The July 23, 2008 *Draft Design of the Regional Cap-and-Trade Program* (23 July 2008) states, “Carbon dioxide emissions from the combustion of biomass or biofuel are not included in the cap-and-trade program” (p2, §1.3). Finally, the September 23, 2008 *Design Recommendations for the WCI Regional Cap-and-Trade Program* states, “For biomass determined by each WCI Partner jurisdiction to be carbon neutral, the carbon dioxide emissions from combustion of that biomass are not included in the cap-and-trade program, except for purposes of reporting” (WCI, 23 September 2008). An ecological definition of carbon neutrality looks to have been replaced by a more political one.

**Offsets.** The WCI *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept 23, 2008) recommend that at most 49% of GHG reductions in the WCI region should be achieved through offsets. Forest carbon offsets are recommended for consideration.

## Chapter 4: Methods

### 4.1 Data Sources

This project uses several data sources. They are as follows: WCI documents issued by the committees delegated to design a regional cap-and-trade system; official government statistics, and other data, on characteristics of WCI jurisdictions, and other jurisdictions that have or have not joined a regional climate initiative; databases, accessed from the WCI website, of public stakeholder comments which were submitted to the WCI as part of a stakeholder process. The principal WCI documents consulted are the presented in Table 3:

Table 3. List of Principal Western Climate Initiative Documents Consulted	
Document Title	Date Issued
Western Regional Climate Action Initiative (signed by original WCI partners)	February 26, 2007
Western Climate Initiative Statement of Regional Goal	August 22, 2007
Western Climate Initiative Work Plan, October 2007 - August 2008	October 29, 2007
Scope Subcommittee Summary of Major Design Options Under Consideration	January 2, 2008
Summary of Major Options for a GHG Offsets System to Support the WCI program	January 3, 2008
WCI Draft Program Scope Recommendations	March 3, 2008
WCI Draft Offsets Design Recommendations	April 3, 2008
Western Climate Initiative Draft Design Recommendations on Elements of the Cap-and-Trade Program	May 16, 2008
Draft Design of the Regional Cap-and-Trade Program	July 23, 2008
Design Recommendations for the WCI Regional Cap-and-Trade Program	September 23, 2008
Source: All documents were accessed from the Western Climate Initiative (WCI) website: <a href="http://www.westernclimateinitiative.org">www.westernclimateinitiative.org</a> . Policy documents have been subject to public commentary through a WCI stakeholder consultation process.	

## 4.2 Research Design

This project uses a nested analysis design similar to the type described in Lieberman (2005). A larger-scale comparative analysis of jurisdictions that have (and have not) joined regional climate initiatives, including the WCI, is followed by a smaller-scale analysis of policy advocacy by stakeholder groups within the WCI region.

The methods used to address **Research Question #1** and **Research Question #2** (‘What economic and political factors are related to state participation in the WCI?’ and ‘What policies are supported by what advocacy groups?’) include qualitative comparative analysis and content analysis. Qualitative comparative analysis is used for economic and political data regarding characteristics of WCI participants, as compared to other jurisdictions. Content analysis is used for the WCI region advocacy group comments on the WCI cap-and-trade system design.

Understanding the development of the WCI cap-and-trade system, and addressing **Research Question #3** (‘Which policy interests, of what organizations, or WCI Partners, are most strongly reflected in the WCI cap-and-trade system design recommendations?’) requires a combined reference to the results of the content analysis, the qualitative comparative analysis, and also to WCI policy documents, including especially the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (23 September 2008).

Addressing **Research Question #4** (‘Does the WCI cap-and-trade system have the potential to promote forest conservation, or forest ecosystem restoration?’) and **Research Question #5** (‘How might that role of forests in the WCI cap-and-trade system affect the integrity of the cap on greenhouse gas emissions?’) depends largely on the context provided by the literature review.

### 4.3 Qualitative Comparative Analysis Methods

**Research Question #1** (‘What economic and political factors are related to state participation in the WCI?’) is addressed by using qualitative comparative analysis (QCA) to examine political and economic characteristics of jurisdictions that have joined or not joined one of three regional climate initiatives in North America.<sup>52</sup> This analysis is informed by the use of official government statistics (from the US Environmental Protection Agency and the US Energy Information Administration), and other data sources such as a compilation of state voting records on environmental legislation in Revesz (2001). (Revesz cites the data from LCV (2000).)

QCA, as described in Rihoux (2008), is a framework for systematically looking for relationships between conditions and results. Ragin (2000) states, “... QCA provides analytic tools for comparing cases as configurations of set memberships and for elucidating their patterned similarities and differences” (p120). As described in Rihoux (2008), “The key analytic tool for analyzing causal complexity using QCA is the truth table” (p726).<sup>53</sup> A truth table for  $n$  binary conditions has  $n$  columns (or  $n+1$  columns, including the outcome), and  $2^n$  rows corresponding to all possible combinations of conditions. Outcomes are classified according to the causal conditions which are present in each of the cases. A truth table may be thought of simply as a tabulation of conditions and results. The term “truth table” is derived from the application of such tables in the field of logic.

QCA methods, as developed in Ragin (1987) use dichotomous (or binary) categories as causal conditions. The truth table is analyzed with ‘set-theoretic methods’ (Rihoux 2008, p724), or ‘Boolean algebraic’ techniques (Rudel and Roper 1996, p161; Harkreader and Imershein 1999, p170). For example, states may be classified according to whether or not they belong to

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<sup>52</sup> The regional climate initiatives under consideration are the Western Climate Initiative (WCI), the Midwestern Greenhouse Gas Reduction Accord (MGGRA), and the Regional Greenhouse Gas Initiative (RGGI). For this project, whether a state or province is a member of an initiative is based on membership on September 23, 2008.

<sup>53</sup> To quote Ragin (1987, p87): “Truth tables have as many rows as there are logically possible combinations of values for the causal variables. If there are four binary independent variables, for example, the truth table will contain  $2^4 = 16$  rows, one for each logically possible combination of four presence/absence independent variables.”

the set of states with high per capita GHG emissions. Results (membership or non-membership in a regional climate initiative) are then examined for ‘set-theoretic’ or ‘Boolean algebraic’ relationships of necessity, sufficiency, and contradiction.<sup>54</sup>

This methods section describes the construction of a truth table (see Table 4 in Chapter 7) of possible causal conditions for membership or non-membership in a regional climate initiative. The two steps to this process are deciding on causal condition categories, and designating the threshold for membership in each of these categories. In this study, QCA is used for qualitative, descriptive purposes, and for hypothesis making rather than hypothesis testing. Rihoux (2008) notes that QCA techniques, “May be used in a straightforward manner simply to summarize data in the form of a truth table, using it as a tool for data exploration,” and also, “to check the coherence of [...] data, mainly through the detection of logical contradictions” (p728). These are the uses of QCA methods in this project.

### **4.3.1 Choosing Conditions for Comparative Analysis**

Potential causal factors have been chosen that may be related to whether or not US states have joined a regional climate initiative. Those factors are per capita GHG emissions, the past voting record of the state on federal environmental legislation, hydroelectricity production, natural gas production, and wood pulp production.<sup>55</sup>

To the extent that a regional GHG cap-and-trade program may place a price on GHG emissions, per capita GHG emissions may be a measure of the approximate cost, whether real or perceived, of such a program. A state’s past support for environmental legislation may show the tendency of the state to support climate change legislation as environmental policy. Together per

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<sup>54</sup> Examples of QCA methods applied to the study of deforestation, and health care policy decisions, are available in Rudel and Roper (1996) and Harkreader and Imershein (1999).

<sup>55</sup> Marx (2005) argues that the validity of explanatory models derived from QCA methods increases as the ratio of cases to variables increases. It would seem that the results in Marx could be extended to build QCA methods into a statistical modeling method. In this thesis project, insofar as the explanatory factors chosen do not lead to a contradiction free table of factors and results, QCA is not used to construct a complete explanatory model.

capita GHG emissions, and past voting record are potential qualitative measures of cost and willingness-to-pay related to joining a regional cap-and-trade initiative.

Since demand for natural gas may increase with a price on carbon (due to fuel switching from oil and coal) a regional cap-and-trade program might benefit producers of natural gas. At the same time, as an energy intensive industry, natural gas production would contribute to increasing a state's GHG emissions. If environmental legislation is at all an impediment to developing natural gas extraction projects, there may be tension between a state being a natural gas producer and being supportive of environmental legislation. These considerations indicate that natural gas production is a potential causal factor which may work in a manner contrary to the two factors mentioned in the paragraph above.

How much hydroelectricity a state uses, rather than fossil fuels, in its electricity generation mix, is a major factor in determining per capita GHG emissions. However, not all states with relatively low per capita GHG emissions are major producers of hydroelectricity. For example, some states import electricity, or may have low emissions due to a relatively small industrial sector. A few states (and Canadian provinces such as British Columbia and Quebec) produce large quantities of hydroelectricity which are then exported. Hydroelectric generation may be a measure of a state's self-sufficiency in low emissions energy.

The cost of a cap-and-trade system for the pulp and paper sector would depend heavily on whether biomass combustion emissions are considered carbon neutral. If compliance credits were required for biomass emissions, it could be a disincentive for a major pulp and paper producing jurisdictions to join. As an indicator of the extent of forested land in a jurisdiction, pulp production may be related to the capacity of a jurisdiction to benefit from the provision of forest carbon offsets. As a consumer of electricity, the pulp and paper sector may be wary of rising electricity prices that may come with joining a regional cap-and-trade program.

**Other Factors Considered.** Oil and coal production are obvious alternative economic factors. However, per capita GHG production is already being used as an aggregate measure of fossil

fuel combustion and production. Relatively few coal producing states have joined a regional climate initiative. However, among the coal producing states themselves there is not a general relationship between quantity of production (total or per capita) and which states have joined a regional cap-and-trade initiative. The top 4 (total) and the top 3 (per capita) states in coal production (2007 values) have not joined a regional cap-and-trade initiative. (See Appendix C.) However, if this effect is in part due to coal production, it is already captured in the per capita GHG emissions. The same general reasoning is applied to choosing per capita GHG emissions rather than oil production as a causal factor.

For natural resources, both per capita and total production values have been considered. Per capita production values account for the large differences in population between states. In a state with a large population, a fairly large production of a certain resource may only account for a small fraction of the state's whole economy. For states with smaller populations, the production of a resource which is small on the national scale may be an important part of that state's economy. Total production values may be important due to the presumably uneven distribution of resource extraction activities throughout a state. A state with a large total production of a resource (even if small on a per capita basis) may have communities within the state where the resource is economically and politically important.

A more detailed discussion of the causal factors used to construct the truth table is provided in Appendix C.

#### **4.4 Content Analysis Methods**

**Research Question #2** ('What policies are supported by what advocacy groups?') is addressed by using *content analysis*. These policy positions are further compared to the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (September 23, 2008), to address **Research Question #3** ('Which policy interests, of what organizations, or WCI Partners, are most strongly reflected in the the WCI cap-and-trade system design recommendations?').

According to Weber (1985) content analysis can be used for “identifying the intentions” or to “reveal the focus” of a group or institution’s attention (p9). Babbie (1994) claims, “Content analysis [...] is particularly well suited to the study of communications and to answering the classic question of communications research: ‘Who says what, to whom, why, how, and with what effect?’ ” (p307). Content is analyzed for public comments which have been submitted to the WCI design committees. Babbie (1994) notes that “Content analysis is essentially a coding operation. Communications [...] are coded or classified according to some conceptual framework” (p311). In describing content analysis methods, Babbie (1994, pp311-321) and Berg (2001, pp238-267) both use the terminology of “units of analysis” being “coded” into “categories.” In this study, the units of analysis are individual stakeholder comments submitted by advocacy organizations.<sup>56</sup> The conceptual framework (Figure 2) is used to inform the coding categories, which are topics related to the connections between climate policy and forests, such as forest offsets and forest-derived renewable energy.

Weber (1985) writes, “The central problems of content analysis originate mainly in the data-reduction process by which the many words of texts are classified into much fewer content categories” (p15). The coding of stakeholder comments into categories is facilitated by comments being directed towards specific policy proposals. For example, in the WCI stakeholder process, economic sectors are considered for potential inclusion in the scope of the cap-and-trade system, or for inclusion as eligible offset project types. Stakeholders are invited to agree or disagree with specific measures. Coding stakeholder groups by type of organization is likewise uncomplicated, since identifying a stakeholder as an environmental NGO, electric utility, or forestry company, is usually a clear decision. Comments have been coded as being for

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<sup>56</sup> Ragin (1987) notes the term unit of analysis has an ambiguous meaning in the social sciences, and advocates making a distinction between analytic units and data units. According to this distinction, in this study the data units would be the stakeholder comments, and the analytic units would be advocacy groups whose policy position are represented in the stakeholder comments. To the extent that the policy positions taken by the environmental NGO community, the forestry sector, electric utilities and others can be aggregated into an “ENGO community,” the “forestry sector,” and the “electric utility sector,” these larger groups might be considered to be the true “analytic units.” However, since there may be internal disagreement between these groups, individual advocacy groups are not assumed to be completely aggregated into these larger communities.

or against forest carbon being included in the scope of the WCI cap-and-trade design, for or against limits on the use of carbon offset projects (including forest offsets), and for or against forest product combustion being considered carbon neutral. Tally sheets have been used to record results, as is done in Babbie (1992, p314).

Stakeholder type is often evident from a stakeholder comment itself. For example, a stakeholder may identify themselves as an electric utility, or as an industry association. Many organizations have assembled themselves into groups such as the Industrial Customers of Northwest Utilities (Industry), WEST Associates (Utilities), the Western Climate Action Network (NGOs), and the Northwest Pulp and Paper Association (Forestry). Membership in these groups is another means of identifying organization types. In some cases, consultation of supplementary material, such as an organization's webpage may be required. For this study the following organization types have been used: Industry, Forestry, NGO, Electric Utility, Natural Gas Distribution, Oil and Gas Production, Carbon Trading, and Finance. Exceptional comments that do not fit into these categories are dealt with on a case by case basis. Further discussion of organization type classification is available in Appendix D.

## **Chapter 5: Comparative Analysis of Climate Initiative Participation**

In this chapter the qualitative comparative analysis data is analyzed. (See Table 4 on the next page.) Following Ragin (1987), contradictions are addressed, and row by row elimination is used to suggest causal factors. In some cases contradictions seem likely to be artifacts of the choice of thresholds for set membership, in other cases, they seem to indicate the importance of possible causal factors other than those that have been considered.

### **5.1 Climate Policy Outcomes**

The first step in analyzing the truth table is identifying contradictions. The outcome for the states of Kansas (MGRAA), New Mexico (WCI), Utah (WCI), Colorado, Texas and Wyoming leads to an apparent contradiction, insofar as Table 4 indicates similar conditions leading to different results. Kansas, New Mexico and Utah have joined regional climate initiatives, while Colorado, Texas and Wyoming have not. Kansas, New Mexico, and Utah, all have lower per capita GHG emissions, and stronger environmental voting ranking than Wyoming. (See Appendix E.) This suggests that the apparent similarity between Wyoming and the other three states may be an artifact of the threshold chosen to distinguish high and low per capita GHG emission states, and the threshold to distinguish states with strong and weak voting records on the environment. Different policy outcomes for Colorado and Texas as compared to Kansas and New Mexico, and Utah, despite similar circumstances may indicate the importance of within state politics, or other factors, in the decision to join or not to join a regional climate initiative.

For Arizona and Nevada, similar circumstances seem to have led to different outcomes.

Table 4. US State Characteristics and Climate Policy Results					
Per capita GHG emissions (2007)	Environmental record	Hydro per capita	Gas per capita (2007)	Pulp per capita (2007)	Result
HIGH	STRONG	HIGH	low	low	North Dakota
HIGH	STRONG	low	HIGH	low	West Virginia
HIGH	STRONG	low	low	HIGH	South Carolina, Mississippi, Arkansas
HIGH	STRONG	low	low	low	Missouri, Pennsylvania
HIGH	weak	HIGH	HIGH	HIGH	Montana (WCI)
HIGH	weak	HIGH	HIGH	low	Alaska
HIGH	weak	HIGH	low	HIGH	Alabama
HIGH	weak	low	HIGH	low	New Mexico (WCI), Utah (WCI), Wyoming, Kansas (MGRAA), Texas, Colorado
HIGH	weak	low	low	low	Iowa (MGRAA), Delaware (RGGI), Indiana, Kentucky, Louisiana, Nebraska, Ohio, Oklahoma, Tennessee
low	STRONG	HIGH	low	HIGH	Maine (RGGI), Oregon (WCI), Washington (WCI)
low	STRONG	HIGH	low	low	New York (RGGI), Vermont (RGGI)
low	STRONG	low	low	low	California (WCI), Connecticut (RGGI), Florida, Hawaii, Illinois (MGRAA), Maryland (RGGI), Massachusetts (RGGI), Michigan (MGRAA), Minnesota (MGRAA), New Hampshire (RGGI), New Jersey (RGGI), Rhode Island (RGGI), Wisconsin (MGRRA)
low	weak	HIGH	low	low	South Dakota, Idaho
low	weak	low	low	HIGH	Georgia, North Carolina, Virginia
low	weak	low	low	low	Arizona (WCI), Nevada

If a state is a participant in a regional climate initiative, that initiative is indicated in parentheses by WCI (Western Climate Initiative), RGGI (Regional Greenhouse Gas Initiative), or MGGRA (Midwestern Greenhouse Gas Reduction Accord). From EPA (2009) data, the 25 states with the highest per capita GHG emissions are designated as having “HIGH” per capita emissions. The top 26 states (due to a tie) for environmental voting records, from Revesz (2001) (citing LCV 2000), are designated as having “STRONG” voting records. States in the top 11 for per capita production of hydroelectricity, natural gas, and wood pulp are designated as having “HIGH” production. Source of hydroelectric and natural gas data: EIA 2009b, 2009c. Source for wood pulp production data: Smith et al. (2003). The table is abbreviated by the exclusion of rows of combinations of conditions not represented by any state. (The complete table would have 32 rows, including the rows with an empty results column.) Further details on the construction of the table are available in Appendix C.

Florida and Hawaii seem to be exceptional as having low GHG emissions per capita, and strong environmental voting records, yet not having joined a regional climate initiative. Florida is close to the threshold for membership in the set of states with strong environmental voting records. Hawaii depends on imported fossil fuels. According to the State of Hawaii Department of Business, Economic Development and Tourism, “Hawaii [is] the most oil-dependent of the 50 states, [and] relies on imported petroleum for about 90% of its primary

energy” (State of Hawaii). While gaining some energy independence through the development of renewable energy may be in Hawaii’s interest, currently Hawaii is very fossil fuel dependent, and this is one possible disincentive from joining the WCI. According to Konan (2009), Hawaii’s unique circumstances mean that it “cannot simply copy a GHG program from elsewhere and expect it to serve our [Hawaii’s] interests” (p11).

It seems that Iowa’s agricultural sector may distinguish it from Indiana, Ohio, Kentucky, and Tennessee. In 2000, Iowa’s agricultural sector GHG emissions were about 19.8% of its total emissions (before the subtraction of the land-use sink), which is fairly high (EPA, Iowa GHG Inventory). And so, Iowa could possibly be motivated by the sale of agriculture related carbon offsets.

## **5.2 Per Capita Emissions as Explanatory Factor**

High per capita GHG emissions distinguish North Dakota (a regional climate initiative non-participant) from New York (RGGI) and Vermont (RGGI) (participants) on the basis of per capita emissions. High per capita emissions distinguish Missouri and Pennsylvania from most of the members of the RGGI.

Likewise Arizona (WCI) is distinguished from Indiana, Kentucky, Louisiana, Nebraska, Ohio, Oklahoma, and Tennessee, on the basis of its low emissions.

## **5.3 Environmental Voting Record as Explanatory Factor**

Among states with low per capita GHG emissions, strong voting records on the environment distinguish regional climate initiative participants New York (RGGI) and Vermont (RGGI) from non-participants Idaho and South Dakota. Among states with high per capita emissions, a stronger history of voting for US federal environmental legislation does not seem to be decisive in favour of regional climate initiative participation. In some cases where given thresholds indicate either per capita emissions, or a strong voting record as a critical deciding factor, both factors may in fact be important. For example, New York and Vermont also have

lower per capita emissions than Idaho and South Dakota, even though this is not indicated by the threshold used to divide high and low GHG emissions states.

#### **5.4 Pulp Production Capacity as a Explanatory Factor**

The data do not suggest that forestry is generally a decisive factor in regional climate initiative participation. Row-by-row comparison of states with the same conditions in other categories eliminates per capita pulp production as a critical causal factor. For example, Maine, Oregon, and Washington differ from New York and Vermont only in the pulp production category. All these states have joined a regional climate initiative. This suggests that pulp production can be eliminated as an obvious causal factor for the decision by these states to join a regional climate initiative. Arkansas, Mississippi, and South Carolina differ from Missouri and Pennsylvania only in the pulp production category. This eliminates pulp production as an obvious causal factor for non-participation by these states.

In the truth table, Montana and Alaska differ only in the pulp production category. Thus the truth table suggests that forestry may be associated with Montana's participation in the WCI. Alaska and Montana are ranked 4th and 6th among US states for the highest year 2007 per capita GHG emissions, and their environmental voting records are tied at 43rd. Both are major fossil fuel producers.<sup>57</sup> Both voted Republican in the 2008 US federal election. However, rather than simply attribute Montana's participation in the WCI to Montana having a major forestry sector,<sup>58</sup> it would be more cautious to simply note that Montana seems to be a 'border-line' state, based on per capita emissions and past environmental voting record, making its participation in the WCI perhaps uncertain. For a handful of states in a similar position (perhaps Maine and

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<sup>57</sup> Montana's per capita hydroelectric production is greater than Alaska's; but Montana's coal production is greater as well.

<sup>58</sup> Recently Montana has been struck by a severe wildfire season, which might shape political interest in the issue of climate change. However, addressing wildfire risk may not necessarily involve emissions reductions: "Millions of dollars in federal economic stimulus money is flowing toward tree-thinning for fuel reduction in Ruidoso, N.M., and Anchorage" (Johnson, June 27, 2009).

Wisconsin), how the forestry sector is treated by cap-and-trade systems could be an incentive or disincentive, along with other considerations, for participation in a regional climate initiative.

## **5.5 Natural Gas Production as a Explanatory Factor**

Montana, Utah, New Mexico, and Kansas are major natural gas producing states with high per capita GHG emissions, that have joined regional climate initiatives. Four out of nine high per capita GHG emissions states which are major natural gas producers have joined a regional climate initiative. Only two out sixteen high per capita GHG emissions states which are not major natural gas producers have joined such an initiative. This is not inconsistent with natural gas production being a possible incentive for participation in a regional climate initiative for some states.

## **5.6 Summary**

A few observations are made here about the relationship between regional climate initiative participation and the characteristics of US states. Further observations will be made in the discussion chapter.

The states that are most likely to have joined a regional climate initiative seem to be those with a combination of low per capita GHG emissions, and strong voting records on past US federal environmental legislation. The presence of a forestry industry, as indicated by wood pulp production, does not seem to be a critical factor in determining whether US states have joined a regional climate initiative.

Four states in the WCI, Arizona, Montana, New Mexico, and Utah seem to have characteristics similar to states which have not joined a regional climate initiative. This may allow these states to be considered borderline with respect to conditions making the pricing of carbon emissions politically feasible.

## **Chapter 6: Content Analysis of Stakeholder Comments**

The results of the content analysis are organized into three sections: Scope, Offsets, and Forest Biomass Combustion.

### **6.1 Summary of Comments on Scope**

The comments considered here have been submitted to the WCI Scope Subcommittee, in response to the WCI *Draft Program Scope Recommendations* (3 March 2008) and *Draft Design Recommendations on Elements of the Cap-and-Trade Program* (May 16, 2008). Topics mentioned by many stakeholders include whether transportation fuels, and natural gas combustion (commercial and residential) should be included in the scope of the WCI cap-and-trade system. It is a limited number of stakeholders who mention forest carbon stock or forest biomass combustion. (Since the WCI had not included forests in the list of sectors feasible for inclusion in the cap-and-trade system, this may have limited discussion on the issue.) The policy positions of those stakeholders that have commented on forests and scope is presented in Table 5, below. A table indicating the individual stakeholder groups is provided in Appendix F.

Table 5. Summary of Comments on Scope which Mention Forests (3 March and 16 May 2008 WCI documents)			
	Opposed regulation of emissions from Forests	In favor of regulation of emissions from forests	Indirectly opposed to regulation of forest emissions
Utility Comments	–	1	2
Industry Comments	1	–	1
NGO Comments	–	5	–
Forestry Comments	2	–	–
Natural Gas Distribution	–	–	1
Comments that argue for the use of forests as offsets have been considered as arguing indirectly against the the inclusion of forests in the scope of the WCI cap-and-trade system. Since the NGO comments do not clearly argue for the inclusion of forests in the actual scope of the WCI, but rather for complementary policies, and the consideration of forest carbon in general, they have been classified as arguing for ‘regulation’ rather than ‘inclusion in the scope’.			

Comments are summarized as “In Favour of Regulation of Forest Based Emissions” or “Opposed to Regulation of Forest Based Emissions.” The May 16, 2008 WCI recommendations do not contain any new developments with regard to forests or biomass, as compared to the April 3, 2008 recommendations; indeed, the comment by WEST Associates on the May 16 document notes that, “they are substantively identical” to the April 3 document (WEST p1). This allows the comments on the two documents to be summarized in a single table. A more detailed account of stakeholder comments which address forests and scope is provided in Appendix H.

## 6.1 Stakeholder Comments on Forest Offsets

Comments have been submitted in response to the WCI *Draft Design of the Regional Cap-and-Trade Program* (July 23, 2008). This document lists agriculture, forestry, and waste management offset projects as “a priority for investigation and development to participate in the offset system”(p8). Table 6 below summarizes the positions of different types of stakeholder groups on forest carbon offset projects.

Table 6. Summary of Stakeholder Positions on Forest Offsets				
	Number of Comments (Out of a Total of 117)	Mentions Forest Offsets	Approves of forest offsets	Concerned about forest offsets
Industry	20	3	3	1
Forestry	11	9	9	0
NGO	24	10	NGO comments on forest offsets are not easily classified into discrete categories of approval or concern and are therefore discussed on a case by case basis.	See column to the left.
Utility	38	7	6	1
Comments have been submitted in response to the WCI <i>Draft Design of the Regional Cap-and-Trade Program</i> (July 23, 2008). Comments not included in the table, as being outside the scope of discussion include: 3 natural gas distributor comments, 7 oil and gas companies, 2 finance industry comments (Goldman Sachs, and Morgan Stanley), 4 carbon trading entities, and 8 comments classified as “other.”				

Most of the comments which mention forest offsets that have been submitted to the WCI in response to the *Draft Design of the Regional Cap-and-Trade Program* (July 23, 2008) are from the forestry sector or from environmental NGOs.

Comments from the forestry sector which mention forest offsets are very clearly in favor of their use. For example, the American Forest and Paper Association comment states that “consideration of managed forests and forest products as offset types [...] are welcomed by the industry” (Aug 13, 2008, pp2-3). The Northwest Pulp and Paper Association states that it “supports the concept that the forest sector should not be a regulated entity under WCI but rather a source of offsets” (Aug 13, 2008, p13). The British Columbia Forestry Climate Change Working Group states, “Forestlands managed for sustainable wood production over time are net carbon sinks providing the opportunity for offsets” (Aug 5, 2009, p3). The California Forestry Association uses exactly the same words (Aug 12, 2008, p1), as does the American Forest Resource Council (Aug 12, 2008, p1).

In general, environmental NGO comments are more difficult to classify as either for or against the use of forest offsets. For example, the Canadian Parks and Wilderness Society states,

“While we are encouraged by the inclusion of preservation/conservation in the list of offset project types that are to be considered for inclusion, we are concerned by the inclusion of forest products,” and also that “We acknowledge the important role that offsets can play within a cap-and-trade framework, but we are also aware and concerned about the possibility of offsets undermining the environmental integrity of that framework” (Aug 13, 2008, p2).

The Oregon Environmental Council comment states,

“We believe that strict quantitative limits should be set so that offsets account for only a small fraction of the total reductions. [...] We also strongly support placing a geographic limit on offsets. In particular we recommend that the WCI restrict offsets from outside the WCI jurisdiction. This will help to capture the co-benefits of offsets for the public within the WCI region, including reduced energy consumption, cleaner air, job creation and restoration of native forests” (Aug 13, 2008, p3).

Since support for offset projects that might aid the “restoration of native forests” is tempered by a call for “strict quantitative limits,” this comment is difficult to classify as simply being for or against the use of forest offsets.

One reason that some NGO comments are difficult to classify as for or against forest offset projects is that they link policy positions on forest carbon sources and sinks. The Climate Solutions comment states,

“We would like to again highlight the apparent double standard between the way the scope and offset subcommittees handle the issue of biomass. While the scope

subcommittee suggests that emissions from biomass is [*sic*] fundamentally different from emissions from fossil sources, the offset subcommittee treats emissions reductions from the agricultural and forest sectors as equivalent to emissions reductions from fossil fuels” (Undated comment on July 23 recommendations, p3).

(I.e. emissions from burning forest products are considered ‘temporary’ but carbon sequestration from forest growth is considered ‘permanent.’) The Western Climate Advocates Network (WeCAN) comment states, “The WCI should expeditiously bring forest emissions and sequestration into an economy-wide cap and trade design” (Aug 13, 2008, p8). While forest carbon offset projects may have the potential to bring sequestration into the design of the cap-and-trade system, they do not do the same for forest emissions. While the use of forest offsets may be somewhat compatible with the WeCAN statement, the inclusion of forest offsets in the absence of complementary measures to account for emissions from forests is less so; thus, the WeCAN statement does not seem to offer unconditional support for forest offsets in the manner of several forestry, industry, and electric utility comments.

Some support for forest offsets comes from environmental NGOs. For example, the Nature Conservancy writes, “We [...] support inclusion of forest projects as an offset project typology” (Aug 13, 2008, p1). The EcoTrust comment states, “Existing forest offset protocols provide models for use by WCI. While no agreement has been reached in the ongoing stakeholder processes on approaches to contentious issues such as baseline/additionality and leakage – these discussions have been productive and are continuing” (Aug 13, 2008, p2). Broad, unconditional support for the use of forest offsets tends to be found in forestry sector comments rather than in environmental NGO comments.

The role that forest offsets could play in the WCI cap-and-trade system will depend not only on whether forest offset projects are allowed, but also on the quantity of offset credits used for fulfilling compliance obligations. For example, a strict limit on offset quantities would limit the use of forest offsets. In response to WCI *Draft Offsets Design Recommendations* (April 3, 2008) and *Draft Design Recommendations on Elements of the Cap-and-Trade Program* (May

16, 2008)<sup>59</sup> stakeholder organizations have commented on the issue of offset quantity limits.

Table 7 summarizes the statements made.<sup>60</sup>

Table 7. Comments on Carbon Offset Quantity Limits (in regard to 3 April 2008 and 16 May 2008 WCI Documents, combined)			
Organization Type	Position on Quantity Limits		
	Opposed to Limits	In Favor of Limits	Phased Approach
Utility	8	1	1
Industry	8	–	–
NGOs	1	12	1
Forestry	2	–	2
Oil and Gas Production	2	–	–
Finance	1	–	–

Stakeholder groups have submitted comments to the WCI on the subject of offsets in response to the *WCI Draft Offsets Design Recommendations* (April 3, 2008) and *WCI Draft Design Recommendations on Elements of the Cap-and-Trade Program* (May 16, 2008). One question to be decided in the WCI design process is to what extent there should be a limit on the quantity of offsets used. Comments tend to argue for “strict limits” or “no limits” rather than proposing a percentage of compliance credits that should be allowed to be held for compliance. A few comments from the forestry sector, and environmental NGOs address forest offset projects directly. Comments in favor of a “phased approach” may argue that quantitative limits on offsets should be eased as the WCI cap-and-trade system develops, or that quantitative limits on offsets should vary with the price of emissions permits.

<sup>59</sup> Comments on the April 3, 2008 *Draft Offsets Design Recommendations*, and the May 16, 2008 *Draft Design Recommendations on Elements of the Cap-and-Trade Program* (regarding quantitative limits on offsets) are summarized in Appendix I and Appendix K. Since the recommendations on offsets made in the two papers are virtually identical (Appendix J shows parallel quotes), the data from the two comment periods have been consolidated in Appendix L.

<sup>60</sup> With respect to the recommendations regarding offsets, these documents are very similar; moreover, if a group has commented on both documents, the comments are in general highly consistent. All 40 stakeholders who submitted comments on the April 3, 2008 document, and all 38 stakeholders who submitted comments, addressed to the WCI Offsets Subcommittee, on the May 16, 2008 document are listed in Appendix M.

## 6.2 Biomass Combustion

The WCI *Draft Design of the Regional Cap-and-Trade Program* (July 23, 2008) states, “Carbon dioxide emissions from the combustion of biomass or biofuel are not included in the cap-and-trade program” (p2). Prior to this point in the WCI stakeholder process, discussion of the carbon neutrality of biomass combustion was relatively limited. The stakeholder comments submitted in response to the July 23, 2008 WCI document are summarized in Table 8 below:

Table 8. Stakeholder Positions on “Carbon Neutrality” of Biomass Combustion				
	Number of Comments (Out of a Total of 117)	Clearly Mentions Biomass Combustion with clear statement of position on carbon neutrality	Approves of ‘carbon neutral’ provision	Concerned about ‘carbon neutral’ provision
Industry	20	1	3	0
Forestry	11	10	10	0
NGO	24	9	0	10
Utility	38	4	3	1
Oil and Gas	7	1	0	1

Comments are in response to the WCI *Draft Design of the Regional Cap-and-Trade Program* (July 23, 2008). Groups not included in the table, to save space and due to lack of relevance, include: 3 natural gas distributors, 2 finance industry comments (Goldman Sachs, and Morgan Stanley), 4 carbon trading entities, and 8 comments classified as ‘other.’ These comments do not making clear statements on the issue of the ‘carbon neutrality’ of biomass combustion. Some organizations mention biomass combustion but don’t directly state a position– for example a utility may simply mention that it generates some electricity from biomass.– Comments were submitted in response to the July 23, 2008, WCI draft. At least one industry group comment in favor of the carbon neutrality is an association which includes forestry groups.

A more detailed account of stakeholder comments submitted with regard to biomass combustion is provided in Appendix N.

The *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept 23, 2008) show that the forestry sector was more successful than environmental NGOs in achieving its advocated policy positions.

Table 9. Summary of the Success of Advocacy Positions			
	Regulation of GHG emissions from Forests	Consideration of Forest Projects for Inclusion in the WCI Offset System	Biomass Carbon Neutrality
Forestry Sector	Successful (Advocated Against Regulation.)	Successful (Advocated for consideration of Forest offsets.)	Successful (Advocated against regulating emissions from biomass combustion.)
WeCAN and NGOs supporting WeCAN	Not Successful (Advocated for Regulation.)	Not Successful (Express concern over forest offsets.)	Not Successful. (Opposed to carbon neutrality provision.)
Ecotrust and the Nature Conservancy	Not Successful (Advocated for Regulation.)	Successful (Advocated for the use of forest offsets.)	Not Successful. (Opposed to unconditional carbon neutrality provision.)
The relationship between policy positions advocated by forestry sector and environmental NGO comments in relation to the <i>Design Recommendations for the WCI Regional Cap-and-Trade Program</i> (Sept. 23, 2008) is indicated. The NGOs that argue ‘against’ forest offsets are perhaps more properly arguing for a more comprehensive consideration of forest sinks and sources that would be provided by an offset system. An argument is made against using offsets as the primary way of accounting for forest carbon. Since the WCI process is on going, assessments of policy results are provisional.			

Policy measures in the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept 23, 2008) may be considered provisional, since the first compliance period for the WCI cap-and-trade system is not scheduled to begin until 2012. Offset project types and protocols are still under consideration. The September 23 WCI recommendations make consideration of forest offsets a high priority, but do not guarantee their use. Details about the limits on the use of offsets, and the consideration of biomass combustion as carbon neutral may be determined at the state level.

## Chapter 7: Discussion

The first part of this discussion evaluates the conceptual framework and methods. The second part addresses the research questions. The third part is a more general discussion of the connections between forests and the WCI cap-and-trade system. Finally, recommendations are made for bringing the WCI design more in accord with some of its originally stated goals, which include reducing regional GHG emissions, and achieving environmental co-benefits.

### 7.1 Evaluation of the Conceptual Framework and Methods

Some of the limitations of the conceptual framework are that it does not directly address public belief in the science of climate change, perceptions of climate change associated risk, or factors directly related to partisan politics. The conceptual framework, which is largely interest based, seems to be fairly consistent with the observed data. However, other conceptual frameworks may be possible. For example, alternatives might be cognitive, behavioral, or value based— to use the terms for environmental conflict types described in Mitchell (2004). These frameworks might focus more on questions related to belief, evidence, and argument (cognitive factors), past and current environmental disputes (behavioral factors), or environmental ethics and quality of life (factors related to values). A further development of the conceptual framework used in this study might incorporate some of the issues related to these alternative frameworks.

One intent of using content analysis and qualitative comparative analysis (QCA) methods has been to make the collection and interpretation of data more systematic. A limit to both methods, as used, is that they are essentially descriptive, and have a limited capacity to address questions of causality, especially when the methods are used separately.<sup>61</sup> (By placing the content analysis in the context provided by the QCA, and by WCI documents, some

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<sup>61</sup> Mitchell (1967) notes that, in its early uses, “data produced by content-analysis techniques have been used primarily for descriptive rather than hypothesis-testing purposes” (p231).

provisional inferences about causality can perhaps be made.) Content analysis can identify who says what, but, used in isolation, is limited in identifying the effects of what has been said. For example, it is difficult to evaluate the effect that the stakeholder commentary process has had in directly shaping WCI policy recommendations. The content analysis is also limited in that there may be WCI region stakeholders who have chosen not to participate in the stakeholder process, or who have not had the capacity to do so. One way to address this limitation is to consult sources outside of the WCI stakeholder process itself. This has, in part, been done through the literature review and by combining the content analysis with the QCA.

At least two reviewers of Ragin's 1987 book on QCA, *The Comparative Method: Beyond Qualitative and Quantitative Strategies*, mention that a log-linear statistical model is a viable alternative to the use of QCA (Miller 1987; Smith 1990). In agreement with Ragin (1987), Hamilton (1988) makes a distinction between QCA and a statistical model, by noting that QCA is not used to identify a single explanatory model for all cases, as a statistical model might, but to identify differences in explanatory conditions between cases. For Miller (1987), the simplicity of QCA methods adds to their value relative to a more complicated statistical alternative: "Even if loglinear analysis did turn out to give the same result in the end, it would carry much less conviction for most readers" (p456). The exploration of data with QCA in this study has essentially been an attempt to make a systematic application of standard concepts of inference, which have long been used in comparative studies.

QCA methods (including truth tables) have been used descriptively, and an attempt has been made to offer a coherent interpretation of the data. However, comparison of the explanatory value of conclusions relative to other possible interpretations has been limited. For example, it would be difficult to rule out the alternative possibilities that participation in the WCI has been heavily influenced by partisan politics (at the state, provincial, or federal level), or by variations in belief in the reality of anthropogenic climate change, rather than the interests of different jurisdictions and economic sectors. However, such alternative interpretations would still have to account for patterns observed in per capita emissions, natural resource production, and regional

cap-and-trade initiative participation, as well as the tendency for proposed forest-related policy measures in the WCI system to be compatible (or not) with the interests of the forestry sector, electric utilities, and other economic sectors.

Using QCA and content analysis methods in combination seems to have been useful. The QCA provides context for the interpretation of the content analysis.<sup>62</sup> Likewise, the stakeholder comments identify specific policy concerns, and thereby identify mechanisms by which the interests of different jurisdictions or economic sectors may shape the design of the WCI cap-and-trade system. These policy concerns and mechanisms would not have been as evident from the results of the QCA used alone.

## **7.2 Addressing the Research Questions**

### **Research Question #1: ‘What economic and political factors are related to state participation in the WCI?’**

A combination of low per capita emissions, and a strong environmental voting record is in strong agreement with a tendency for states to have joined regional climate initiatives. The rate of participation is lower for states with higher per capita emissions, and with weaker voting records on the environment. However, among states with high per capita emissions an effect associated with a strong environmental voting record is not manifest. These observations should be considered correlative rather than causal, because the ways in which these aggregate statistics may be interconnected has not been subjected to detailed analysis.

The QCA suggests natural gas production as a possible motivating factor for states with high per capita emissions to join a regional climate initiative.

The qualitative comparative analysis does not suggest that forestry is, in general, a critical determinant of state participation in regional climate initiatives. Among states that have

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<sup>62</sup> Markoff et al. (1975) has emphasized that it is important to integrate content analysis into an overall research design.

joined regional climate initiatives there is a mix of high and low pulp producing states; likewise among states that have not joined regional climate initiatives. Even without their forest industries, Oregon and Washington would have characteristics, such as low per capita emissions and strong environmental voting records, consistent with other states that have joined regional climate initiatives. An exploratory examination of state characteristics suggests that Maine (in the RGGI), Wisconsin (in the MGGRA), and Montana (in the WCI) might be states for which a further investigation of factors which encouraged participation might show connections to potential benefits from forest offsets.

For Oregon and Washington, the potential for selling forest offsets may be an incentive for participating in the WCI, but Oregon and Washington already fit the profile of low per capita GHG emissions states with strong environmental voting records, and the qualitative comparative analysis does not indicate the forestry sector as a necessary condition for their participation.

Maine is an exceptional member of RGGI, based on its per capita GHG emissions being relatively high.<sup>63</sup> This might mean that Maine would need an added incentive to participate. Maine's higher emissions may be associated with the forest industry: "Due to its energy-intensive forest products industry, Maine is the only New England state in which industry is the leading energy-consuming sector" (EIA, profile on Maine).<sup>64</sup> Declaring electricity generation from "sustainable" biomass combustion to be carbon neutral and allowing afforestation offset projects could have been a way of encouraging Maine's participation in the RGGI.

Since the presence of a forestry industry does not seem to be a make or break condition for regional climate initiative participation, any influence the forestry sector may have on cap-and-trade systems could be through internal advocacy for particular policies related to forest carbon, rather than advocacy for or against the cap-and-trade systems as a whole. And so, if the forestry industry is having an effect on climate policy formation the place to look for this effect may be the internal policy design process, rather than large scale patterns of state participation.

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<sup>63</sup> Maine's per capita emissions are close to the threshold for membership in the set of states with high per capita emissions.

<sup>64</sup> Maine also uses large amounts of fuel oil for residential energy (Source EIA, profile on Maine).

(In contrast, the general strategy of major fossil fuel producers seems to have been to advocate for alternatives to cap-and-trade systems.<sup>65</sup>)

## **Research Question #2: ‘What policies are supported by what advocacy groups?’**

Overall, industry groups, including the forestry sector, and electric utilities support an extensive WCI offset system. Forestry sector groups support the ‘carbon neutrality’ of forest biomass combustion. In general, for other industries, and electric utilities, biomass combustion does not seem to be a major issue. Forestry groups are opposed to the inclusion of forest carbon in the cap of the WCI cap-and-trade system.

In general, the environmental NGO comments submitted to the WCI have opposed the extensive use of offsets by the cap-and-trade system. Environmental NGO comments also tend to be opposed to the unconditional consideration of biomass combustion as carbon neutral. There is some disagreement among the environmental NGOs over forest carbon offset projects, with the Nature Conservancy and EcoTrust arguing for them, and most other environmental NGOs expressing concerns.

After the July 23, 2008 WCI recommendations, essentially all forestry sector comments argue for the unconditional carbon neutrality of biomass combustion. Environmental groups, when they comment, are opposed to the unconditional granting of carbon neutrality to biomass combustion. However, as a group, the environmental NGOs are less focused on this issue than the forestry sector, to judge by the relative frequency that biomass combustion is mentioned in forestry sector and environmental NGO comments. Forestry sector comments are against the inclusion of forest carbon in the scope of the cap-and-trade system, and in favour of the use of forest carbon offsets. Several environmental NGOs argue for policies that would regulate forest carbon emissions, although they do not necessarily argue for all forest carbon changes to be included in the WCI cap-and-trade system.

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<sup>65</sup> For example, Alberta and Saskatchewan have expressed concerns about cap-and-trade systems (Laghi 2009).

**Research Question #3: ‘Which policy interests, of what organizations, or WCI Partners, are most strongly reflected in the WCI cap-and-trade system design recommendations?’**

Several of the details of the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept. 23, 2008) may benefit the forestry sector. Forestry emissions are not included in the scope of the cap-and-trade system; forest biomass combustion is being considered carbon neutral at the WCI level; and forests are under consideration as a source of offset projects. The September 2008 recommendations generally agree with the policy positions advocated for by forest sector groups in stakeholder comments.

The potentially extensive WCI offset system is largely in agreement with requests made by industry and utility groups. The common request by industry and electric utility groups is for no limit on the offset credits that can be held for compliance purposes; environmental NGOs generally argue for a strict limit on the availability of offsets. Whether a productive compromise is achieved by the 49% limit on the GHG emissions reductions that can take place through offsets is a complex question. However, in terms of the types of offset projects that may be allowed, the WCI system has the potential to be more extensive than the RGGI system. For example, the WCI system may allow CDM credits, which are not permitted in the RGGI system. The WCI may allow forest conservation and agricultural soil carbon sequestration offsets, while the RGGI system does not allow these two types.

The provision for the carbon neutrality of biomass combustion reflects the position that is advocated by the forest industry. While the details of what constitutes sustainable biomass combustion are currently left up to individual jurisdictions, the WCI framework itself leaves forest biomass combustion unregulated. The RGGI Model Rule (2008) states that old-growth timber is not eligible for use in sustainable biomass combustion. No such provision is made in the September 23, 2008 WCI recommendations. British Columbia’s Carbon Tax Act (2008) regulates the commercial combustion of peat. Again no such provision is made in the WCI recommendations.

That the WCI cap-and-trade system is in several respects less stringent than the RGGI system may be related to the circumstance that several WCI participants have higher per capita GHG emissions than the RGGI participants. It may also be related to RGGI participants having, overall, stronger records in promoting environmental legislation. It is beyond the scope of this study to attribute a direct cause to the form of the September 23, 2008 WCI recommendations; but those recommendations are consistent with economic concessions being made to the sectors (including the forestry sector) which will be regulated by the WCI cap-and-trade system.

**Research Question #4: ‘Does the WCI cap-and-trade system have the potential to promote forest conservation, or forest ecosystem restoration?’**

The September 23, 2008 WCI *Recommendations* are still very general. The actual effects of the system on forests will depend on further developments before its (possible) implementation in 2012, as well as what complementary environmental policies are in place.

The potential for the September 23, 2008 WCI cap-and-trade system design recommendations to promote the conservation of old-growth forest habitat seems limited. In general, the reasons for this limitation are similar to some of those that may weaken the integrity of the cap-and-trade system: the “carbon neutrality” of forest biomass combustion, leakage related to forest offset projects, and a lack of provisions to encourage maintaining land in a forested condition. In some cases there may be differences between carbon conservation and habitat conservation effectiveness. For example, forest conservation offsets may have local conservation benefits, even if they fall short in conserving forest carbon throughout the WCI region. On the other hand, a forest offset project may result in forest carbon accumulation but do little to restore old-growth habitat.

If included as part of the WCI offset system, forest conservation offset projects may have the potential to achieve some local conservation benefits. However, the exclusion of forest carbon from the scope of the cap-and-trade system will mean that leakage, caused by activity shifting or market effects, will not be controlled by the WCI GHG emissions cap. This may

lessen the likelihood that the cap-and-trade system will encourage forest ecosystem conservation region wide. Much old-growth forest habitat in the western US is on public land which has been under the protection of the Endangered Species Act and the Northwest Forest Plan. Establishing a forest carbon offset program that could increase the economic viability of protecting land that may already be protected faces the challenge of addressing additionality requirements.

The WCI provision for the carbon neutrality of forest biomass combustion seems to have the potential to encourage a more intensive use of forest resources. The effect that the WCI may have on forest ecosystems will depend on the extent of fuel switching to forest biomass, the development of the market for forest offsets, and the particular protocols used for those offsets. However, it is important to recognize that the WCI has the potential to deplete forest carbon, and to reduce the extent of valuable forest habitat under certain circumstances.

**Research Question #5: ‘How might the role of forests in the WCI cap-and-trade system affect the integrity of the cap on greenhouse gas emissions?’**

The unconditional consideration of biomass combustion as carbon neutral, and the lack of consideration of emissions leakage associated with forest carbon offset projects (multiplied by the high proportion of emissions credits that can be held in offsets) have the potential to weaken the integrity of the WCI cap-and-trade system GHG emissions cap. A provision in the RGGI Model Rule (2008) states that old-growth timber combustion is not eligible for carbon neutrality. This provision is lacking in the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept. 23, 2008). This means that carbon in long-term storage in old forests could be unaccounted for if released by burning old-growth timber.

Declaring biomass combustion carbon neutral open may encourage fuel shifting to “renewable” forest energy. Reductions in fossil fuel use due to replacement by biomass burning may involve borrowing against future sequestration by forest ecosystems. Given concerns about how forest ecosystems may react to climate change, the continued maintenance of forest carbon

sinks in western North America is open to question.<sup>66</sup> Declaring forest biomass combustion to be unconditionally carbon neutral seems a risky strategy for achieving GHG emissions reductions.

Forest carbon offsets, if approved for the WCI cap-and-trade system, will likely result in some GHG emissions leakage. The September 23, 2008 WCI recommendations allow offsets to account for 49% of GHG reductions in capped sectors. Any offsets from forest carbon projects will likely involve some GHG emissions reduction credits which do not correspond to real reductions. The exclusion of forest carbon from the WCI cap-and-trade system scope removes one option for controlling this source of leakage. It is beyond this project to quantify how much carbon offset use may weaken the WCI cap-and-trade system. Rather, it is observed that forest offset projects will likely, to some degree, replace real GHG reductions with reductions that will take place only on paper.

## **7.3 General Discussion**

### **7.3.1 The WCI Offset Mechanism and Participation**

The *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept. 23, 2008, p10, §9.2) allow 49% of the WCI GHG emissions reductions to be made with offset credits. In contrast, the RGGI sets a limit of 3.3–10% for the compliance credits that a regulated entity can hold in offsets (RGGI Model Rule 2008, p54).<sup>67</sup> The greatest difference in stringency between the two cap-and-trade designs may turn out to be in the types of offset projects allowed. For the WCI design as planned so far, the limits on offset project types have the potential to be substantially fewer than for the RGGI.

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<sup>66</sup> For example, Kurz and Apps (1999) notes that the strength of Canada's forest carbon sink weakens near the end of the 20th Century.

<sup>67</sup> It is difficult to directly compare these two values for a variety of reasons. The scope of the two systems is different, and the limit on offsets in the RGGI system can vary from 3%-10% per regulated entity, depending on the price of carbon emissions credits. Moreover, in the RGGI Model Rule the quantitative limit applies to each regulated entity, whereas for the WCI the limit seems to apply to each WCI jurisdiction.

Offset project types being considered for the WCI include fugitive gas reduction (from land-fills), agricultural offsets (manure management/soil carbon sequestration), and forest carbon sequestration projects (including forest preservation) (WCI, Sept 23, 2008, Section 1, pp10-11, Item 9.4). In contrast, the RGGI Model Rule does not allow soil carbon sequestration or forest preservation offset projects (RGGI Model Rule, p91). The greater possible role for offsets in the September 23, 2008 recommendations for the WCI cap-and-trade system, as compared to the RGGI, is consistent with some WCI jurisdictions being more fossil fuel intensive, as reflected by per capita GHG emissions, (which could lead to interest in using offset credits to reduce compliance costs), and also with the WCI being home to a larger forestry sector (which would be interested in selling carbon sequestration offsets). The large role suggested for offsets in the WCI system may in part be motivated by motivating participation, and reducing costs for certain industries, rather than increasing the efficiency and effectiveness of the cap-and-trade system in achieving GHG reductions.

Arizona, Montana, New Mexico, and Utah are WCI participants without strong records of voting for environmental legislation, and with relatively high per capita emissions (relative to California, Oregon and Washington). For these states, putting a price on carbon might seem relatively expensive. Consequently, they might require additional incentives to participate in the WCI.<sup>68</sup> This could in part be done through the selection of offset project types from which Montana, New Mexico, Utah and Arizona could benefit. Another way would be to reduce compliance costs by not auctioning many emissions permits, and allowing entities to use a large proportion of offset credits for compliance. Aversion to auction requirements, and demand for an extensive offset system, may have been less present among the participants of the RGGI, which have lower per capita GHG emissions, and have, in the past, shown a stronger interest in promoting environmental legislation.

Other factors that might motivate Montana, New Mexico, and Utah to participate in the WCI could be that these states are especially concerned about the impacts of climate change, or

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<sup>68</sup> Natural gas production may be an incentive for Montana, New Mexico, and Utah. Arizona is major hydroelectric producer.

that they are motivated by a combination of concern about the effects of climate change, carbon offset opportunities, and benefits to the natural gas industry.<sup>69</sup> This study does not rule out that such factors may be important.

### **7.3.2 Participation by Canadian Provinces**

The four Canadian provinces that have joined the WCI have among the lowest per capita GHG emissions in Canada. They are ranked 1st, 2nd, 3rd, and 5th for lowest per capita emissions in 2004, among the Canadian Provinces (Environment Canada 2004). It seems that US states and Canadian provinces may have chosen to participate in certain regional cap-and-trade initiatives based in part on their natural resource economies.<sup>70</sup> With forestry, agriculture, and hydroelectricity, not much in the way of fossil fuel resources, and relatively low population densities, Ontario and Quebec may have more in common with WCI members like Oregon and Washington than with the RGGI states. Under the RGGI system, Ontario, Quebec and Manitoba would perhaps have less potential to benefit from the sale of forest or agriculture offsets. For example, the RGGI does not accept no-till agriculture offsets for compliance purposes. This could be a major consideration for Manitoba. Indeed a large proportion of Manitoba's emissions are agriculture based.<sup>71</sup> Putting a price on carbon emissions in North America may have similar impacts on demand for hydroelectricity which would be felt by Ontario, Quebec, Manitoba,

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<sup>69</sup> That hydroelectricity production seems to be associated with non-participation in regional climate initiatives by states with high per capita emissions may suggest that it would be worth investigating whether states with more water are less worried about environmental risks associated drought. This effect (if it is real) is apparent for total hydroelectric production, but not per capita production.

<sup>70</sup> A 2009 environmental report card published by *Corporate Knights* magazine (2009. Accessed Sept 24, 2009: <http://www.corporateknights.ca/special-reports/83-green-provincial-report.html>) ranked the environmental performance of BC, Ontario, Quebec and Manitoba 1st, 2nd, 6th and 7th among the 10 Canadian provinces, with Alberta and Saskatchewan ranked 3rd and 5th. The overall pattern of participation of Canadian provinces in the WCI seems consistent with the pattern of participation of US states in regional climate initiatives. A combination of both low per capita GHG emissions and a strong interest in environmental concerns in general may make joining a regional climate initiative attractive. However, without low per capita emissions, general support for environmental policy does not seem to be incentive enough, on its own, for a jurisdiction to take an interest in pricing carbon emissions.

<sup>71</sup> Approximately 36% of Manitoba's GHG emissions are from the agricultural sector– Government of Manitoba, citing Environment Canada, National Inventory Report 1990-2006 (2008). [http://www.gov.mb.ca/stem/climate/pdf/vsab\\_report.pdf](http://www.gov.mb.ca/stem/climate/pdf/vsab_report.pdf)

Oregon, and Washington State. As a natural gas producer, British Columbia would be out of place in the RGGI, but not in the WCI.

## **7.4 The Role of Forests in the WCI Cap-and-Trade Design**

The role of forests in the WCI cap-and-trade design is discussed, with reference to forest sector points of regulation, forest carbon offsets, and forest biomass combustion.

### **7.4.1 Points of Regulation**

Making forest stands at the landowner level the only point of regulation considered for the inclusion of forests in the WCI cap-and-trade system seems to contradict the WCI's own principles: this point of regulation involves a large number of entities, and is not necessarily close to the point of GHG emissions (which for many forest products may be the point of biomass combustion, or landfill emissions). Moreover, the WCI principles for minimum thresholds for regulation state that thresholds should be high enough to make the number of regulated entities in a sector manageable,<sup>72</sup> and low enough to cover most of the emissions in that sector. In the case of the forestry sector, minimum thresholds for regulation are not adequately considered. While accounting for all changes in forest carbon may not be feasible across the whole WCI region, it may be possible to account for land conversion, and forest biomass combustion, above a certain threshold. The lack of options for points of regulation and thresholds may indicate that proper consideration was not given to the feasibility of including

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<sup>72</sup> The WCI document *Summary of Major Options for a GHG Offsets System to Support the WCI Program* notes that, "A threshold of parcel size may be used to limit the coverage of the large numbers of owners of small amounts of forest lands" (WCI 2008, p41). The same document notes that "... the cap-and-trade program could focus solely on land conversion, from forest cover to other uses, and from other uses to forest cover"(p43). However, development of these options is not pursued further in the policy design process.

forestry in the GHG emissions cap in the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept. 23, 2008).

#### **7.4.2 Forest Offsets**

Despite uncertainty about the effectiveness of offsets, there is broad support, in sectors which may be regulated by the WCI cap-and-trade system, for their use. Since the offset system is being designed to reduce compliance costs,<sup>73</sup> it may have been expected that most electric utility and industry stakeholders would support having no quantitative limit on offsets. Because forest offset projects involve making payments to owners of forested land, it is not surprising that they are supported by the forest industry. Forest offset projects may have potential habitat conservation value, but may also face complications related to additionality, leakage, and monitoring— and so the likely attitude of environmental NGOs towards forest offset projects may be less predictable. Most environmental NGO comments submitted to the WCI regarding offsets, with the exception of those by the Nature Conservancy, Pacific Forest Trust, and EcoTrust, advocate limiting the use of offsets. However, environmental NGOs have a tendency to express concern over the use of forest offsets, rather than unconditional support or opposition.

It is clear from the stakeholder comments that many industry and electric utility stakeholders want widely available carbon offsets. It also seems that, due to differences in energy production and GHG emissions levels, some WCI jurisdictions may have particularly strong motivations to look for opportunities to reduce compliance costs, and increase economic benefits. An extensive offset system, including forest offsets, may be one way of pursuing these goals. However, it is less than clear that the WCI offset system is being designed to achieve real GHG emissions reductions.

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<sup>73</sup> “The primary role of the offsets system is to reduce the compliance costs for the cap-and-trade program, while ensuring the environmental integrity of the cap” (WCI, Sept 23, 2008, Section 1, p10, Article 9.1).

### 7.4.3 Forest Biomass Combustion

The WCI GHG emissions reduction goal is a 15% reduction by 2020 from a 2005 baseline (WCI, 22 August 2007). However, the treatment of biomass combustion seems inconsistent with this baseline. A simple argument for the carbon neutrality of burning forest biomass is that the carbon released used to be in the atmosphere anyway. If a baseline year is established for forest carbon stock, then it may be plausible to consider additional forest carbon sequestered since that baseline year to be carbon neutral when burned. However, to consider the combustion of older forest biomass to be carbon neutral involves an implicit shifting of the baseline backwards in time for the sake of gaining “additional” GHG reductions.<sup>74</sup> Alternatively, if a baseline year applies to changes in carbon flux, rather than changes in carbon stock, it should be asked if biomass combustion allows for forest carbon sinks to be maintained or increased in strength relative to baseline conditions. Fundamentally, the unconditional carbon neutrality of forest biomass combustion seems to depend on an imprecise use of implicitly shifting baselines.

## 7.5 Recommendations

Three basic recommendations are made to address some of the weaknesses of the *Design Recommendations for the WCI Regional Cap-and-Trade Program* (Sept 23, 2008). Measures should be considered to account for forest carbon emissions from land conversion to non-forest. The combustion of biomass from old-growth forests should not be considered carbon neutral. Consideration should be given to appropriately discounting emissions reductions from forest offset projects to address GHG emissions leakage. There is some precedent for such provisions. The RGGI (2008) “excludes old-growth timber” from eligibility for consideration as sustainably harvested biomass (p13). A cap-and-trade system designed for New Zealand includes

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<sup>74</sup> Possible baseline years might seem to be 2005 might be the 1990 Kyoto baseline, or a carbon baseline for a forest based on a pre-industrial, relatively undisturbed condition. What seems highly questionable is a floating baseline that allows for the borrowing of carbon sequestration from undefined points in the past or future for the sake of present convenience. Either shifting a baseline to a past time before carbon was sequestered, or to a future time when it will be re-sequestered are both possible ways of arguing that burning something doesn't really release CO<sub>2</sub>.

the forestry sector (Young 2007).<sup>75</sup> A discussion draft of the ACESA required the purchase of 1.25 tons of offset credits for every ton of GHG emissions offset (RAN 2009, p4).

Better consideration should be given to a range of potential points of regulation for forest carbon sinks and emissions. The only point seriously considered in the WCI process to date seems to have been forest carbon stock at the the landowner level. An important alternative to the complete inclusion of forest carbon in the cap-and-trade system could be incentives against the conversion of forested land to non-forest. Unlike changes in carbon stock which may be due to new growth, forest fires, or other factors with a combination of natural and anthropogenic causes, land conversion is clearly anthropogenic. Moreover, regulating land conversion could be more administratively feasible than regulating all forest carbon across the WCI region.

Carbon neutrality for forest biomass combustion should be reconsidered. It is politically attractive, but environmentally untenable. Land-use emissions are not included in the WCI cap, while forest carbon stock increases from offset projects are being considered— meaning an imbalance in the accounting of forest carbon loss and uptake. It has been argued that “under a system of greenhouse gas taxation, the CO<sub>2</sub> from using wood for space heating should be taxed in the same way as CO<sub>2</sub> from oil heating, and a credit for CO<sub>2</sub> should be paid only when and where the wood is replaced by new growth” (Rabl et al. 2007). It would seem reasonable to apply the same condition to emissions under a cap-and-trade system. More limited provisions could include ones like those in the RGGI Model Rule (2008) which declares that the combustion of old-growth timber cannot be considered sustainable, and in British Columbia’s Carbon Tax Act (2008) which applies to the combustion of peat.

Consideration should be given to the appropriate discounting of offset projects, so that offsets do not compromise the integrity of the cap of the WCI cap-and-trade system. Some of the GHG emissions loss associated with forest carbon offset projects would likely be from market

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<sup>75</sup> The future of New Zealand’s cap-and-trade system currently seems uncertain: “The Government is waiting on the report back from the Review Committee before committing to any decisions on the future of New Zealand’s ETS [emissions trading scheme]”(Government of New Zealand. Website. Accessed 5 Aug 2009. <http://www.climatechange.govt.nz/emissions-trading-scheme/index.html>).

effects (Murray et al. 2004), which will not be controlled for by even very good monitoring and forest carbon accounting protocols.

These recommendations regarding the role of forests in the WCI may have the potential to limit some risk of negative environmental consequences from WCI policy measures, and may help to ensure that emissions reductions under the WCI are real. These recommendations may remain applicable in the case where the WCI is replaced by federal initiatives in the US and Canada.

## References

- A., J.A. 1892. Merriam on the life areas of North America (anonymous review). *Auk* 9 (4): 377–382.
- Abate, Tom. 1992. Which bird is the better indicator species for old-growth forest? *BioScience* 42 (1): 8–9.
- Abbe, Owen G., Jay Goodliffe, Paul S. Herrnson, and Kelly D. Patterson. 2003. Agenda setting in congressional elections: The impact of issues and campaigns on voting behavior. *Political Research Quarterly* 56 (4): 419–430.
- Adams, Charles C. 1908. The ecological succession of birds. *Auk* 25 (2): 109–153.
- Allen, Arthur A., and P. Paul Kellogg. 1937. Recent observations on the ivory-billed woodpecker. *Auk* 54 (2): 164–184.
- American Forest and Paper Association. 2008. Untitled comment, dated August 13. (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June 6, 2009).
- Babbie, Earl. 1994. *The practice of social research (7th edition)*. Belmont, CA: Wadsworth Publishing.
- Barringer, Felicity. 2007. New battle of logging vs. spotted owls looms in West. *New York Times*, October 18.
- Barringer, Felicity. 2008. U.S.-Canadian group plans to curb emissions. *New York Times*, September 23. Available at <http://www.nytimes.com/2008/09/24/us/24climate.html> (accessed June 10, 2009).
- Barringer, Felicity, and Kate Galbraith. 2008. States aim to cut gases by making polluters pay. *New York Times*, September 15. Available at [http://www.nytimes.com/2008/09/16/us/16carbon.html?pagewanted=1&\\_r=1](http://www.nytimes.com/2008/09/16/us/16carbon.html?pagewanted=1&_r=1) (accessed May 15, 2009).
- Barrow, Mark V., Jr. 2002. Science, sentiment, and the specter of extinction: Reconsidering birds of prey during America's interwar years. *Environmental History* 7 (1): 69–98.
- Bartemucci, Paula, K. Dave Coates, Karen A. Harper, and Elaine F. Wright. 2002. Gap disturbances in northern old-growth forests of British Columbia, Canada. *Journal of Vegetation Science* 13 (5): 685–696.
- BC (British Columbia) Carbon Tax Act, Bill 37. 2008. Available at [http://leg.bc.ca/38th4th/1st\\_read/gov37-1.htm](http://leg.bc.ca/38th4th/1st_read/gov37-1.htm) (accessed August 21, 2009).
- BC (British Columbia) Forestry Climate Change Working Group. 2008. Recommendations to the WCI on the “Draft Design of the Regional Cap-and-Trade Program” (Aug 5, 2008). (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Accessed from the WCI website, June 2009. (A document with a different date and title is available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> and was accessed September 27, 2009), and is also indicated as a response to the July 23 WCI recommendations. This suggests perhaps that these two BC Forestry Climate Change Working Group documents have been archived inconsistently.)
- BC (British Columbia) Ministry of Environment, Natural Resources Canada, and Fisheries and Ocean's Canada. 2008. Projected Sea Level Changes for British Columbia During the 21st Century. Available at [http://nerrs.noaa.gov/pdf/projected\\_sea\\_level.pdf](http://nerrs.noaa.gov/pdf/projected_sea_level.pdf) (accessed August 21, 2009).
- BC (British Columbia) Stats (Ministry of Management Services). 2009. Softwood Lumber Exports to the USA by Province. Available at [http://www.bcstats.gov.bc.ca/data/bus\\_stat/busind/trade/SWLprov.asp](http://www.bcstats.gov.bc.ca/data/bus_stat/busind/trade/SWLprov.asp) (accessed June 26, 2009).

- BC (British Columbia) Stats (British Columbia Ministry of Management Services). 2003. Exports. Available at "<http://www.bcstats.gov.bc.ca/pubs/exp/exp0306.pdf>" (accessed June 25, 2009).
- Benndorf, R., S. Federici, C. Forner, N. Pena, E. Rametsteiner, M.J. Sanz, and Z. Somogyi. 2007. Including land use, land-use change, and forestry in future climate change agreements: Thinking outside the box. *Environmental Science & Policy* 10 (4): 283–294.
- Berg, Bruce L. 2001. *Qualitative research methods for the social sciences*. Needham Heights, MA: Allyn and Bacon.
- Binkley, Clark S., David Brand, Zoe Harkin, Gary Bull, N.H. Ravindranath, Michael Obersteiner, Sten Nilsson, Yoshiki Yamagata, and Max Krott. 2002. Carbon sink by the forest sector—options and needs for implementation. *Forest Policy and Economics* 4: 65–77.
- Bond, Monica L., R. J. Gutierrez, Alan B. Franklin, William S. LaHaye, Christopher A. May, and Mark E. Seamans. 2002. Short-term effects of wildfires on spotted owl survival, site fidelity, mate fidelity, and reproductive success. *Wildlife Society Bulletin* 30 (4): 1022–1028.
- Booth, William. 1989. New thinking on old growth. *Science* 244 (4901): 141–143.
- Boyd, Emily, and Emma Lisa Schipper. 2002. The Marrakech Accord at the crossroad to ratification: Seventh Conference of the Parties to the United Nations Framework Convention on Climate Change. *The Journal of Environmental Development* 11 (2): 184–190.
- Boyd, William S. 1970. Federal protection of endangered wildlife species. *Stanford Law Review* 22 (6): 1289–1309.
- Brock, Emily. 2004. The challenge of reforestation: Ecological experiments in the Douglas fir forest, 1920–1940. *Environmental History* 9 (1): 57–79.
- Brown, Sandra. 2002. Measuring, monitoring, and verification of carbon benefits for forest-based projects. *Philosophical Transactions: Mathematical, Physical and Engineering Sciences* 360 (1797): 1669–1683.
- Brown, Sandra, and Ian Swingland, et al. 2002. Changes in the use and management of forests for abating carbon emissions: Issues and challenges under the Kyoto Protocol. *Philosophical Transactions: Mathematical, Physical and Engineering Sciences* 360 (1797): 1593–1605.
- Bumiller, Elisabeth, and John M. Broder. 2008. Greenhouse gas must be capped, McCain asserts. *New York Times*, May 13. Available at <http://www.nytimes.com/2008/05/13/us/politics/13mccain.html?scp=117&sq=&st=nyt> (accessed September 27, 2009).
- California Forestry Association. 2008. Untitled comment on *Draft Design of the Regional Cap-and-Trade Program* (July 23, 2008). Comment dated August 12, 2008. Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June 6, 2009).
- Canadian Press. 2008. Irving challenges bird protection laws. *Toronto Star*, March 25. Available at <http://www.thestar.com/article/350679> (accessed March 23, 2009).
- Carr, David L., Laurel Suter, and Alisson Barbieri. 2005. Population dynamics and tropical deforestation: State of the debate and conceptual challenges. *Population and Environment* 27 (1): 89–113.
- Carroll, Allan L., Steve W. Taylor, Jacques Régnière, and Les Safranyik. 2004. Effects of climate change on range expansion by the mountain pine beetle in British Columbia. In *Mountain Pine Beetle Symposium: Challenges and Solutions* (Report number BC-X-399), eds. T.L. Shore, J.E. Brooks, and J.E. Stone. Victoria, BC: Natural Resources Canada, Canadian Forest Service, 223–232. Available at [http://www4.nau.edu/direnet/publications/publications\\_c/files/Carrol\\_et\\_al\\_2003.pdf](http://www4.nau.edu/direnet/publications/publications_c/files/Carrol_et_al_2003.pdf) (accessed September 28, 2009).

CCAR (California Climate Action Registry). California Climate Action Registry forest protocols overview. Available at [http://www.climateregistry.org/resources/docs/protocols/project/forest\\_04.06.14\\_Final\\_Forest\\_Protocols\\_Board\\_Overview.pdf](http://www.climateregistry.org/resources/docs/protocols/project/forest_04.06.14_Final_Forest_Protocols_Board_Overview.pdf) (accessed May 15, 2009).

CDM (Clean Development Mechanism) website. Available at <http://cdm.unfccc.int/about/index.html> (accessed May 15, 2009).

Chameides, William, and Michael Oppenheimer. 2007. Carbon trading over taxes. *Science* 315 (5819): 1670.

Chase, Steven. 2008. And they're off... . *Globe and Mail*, September 7. Available at <http://www.theglobeandmail.com/news/national/and-theyre-off/article708338/> (accessed April 21, 2009).

Chelan PUD (Public Utility District No. 1 of Chelan County). 2008. "Draft Design Recommendations on Elements of the Cap-and-Trade Program dated May 16, 2008", June 4. (Comment on *Western Climate Initiative Draft Design Recommendations on Elements of the Cap-and-Trade Program*, May 16, 2008.) Available at <http://www.westernclimateinitiative.org/public-comments/archived-comments> (last accessed September 27, 2009).

Christensen, Norman L., Ann M. Bartuska, James H. Brown, Stephen Carpenter, Carla D'Antonio, Rober Francis, Jerry F. Franklin, James A. MacMahon, Reed F. Noss, David J. Parsons, Charles H. Peterson, Monica G. Turner, and Robert G. Woodmansee. 1996. The report of the Ecological Society of America Committee on the scientific basis for ecosystem management. *Ecological Applications* 6 (3): 665–691.

City of Seattle, Office of Sustainability & Environment. Comment on WCI Scope document, March 3, 2008. Accessed from the WCI website at [www.westernclimateinitiative.org](http://www.westernclimateinitiative.org). Public comments on WCI documents have been archived at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.

Clark Public Utilities. 2008. Comments of Clark Public Utilities to the Western Climate Initiative Scope Subcommittee (Scope Draft Design Recommendations). March 17. Accessed from the WCI website at [www.westernclimateinitiative.org](http://www.westernclimateinitiative.org). Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.

Clarke, Harold D., Allan Kornberg, John MacLeod, and Thomas Scotto. 2005. Too close to call: Political choice in Canada, 2004. *Political Science and Politics* 38 (2): 247–253.

Clarke, Thomas H., Jr. 2009. California is re-examining the forestry protocol for voluntary GHG reductions. January 28. *Emerging Issues Law Center*. Available at <http://law.lexisnexis.com/practiceareas/Emerging-Issues-Law-Blog/--Climate-Change/California-is-reexamining-the-forestry-protocol-for-voluntary-GHG-reductions> (accessed May 15, 2009).

Clary, David A. 1987. What price sustained yield? The Forest Service, community stability, and timber monopoly under the 1944 Sustained-Yield Act. *Journal of Forest History* 31 (1): 4–18.

Clean Development Mechanism (CDM). Baseline and monitoring methodologies. Available at <http://cdm.unfccc.int/methodologies/index.html> (last accessed September. 28, 2009).

Clements, Frederic E. 1936. Nature and structure of the climax. *Journal of Ecology* 24 (1): 252–284.

Climate Trust website. Available at <http://www.climatetrust.org> (accessed June 3, 2009).

Climate Solutions. (Untitled, undated comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June 6, 2009).

- Conca, Ken. 2002. Beyond the Earth Summit framework. *Politics and the Life Sciences* 21 (2): 53–55.
- CPAWS (Canadian Parks and Wilderness Society). 2008. Comments on the Draft Western Climate Initiative Cap-and-Trade Program, August 13, 2008. (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June 6, 2009).
- Crook, John R., editor. 2008. U.S. state governments join International Carbon Action Partnership on global cap-and-trade markets. *American Journal of International Law* 102 (1): 162–164.
- De Deyn, Gerlinde B., Johannes H.C. Cornelissen, and Richard D. Bardgett. 2008. Plant functional traits and soil carbon sequestration in contrasting biomes. *Ecology Letters* 11 (5): 516–531.
- Dessai, Suraje, and Emma Lisa Schipper. 2003. The Marrakech Accords to the Kyoto Protocol: Analysis and future prospects. *Global Environmental Change* 13 (2): 149–153.
- Drushka, Ken. 2003. *Canada's forests: A history*. Montreal QC, and Kingston ON: McGill-Queen's University Press.
- Dyer, Gwynne. 2008. *The climate wars*. Toronto, ON: Random House Canada.
- Ecojustice. 2008. Canada back in court over Kyoto lawsuit. November 25. Available at <http://www.ecojustice.ca/media-centre/press-releases/canada-back-in-court-over-kyoto-lawsuit/> (accessed April 21, 2009).
- EcoTrust. 2008. Untitled comment, dated June 6, 2009 (Comment on *Western Climate Initiative Draft Design Recommendations on Elements of the Cap-and-Trade Program*, May 16, 2008.) Available at <http://www.westernclimateinitiative.org/public-comments/archived-comments> (last accessed September 27, 2009).
- EcoTrust. 2008. “Comments on the Draft Western Climate Initiative Cap-and-Trade Program”, August 13. Accessed from WCI website June, 2008. (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June, 2008).
- EIA (Energy Information Administration). 2008. Coal production and number of mines by state and mine type. (From Report No.: DOE/EIA 0584 (2007) Report Released September 2008.) Available at [www.eia.doe.gov/cneaf/coal/page/acr/table1.html](http://www.eia.doe.gov/cneaf/coal/page/acr/table1.html) (accessed July 18, 2009).
- EIA. 2009a. Crude oil production. Available at [http://tonto.eia.doe.gov/dnav/pet/pet\\_crd\\_crpdn\\_adc\\_mbb1\\_a.htm](http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdn_adc_mbb1_a.htm) (accessed July 17, 2009).
- EIA. Frequently Asked Questions–Environment. Available at [http://tonto.eia.doe.gov/ask/environment\\_faqs.asp](http://tonto.eia.doe.gov/ask/environment_faqs.asp) (last accessed September 15, 2009).
- EIA. 2009b. Natural gas production. With data from Form EIA-914, "Monthly Natural Gas Production Report", Form EIA-816, "Monthly Natural Gas Liquids Report", Form EIA-64A, "Annual Report of the Origin of Natural Gas Liquids Production", the U.S. Mineral Management Service, and industry reports. Accessed at <http://tonto.eia.doe.gov/dnav/ng> (accessed July 17, 2009).
- EIA. 2009c. Renewable and alternative fuels. From data form EIA-923, “Power Plant Operations Report.” Available at <http://www.eia.doe.gov/fuelrenewable.html> (accessed September 27, 2009).
- EIA. State energy profiles: Maine. Available at [http://tonto.eia.doe.gov/state/state\\_energy\\_profiles.cfm?sid=ME](http://tonto.eia.doe.gov/state/state_energy_profiles.cfm?sid=ME) (last accessed September 27, 2009).

EIA. Voluntary Reporting Program. Voluntary reporting of greenhouse gases program fuel and energy sources codes and emission coefficients. Available at <http://www.eia.doe.gov/oiaf/1605/coefficients.html> (accessed October 27, 2009).

Eizenstat, Stuart E. 2006. Seeing the Climate Policy for the Trees (Op-ed). *New York Times*, November 4. Available at <http://www.nytimes.com/2006/11/04/opinion/04eizenstat.html> (On-line article is one page, and so the quote in the text is referenced as page 1) (accessed May 15 2009).

El Paso Pipeline Group and El Paso Pipeline Partners. 2008. “Western Climate Initiative (WCI) Scope Draft Design Recommendations, March 3, 2008 –Comments from El Paso Pipeline Group and El Paso Pipeline Partners”, March 17. Accessed from WCI website. Public comments on WCI documents are archived at [www.westernclimateinitiative.org/public-comments/archived-comments](http://www.westernclimateinitiative.org/public-comments/archived-comments). Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.

Elster, Jon. 2009. *Reason and rationality*. Princeton and Oxford: Princeton University Press.

Emery, Claude. 1997. Pacific salmon: The Canada–United States dispute. Government of Canada, Depository Services Program. Available at <http://dsp-psd.tpsgc.gc.ca/Collection-R/LoPBdP/BP/bp429-e.htm> (last accessed September 4, 2009).

Environment Canada. 2009. Canada’s 2007 greenhouse gas inventory. Available at [http://www.ec.gc.ca/pdb/ghg/inventory\\_e.cfm](http://www.ec.gc.ca/pdb/ghg/inventory_e.cfm) (accessed July 25, 2009).

Environment Canada. National inventory report, 1990-2004 - Greenhouse gas sources and sinks in Canada. (Annex 11: Provincial/Territorial Analysis.) Available at [http://www.ec.gc.ca/pdb/GHG/inventory\\_report/2004\\_report/ann11\\_e.cfm#sa11\\_10\\_1](http://www.ec.gc.ca/pdb/GHG/inventory_report/2004_report/ann11_e.cfm#sa11_10_1) (accessed August 5, 2009).

EPA (Environmental Protection Agency) 2009. Executive summary. In *2009 U.S. greenhouse gas inventory report, Inventory of U.S. greenhouse gas emissions and sinks: 1990-2007*. pp. 4-5. Available at <http://epa.gov/climatechange/emissions/usinventoryreport.html> (accessed August 14, 2009).

EPA. Iowa greenhouse gas emissions and sinks inventory: Summary (1990). Available at <http://www.epa.gov/climatechange/emissions/downloads/IASummary.PDF> (last accessed September 27, 2009).

EPA. Iowa greenhouse gas emissions and sinks inventory: Summary 1990 & 2000. Available at [http://www.epa.gov/climatechange/emissions/downloads/IAInventorySummary\\_11-16b.pdf](http://www.epa.gov/climatechange/emissions/downloads/IAInventorySummary_11-16b.pdf) (last accessed September 27, 2009).

European Environment Agency (EEA). Greenhouse gas emissions per capita for the EU candidate countries and other EEA member countries. Available at <http://dataservice.eea.europa.eu/atlas/viewdata/viewpub.asp?id=3272> (accessed September 15, 2009).

Fairfield, Hannah. 2007. When carbon is currency. *New York Times*, May 6. Available at [http://www.nytimes.com/2007/05/06/business/yourmoney/06emit2.html?\\_r=1&scp=2&sq=%22regional%20greenhouse%20gas%20initiative%22&st=cse](http://www.nytimes.com/2007/05/06/business/yourmoney/06emit2.html?_r=1&scp=2&sq=%22regional%20greenhouse%20gas%20initiative%22&st=cse) (accessed May 15, 2009).

Fargione, Joseph, Jason Hill, David Tilman, Stephen Polasky, and Peter Hawthorne. 2008. Land clearing and the biofuel carbon debt. *Science* 319 (5867): 1235–1238.

Florence, R.G. 1965. Decline of old-growth redwood forests in relation to some soil microbiological processes. *Ecology* 46 (1/2): 52–64.

Foley, Jonathan A., Ruth DeFries, Gregory P. Asner, Carol Barford, Gordon Bonan, Stephen R. Carpenter, F. Stuart Chapin, Michael T. Coe, Gretchen C. Daily, Holly K. Gibbs et al. 2005. Global consequences of land use. *Science* 309 (5734): 570–574.

- Forsman, Eric D. 1975. A preliminary investigation of the spotted owl in Oregon. MS Thesis. Oregon State University. Available at <http://ir.library.oregonstate.edu/dspace/handle/1957/7272> (last accessed September 27, 2009).
- Forsman, Eric D., E. Charles Meslow, and Howard M. Wight. 1984. Distribution and biology of the spotted owl in Oregon. *Wildlife Monographs*, No. 87 (April): 3–64.
- Forsman, Eric D., E. Charles Meslow, and Monica J. Strub. 1977. Spotted owl abundance in young versus old-growth forests, Oregon. *Wildlife Society Bulletin* 5 (2): 43–47.
- Fowlie, Jonathan. 2009. Carbon tax to rise by 50 per cent. *Vancouver Sun*, June 30. Available at <http://www.vancouversun.com/health/Carbon+rise+cent/1745799/story.html> (last accessed September 27, 2009).
- Franklin, Jerry F., and M.A. Hemstrom. 1981. "Aspects of succession in the coniferous forests of the Pacific Northwest." In *Forest Succession Concepts and Application*, eds. D.C. West, H.H. Shugart and D.B. Botkin. New York: Springer-Verlag.
- Franklin, Jerry F., and Thomas A. Spies. 1991. Ecological definitions of old-growth Douglas-fir forest. In document PNW-GTR-285. Olympia, WA: United States Department of Agriculture, Forest Service, Pacific Northwest Research Station, 61–69. Available at [http://courses.washington.edu/esrm315/Franklin\\_Spies\\_Eco\\_Def\\_1991.pdf](http://courses.washington.edu/esrm315/Franklin_Spies_Eco_Def_1991.pdf) (accessed September 28, 2009).
- Furlong, Scott R., and Cornelius M. Kerwin. 2005. Interest group participation in rule making: A decade of change. *Journal of Public Administration Research and Theory* 15 (3): 353–370.
- Galbraith, Kate. January 29, 2009. Lawsuit filed in Northeast carbon trading scheme. *New York Times* (web-log). Available at <http://greeninc.blogs.nytimes.com/2009/01/29/lawsuit-filed-against-northeast-carbon-trading-scheme/> (last accessed September 27, 2009).
- Gallagher, Dawn R. 2004. Biomass Neutrality Memo. July 22. DEP Commissioner's Office. Available at "<http://maineghg.raabassociates.org/events.asp?type=dte&event=7%2F29%2F2004&Submit=Search+by+Date>" (accessed June 9, 2009).
- Galst, Liz. 2008. A Balancing Act on Emissions. *New York Times*, September 1. Available at <http://www.nytimes.com/2008/09/02/business/02carbon.html> (accessed May 15, 2009).
- Gerring, John. 2008. Case selection for case-study analysis: Qualitative and quantitative techniques. In *The Oxford Handbook of Political Methodology*, eds. Box-Steffensmeier, J.M., Brady, H.E., and Collier, D. New York: Oxford University Press, 645–684.
- Gessel, Stanley P. 1970. International Biological Program analysis of ecosystems: Coniferous forest biome; Proposal. Seattle, WA: University of Washington. Available at <http://ir.library.oregonstate.edu/dspace/handle/1957/7556> (last accessed September 27, 2009).
- Globe and Mail*, 24 Sept 2007. Harper's green stand over the years. Available at <http://v1.theglobeandmail.com/servlet/story/RTGAM.20070924.wharperquotes/BNSStory/National> (last accessed September 27, 2009).
- Goodell, Jeff. 2006. Capital pollution solution? *New York Times*, July 30. Available at <http://query.nytimes.com/gst/fullpage.html?res=9E07E2D7143FF933A05754C0A9609C8B63&sec=&spon=&pagewanted=1> (accessed May 15, 2009).
- Goulder, Lawrence H. 1992. Carbon tax design and U.S. industry performance. *Tax Policy and the Economy* 6: 59–104.

- Government of Canada. Sector Sustainability Tables. Available at <http://www.tdds-sst.gc.ca/default.asp?lang=En&n=CB51D3B8-1&offset=4&toc=show> (accessed July 22, 2009).
- Government of Canada. 2008. Turning the corner: Regulatory framework for industrial greenhouse gas emissions. Available at [www.ec.gc.ca](http://www.ec.gc.ca) (last accessed October 31, 2008).
- Green, Andrew J. 1997. Public participation and environmental policy outcomes. *Canadian Public Policy* 23 (4):435-458.
- Gronewold, Nathaniel. 2009. Is the Clean Development Mechanism slumping toward extinction? *New York Times*, March 20. Available at <http://www.nytimes.com/cwire/2009/03/20/20climatewire-is-the-clean-development-mechanism-slumping--10224.html?pagewanted=all> (last accessed September 27, 2009).
- Grumbine, R. Edward. 1994. What is ecosystem management? *Conservation Biology* 8 (1): 27-38.
- Hagar, Donald C. 1960. The interrelationships of logging, birds, and timber regeneration in the Douglas-fir region of northwestern California. *Ecology* 41 (1): 116-125.
- Hamerstrom, Frederick N., Jr., Harrison F. Lewis, and James T. Tanner. Wildlife conservation. 1942. *Wilson Bulletin* 54 (1): 57-60.
- Hansen, James E., and Makiko Sato. 2001. Trends of measured climate forcing agents. *Proceedings of the National Academy of Sciences of the United States of America* 98 (26): 14778-14783.
- Hardin, Garrett. 1968. The tragedy of the commons. *Science* 162 (3859): 1243-1248.
- Harkreader, Steve, and Allen W. Imershein. 1999. The conditions for state action in Florida's health-care market. *Journal of Health and Social Behavior* 40 (2):159-174.
- Harmon, Mark E., William K. Ferrell, and Jerry F. Franklin. 1990. Effects on carbon storage of conversion of old-growth forests to young forests. *Science* 247 (4943): 699-702.
- Harrison, Kathryn. 2007. The road not taken: Climate change policy in Canada and the United States. *Global Environmental Politics* 7 (4): 92-117.
- Harrison, Kathryn, and Lisa McIntosh Sundstrom. 2007. The comparative politics of climate change. *Global Environmental Politics* 7 (4): 1-18.
- Harvey, L.D. Danny. 2004. Climatic change: Addressing complexity, uncertainty, and conflict. In *Resource and Environmental Management in Canada: Addressing Conflict and Uncertainty*, Third Edition, ed. Bruce Mitchell. Don Mills, ON: Oxford University Press, 132-165.
- Hayward, Gregory D. 1991. Using population biology to define old-growth forests. *Wildlife Society Bulletin* 19 (1): 111-116.
- Hoberg, George, and Kathryn Harrison. 1994. It's not easy being green: The politics of Canada's Green Plan. *Canadian Public Policy* 20 (2): 119-137.
- Hodge, C.F. 1912. A last word on the passenger pigeon. *The Auk* 29 (2): 169-175.
- Hofmann, J.V. 1920. The establishment of a Douglas fir forest. *Ecology* 1 (1): 49-53.
- Hojnacki, Marie. 1998. Organized interests' advocacy behavior in alliances. *Political Research Quarterly* 51 (2):437-459.
- Howlett, Michael. 2000. Beyond legalism? Policy ideas, implementation styles and emulation-based convergence in Canadian and U.S. environmental policy. *Journal of Public Policy* 20 (3): 305-329.

Howlett, Michael, and Jeremy Rayner. 2006. Convergence and divergence in ‘New Governance’ arrangements: Evidence from European integrated natural resource strategies. *Journal of Public Policy* 26 (2): 167–189.

Hunter, J.C., and V.T. Parker. 1993. The disturbance regime of an old-growth forest in coastal California. *Journal of Vegetation Science* 4 (1): 19-24.

ICNU (Industrial Customers of Northwest Utilities). 2008. “ICNU Comments on Draft WCI Recommendations on Scope and Electricity Sector”, March 17. Accessed from WCI website. Public comments on WCI documents are archived at [www.westernclimateinitiative.org/public-comments/archived-comments](http://www.westernclimateinitiative.org/public-comments/archived-comments). Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.

ICNU. “Petition to Intervene of the Industrial Customers of Northwest Utilities” (Attachment A). The Bonneville Power Administration 2008 Wind Integration Rate Case. BPA Docket No. WI-09. Available at [http://www.transmission.bpa.gov/business/rates\\_and\\_tariff/2009wrc/interv/Industrial\\_Customers\\_of\\_Northwest\\_Utillities.pdf](http://www.transmission.bpa.gov/business/rates_and_tariff/2009wrc/interv/Industrial_Customers_of_Northwest_Utillities.pdf) (accessed June 9, 2009).

IPCC. 2007. Climate change 2007: The AR4 synthesis report. Available at [www.ipcc.ch](http://www.ipcc.ch) (last accessed Sept 27, 2009).

Irvine, J., B.E. Law, and K.A Hibbard. 2007. Postfire carbon pools and fluxes in semiarid ponderosa pine in Central Oregon. *Global Change Biology* 13 (8): 1748-1760.

Issac, Leo A, and Howard G. Hopkins. 1937. The Forest Soil of the Douglas Fir Region, and Changes Wrought Upon it by Logging and Slash Burning. *Ecology* 18 (2): 264-279.

Jackson, Jerome A. 2006. Ivory-billed woodpecker (*Campephilus Principalis*): Hope, and the interfaces of science, conservation, and politics. *The Auk* 123 (1): 1-15.

Jacot, Arthur Paul. 1935. Molluscan populations of old growth forests and rewooded fields in the Asheville Basin of North Carolina. *Ecology* 16 (4): 603–605.

Johnson, Eric. 2009. Goodbye to carbon neutral: Getting biomass footprints right. *Environmental Impact Assessment Review* 29 (3): 165–168.

Johnson, Kirk. 2009. Beetles add new dynamic to forest fire control efforts. *New York Times*, June 27. Available at <http://www.nytimes.com/2009/06/28/us/28wildfires.html> (accessed September 4, 2009).

Jorgenson, Dale W., Daniel T. Slesnick, Peter J. Wilcoxon, Paul L. Joskow, and Raymond Kopp. 1992. Carbon taxes and economic welfare. *Brookings Papers on Economic Activity, Microeconomics* 1992: 393-454.

Klyza, Christopher McGrory, and David J. Sousa. 2008. American environmental policy, 1990-2006: Beyond Gridlock. Cambridge, MA: MIT Press.

Kolchugina, Tatyana P., and Ted S. Vinson. 1995. Russian forests in the global carbon balance. *Ambio* 24 (5): 258-264.

Konan, Denise Eby. 2009. Energy & greenhouse gas solutions: Economic impact of climate change policy (Slide Show.) Legislative Hearing on Global Climate Change, January 15. Available at [http://www.capitol.hawaii.gov/session2009/Testimony/info\\_testimony\\_ENE-EEP\\_01-15-09\\_DeniseKonan.pdf](http://www.capitol.hawaii.gov/session2009/Testimony/info_testimony_ENE-EEP_01-15-09_DeniseKonan.pdf) (last accessed September 27, 2009).

Koziell, Izabella, and Ian R. Swingland. 2002. Collateral biodiversity benefits associated with ‘free-market’ approaches to sustainable land use and forestry activities. *Philosophical Transactions: Mathematical, Physical and Engineering Sciences* 360 (1797): 1807–1816.

- Kramer, Marc G., Andrew J. Hansen, Mark L. Taper, and Everett J. Kissinger. 2001. Abiotic controls on long-term windthrow disturbance and temperate rain forest dynamics in Southeast Alaska. *Ecology* 82 (10): 2749–2768.
- Kurz, Werner A., and Michael J. Apps. 1999. A 70-year retrospective analysis of carbon fluxes in the Canadian forest sector. *Ecological Applications* 9 (2): 526–547.
- Kurz, Werner A., C.C. Dymond, G. Stinson, G.J. Rampley, E.T. Neilson, A.L. Carroll, T. Ebata, and L. Safranyik. 2008. Mountain pine beetle and forest carbon feedback to climate change. *Nature* 452 (7190): 987–990.
- Laghi, Brian. 2009. Saskatchewan warms to Obama climate plan. *Globe and Mail*, Aug 7. Available at <http://www.theglobeandmail.com/news/politics/saskatchewan-warms-to-obama-climate-plan/article1244727/> (accessed August 16, 2009).
- Larsen, J.A. 1929. Fires and forest succession in the Bitterroot Mountains of Northern Idaho. *Ecology* 10 (1): 67–76.
- Latham & Watkins LLP website. Available at <http://www.lw.com/Resources.aspx?page=ClientAlertDetail&publication=1576> (last accessed September 28, 2009).
- Law, Beverley E., D. Turner, J. Campbell, O.J. Sun, S. Van Tuyl, W.D. Ritts, and W.B. Cohen. 2004. Disturbance and climate effects on carbon stocks and fluxes across Western Oregon USA. *Global Change Biology* (2004) 10: 1429-1444.
- LCV (League of Conservation Voters). 2000. 1999 National Environmental Scorecard. (Cited in Revesz (2001).)
- League of Women Voters of Washington. 2008. “Public Testimony to the Western Climate Initiative (WCI) Stakeholder Meeting”, June 6. Accessed from the WCI website. Public comments on WCI documents are archived at [www.westernclimateinitiative.org/public-comments/archived-comments](http://www.westernclimateinitiative.org/public-comments/archived-comments). Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.
- Lee, Danny C., and Larry L. Irwin. 2005. Assessing risks to spotted owls from forest thinning in fire-adapted forests of the western United States. *Forest Ecology and Management* 211 (2005): 191–209.
- Lieberman, Evan S. 2005. Nested Analysis as a Mixed-Method Strategy for Comparative Research. *The American Political Science Review* 99 (3): 435–452.
- Lindenmayer, David B., Philip J. Burton, and Jerry F. Franklin. 2008. *Salvage logging and its ecological consequences*. Island Press: Washington, Covelo, London.
- Littell, Jeremy S., David L. Peterson, and Michael Tjoelker. 2008. Douglas-fir growth in mountain ecosystems: Water limits tree growth from stand to region. *Ecological Monographs* 78 (3): 349–368.
- Livingstone, Nigel J., and G. Cornelis van Kooten. 2004. Terrestrial carbon sinks and climate change mitigation. In *Hard Choices: Climate Change in Canada*, eds. Harold Coward and Andrew J. Weaver. Waterloo, ON: Wilfrid Laurier University Press.
- Loucks, Orie L. 1970. Evolution of diversity, efficiency, and community stability. *American Zoologist* 10 (1):17–25.
- Luyssaert, Sebastiaan, et al. 2008. Old-growth forests as global carbon sinks. *Nature*, 455: 213–215.
- MacArthur, Robert H., and Edward O. Wilson. 1967. *The theory of island biogeography*. Princeton, NJ: Princeton University Press.

- Mahli, Yadvinder, Patrick Meir, and Sandra Brown. 2002. Forests, carbon and global climate. *Philosophical Transactions: Mathematical, Physical and Engineering Sciences* 360 (1797): 1567–1591.
- Mark E. Harmon, William K. Ferrell, and Jerry F. Franklin. 1990. Effects on carbon storage of conversion of old-growth forests to young forests. *Science* 247 (4943): 699–702.
- Markoff, John, Gilbert Shapiro, and Sasha R. Weitman. 1975. Toward the integration of content analysis and general methodology. *Sociological Methodology* 6: 1–58.
- Marx, Axel. 2005. Qualitative comparative analysis: Is there a difference between random and real models? August 12 (Paper presented at the annual meeting of the American Sociological Association.) Available at [http://www.allacademic.com/meta/p\\_mla\\_apa\\_research\\_citation/0/2/0/3/5/pages20357/p20357-1.php](http://www.allacademic.com/meta/p_mla_apa_research_citation/0/2/0/3/5/pages20357/p20357-1.php) (last accessed Sept 27, 2009).
- Marshall, Joe T., Jr. 1942. Food and habitat of the spotted owl. *The Condor* 44 (2): 66–67.
- McCright, Aaron M., and Riley E. Dunlap. 2003. Defeating Kyoto: The conservative movement's impact on U.S. climate change policy. *Social Problems* 50 (3): 348–373.
- McDonald, Stephen L. 1954. Sustained yield forest management: Some observations on its economic significance and implications for resource policy. *American Journal of Economics and Sociology* 13 (4): 389–399.
- McIlhenny, E.A. 1941. The passing of the ivory-billed woodpecker. *The Auk* 58 (4): 582–584.
- Means, Benjamin. 1998. Prohibiting conduct, not consequences: The limited reach of the Migratory Bird Treaty Act. *Michigan Law Review* 97 (3): 823–842.
- Merriam, Willis B. 1938. Forest situation in the Pacific Northwest. *Economic Geography* 14 (1): 103–108.
- MGGRA (Midwestern Greenhouse Gas Reduction Accord) website. Available at <http://www.midwesternaccord.org/news.html> (accessed July 17, 2008).
- Mitchell, Bruce. 2004. Introduction. In *Resource and Environmental Management in Canada: Addressing Conflict and Uncertainty*, Third Edition, ed. Bruce Mitchell. Don Mills, ON: Oxford University Press. pp. 1–18.
- Mitchell, Robert Edward. 1967. The use of content analysis for explanatory studies. *The Public Opinion Quarterly* 31 (2): 230–241.
- Miller, William. Untitled review of Ragin (1987), *The Comparative Method: Beyond Qualitative and Quantitative Strategies*. *Journal of Public Policy* 7 (4): 454–456.
- Monbiot, George. 2006. *Heat: How to stop the planet from burning*. Anchor Canada.
- Moura Costa, Pedro, Marc Stuart, Michelle Pinard, and Gareth Phillips. 2000. Elements of a certification system for forestry-based carbon offset projects. *Mitigation and Adaptation Strategies for Global Change* 5 (1): 39–50.
- Muldoon, Paul, Alastair Lucas, Robert B. Gibson, and Peter Pickfield. 2009. *An introduction to environmental law and policy in Canada*. Toronto, ON: Emond Montgomery Publications Limited.
- Munger, Thornton T. 1930. Ecological aspects of the transition from old forests to new. *Science* 72 (1866): 327–332.
- Munger, Thornton T. 1940. The cycle from Douglas fir to hemlock. *Ecology* 21 (4): 451–459.

Murray, Brian C., Bruce A. McCarl, and Heng-Chi Lee. 2004. Estimating leakage from forest carbon sequestration programs. *Land Economics* 80 (1): 109–124.

Nature Conservancy. 2008. Undated document, commenting on the 3 March 2008 Scope Subcommittee recommendations. Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.

Nature Conservancy. 2008. “Response of The Nature Conservancy to the Western Climate Initiative July 23, 2008 Draft Design of the Regional Cap-and-Trade Program”, August 13. (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June, 2009).

NCOC (National Carbon Offset Coalition, Inc). Website. Available at [www.ncoc.us](http://www.ncoc.us) (accessed June 3, 2009).

Nelson, Jon P. 2002. “Green” voting and ideology: LCV scores and roll-call voting in the U.S. Senate, 1988-1998. *Review of Economics and Statistics* 84 (3): 518–529.

*New York Times*. 2008. Election Results 2008. December 9. Available at <http://elections.nytimes.com/2008/results/president/map.html> (accessed July 22, 2009).

*New York Times*. 2009. House Vote on H.R.2454: American Clean Energy and Security Act. June 26. Available at <http://politics.nytimes.com/congress/votes/111/house/1/477> (accessed June 27, 2009).

Noon, Barry R., and Jennifer A. Blakesley. 2006. Conservation of the northern spotted owl under the Northwest Forest Plan. *Conservation Biology* 20 (2): 288–296.

Noon, Barry R., and Kevin S. McKelvey. 1996. Management of the spotted owl: A case history in conservation biology. *Annual. Review of Ecology and Systematics* 27: 135–62.

NWPPA (Northwest Pulp and Paper Association). 2008. “Comments on Western Climate Initiative Scope Recommendations Paper”, March 17. (A comment on *Draft Scope Recommendations*, March 3, 2008.) Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.

NWPPA (Northwest Pulp and Paper Association). 2008. “Northwest Pulp and Paper Association Comments on Western Climate Initiative Design of the Regional Cap-and-Trade Program”, August 13. (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June, 2009).

Oberholser, Harry C. 1940. A goshawk nest in the upper Sonoran life-zone. *The Condor* 42 (2): 100–103.

Odum, Eugene P. 1945. The concept of the biome as applied to the distribution of North American birds. *The Wilson Bulletin* 57 (3): 191–201.

Odum, Eugene P. 1950. Bird populations of the Highlands (North Carolina) Plateau in relation to plant succession and avian invasion. *Ecology* 31 (4): 587–605.

Oregon Environmental Council. 2008. “Comments on the Draft Design of the WCI Regional Cap-and-Trade Program From the Oregon Environmental Council”, August 13. (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June, 2009).

Oregon Wild. 2008. "Comment on the 3 March 2008 Scope subcommittee document", March 17. Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are "currently being migrated" from an older site. It seems that some documents, including the one cited here may be temporarily unavailable on-line.

Pacala, S., and R. Socolow. 2004. Stabilization wedges: Solving the climate problem for the next 50 years with current technologies. *Science* 305 (5686): 968–972.

Pacific Salmon Commission. 2008. Pacific Salmon Commission's Response to IUCN's Status Assessment of Fraser Sockeye. November 13. Available at [http://www.psc.org/pubs/IUCN/IUCN\\_OA\\_Final.pdf](http://www.psc.org/pubs/IUCN/IUCN_OA_Final.pdf) (accessed September 4, 2009).

PacifiCorp website. Available at <http://www.pacificcorp.com/Navigation/Navigation3883.html>.

Palmer, Monte, Larry Stern, and Charles Gaile. 1974. *The interdisciplinary study of politics*. New York, NY: Harper & Row Publishers.

Pearson, Timothy R.H., Sandra L. Brown, and Richard A. Birdsey. 2007. Measurement guidelines for the sequestration of forest carbon. Newtown Square, PA: U.S. Department of Agriculture, Forest Service, Northern Research Station. Available at <http://www.nrs.fs.fed.us/pubs/3292> (accessed September 28, 2009).

Pembina Institute. 2008. "Pembina Institute Comments on Draft Scope Recommendations for WCI Cap & Trade", March 18. Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are "currently being migrated" from an older site. It seems that some documents, including the one cited here may be temporarily unavailable on-line.

Pew Center on Global Climate Change website. Pew Center Summary of the Waxman-Markey Discussion Draft: The American Clean Energy and Security Act of 2009. Available at <http://www.pewclimate.org/docUploads/waxman-markey-discussion-draft-summary.pdf> (accessed 29 June, 2009).

Pew Center on Global Climate Change website. Midwest Greenhouse Gas Reduction Accord. Available at [http://www.pewclimate.org/what\\_s\\_being\\_done/in\\_the\\_states/mggra](http://www.pewclimate.org/what_s_being_done/in_the_states/mggra) (accessed October 16, 2009).

PFT (Pacific Forest Trust). 2008. "Comments on the Draft Program Scope Recommendations", March 17. Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.

PFT (Pacific Forest Trust) website. Available at [www.pacificforest.org](http://www.pacificforest.org) (accessed July 5, 2009).

Piatt, John F. 1993. Distribution and abundance of marbled murrelets in Alaska. *The Condor* 95 (3): 662–669.

Pike, Lawrence H., William C. Denison, Diane M. Tracy, Martha A. Sherwood, and Frederick M. Rhoades. 1975. Floristic survey of epiphytic lichens and bryophytes on old-growth conifers in Western Oregon. *The Bryologist* 78 (4): 389–402.

Pinchot, Gifford. 1891. Government forestry abroad. *Publications of the American Economic Association* 6 (3): 7–54.

Port of Seattle website. Available at [www.portseattle.org](http://www.portseattle.org) (accessed June 3, 2009).

Post, Wilfred M., R. Cesar Izaurralde, Julie D. Jastrow, Bruce A. McCarl, James E. Amonette, Vanessa L. Bailey, Philip M. Jardine, Tristram O. West, and Jizhong Zhou. 2004. Enhancement of carbon sequestration in US soils. *BioScience* 54 (10): 895–908.

- Pralle, Sarah B. 2006. *Branching out, digging In: Environmental advocacy and agenda setting*. Washington, DC: Georgetown University Press.
- PSE (Puget Sound Energy). 2008. Untitled comment. (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June, 2009).
- PSE (Puget Sound Energy) website. Available at [http://www.pse.com/energyEnvironment/energysupply/Pages/EnergySupply\\_ElectricitySolar.aspx](http://www.pse.com/energyEnvironment/energysupply/Pages/EnergySupply_ElectricitySolar.aspx) (last accessed September 27, 2009).
- Pulp and Paper Task Force (Members: AbitibiBowater, Canfor Corporation, Canfor Pulp Limited Partnership, Catalyst Paper, Cariboo Pulp, Domtar, Howe Sound Pulp and Paper, Mercer International, Neucel Specialty Cellulose, Pope and Talbot, Tembec, and West Fraser). 2007. "BC Pulp and Paper Industry Carbon Emissions Performance and Proposed Carbon Reduction Policies: A Position Paper with Recommendations for Successful Implementation of a BC Carbon Cap and Trade System." Available at <http://www.pulpandpaperbc.ca/pdf/Carbon%20Policy%20Position%20Paper.pdf> (accessed July 22, 2009).
- Pyne, Stephen. 1982. *Fire in America: A cultural history of wildland and rural fire*. Princeton, NJ: Princeton University Press.
- Rabe, Barry G. 2002. Statehouse and greenhouse: The States are taking the lead on climate change. *The Brookings Review* 20 (2): 11-13.
- Rabl, Ari, Anthony Benoist, Dominique Dron, Bruno Peupartier, Joseph V. Spadaro, and Assaad Zoughaib. 2007. (Editorial). *International Journal of Life Cycle Analysis* 12 (5): 281. Available at <http://www.springerlink.com/content/11x7777m03760726/fulltext.pdf> (last accessed September 27, 2009).
- Ragin, Charles C. 1987. *The comparative method: Moving beyond qualitative and quantitative strategies*. Berkeley and Los Angeles, CA and London: University of California Press.
- Rainforest Action Network (RAN) and Rivers International. 2009. "Initial Analysis of Offsets Provisions in the Draft of the American Clean Energy and Security Act of 2009 (ACESA)", April 15. Available at <http://internationalrivers.org/files/WaxmanIRРАН.pdf> (accessed June 24 2009).
- Rajala, Richard. 1998. *Clearcutting the Pacific rain forest: Production, science, and regulation*. Vancouver, BC: University of British Columbia Press.
- Repetto, Robert. 2001. The Clean Development Mechanism: Institutional breakthrough or institutional nightmare? *Policy Studies* 34 (3/4): 303-327.
- Revesz, Richard L. 2001. Federalism and environmental regulation: A public choice analysis. *Harvard Law Review* 115(2): 553-641.
- Revkin, Andrew C. 2007. Buying carbon-neutral. *New York Times*, April 29. Available at <http://www.nytimes.com/2007/04/29/weekinreview/revkinsidebarinnwr4820.html> (accessed May 15, 2009).
- Revkin, Andrew C. 2008. On global warming, McCain and Obama agree: Urgent action is needed. *New York Times*, October 18. Available at <http://www.nytimes.com/2008/10/19/us/politics/19climate.html?scp=18&sq=%22climate%20change%22%20obama%202008&st=cse> (accessed April 21, 2009).
- RGGI (Regional Greenhouse Gas Initiative). 2008. "Regional Greenhouse Gas Initiative Model Rule of December 31, 2008, final with corrections." Available at [http://www.rggi.org/about/history/model\\_rule](http://www.rggi.org/about/history/model_rule) (accessed July 9, 2009).
- RGGI (Regional Greenhouse Gas Initiative) website. Available at [www.rggi.org/states](http://www.rggi.org/states)

- Rihoux, Benoît. 2008. Case-oriented configurational research: Qualitative comparative analysis (QCA), Fuzzy Sets, and Related Techniques. In *The Oxford Handbook of Political Methodology*, eds. Box-Steffensmeier, J.M., Brady, H.E., and Collier, D. New York, NY: Oxford University Press. pp. 645-684.
- Rio Tinto. 2008. "Rio Tinto's Preliminary Comment on the Western Climate Initiative's Design Recommendations on Elements of the Cap-and-Trade Program – Allocations and Scope", June 16. Available at <http://www.westernclimateinitiative.org/scope-comments> (last accessed September 27, 2009).
- Ross, Michael Lee. 2005. *First Nations sacred sites in Canada's courts*. Vancouver, BC: University of British Columbia Press.
- Rowe, Gene, and Lynn J. Frewer. 2005. A typology of public engagement mechanisms. *Science, Technology, & Human Values* 30 (2): 251–290.
- Rudel, Tom, and Jill Roper. 1996. Regional patterns and historical trends in tropical deforestation, 1976-1990: A qualitative comparative analysis. *Ambio* 25 (3): 160-66.
- Salt River Project. 2008. "Comments of the Salt River Project to the WCI Partners on the May 16, 2008 Draft Design Recommendations on Elements of the Cap-and-Trade Program", June 6. Available at <http://www.westernclimateinitiative.org/scope-comments>
- San Francisco Chronicle*. 2008. Ontario joins North American environmental plan. July 18. (accessed June 10, 2009).
- Satterfield, Terre. 2002. *Anatomy of a conflict: Identity, knowledge, and emotion in old-growth forests*. Vancouver, BC: University of British Columbia Press.
- Saunders, Craig. 2008. Carbon offsets: Who's tracking the trackers? *Globe and Mail*, April 22. Available at <http://www.theglobeandmail.com/archives/whos-tracking-the-trackers/article680601/> (last accessed September 27, 2009).
- Savolainen, Jukka. 1994. The rationality of drawing big conclusions based on small samples: In defense of Mill's methods. *Social Forces* 72 (4): 1217-1224.
- Sayer, Jeffrey. 2000. Forward. In Wunder, Sven. 2007. *The Economics of Deforestation*. New York: St. Martin's Press.
- Sayer, Jeffrey, Natarajan Ishwaran, James Thorsell, and Todd Sigaty. 2000. Tropical forest biodiversity and the World Heritage Convention. *Ambio* 29(6): 302–309.
- Schlamadinger, Bernhard., J. Spitzer, G.H. Kohlmaier, M. Lüdeke. 1995. Carbon balance of bioenergy from logging residues. *Biomass and Bioenergy* 8 (4): 221-234.
- Schrope, Mark. 2009. When money grows on trees. *Nature Reports* 3 (Climate Change): 101-103. Available at <http://www.nature.com/climate/2009/0909/full/climate.2009.78.html> (last accessed September 27, 2009).
- Science*. 1931. Virgin forest lands of the United States. 73 (1891): 334–335.
- Science*. 1938. Forests of the Pacific Northwest. 88 (2281): 250–251.
- Science*. 1961. Conferences on Science and World Affairs. 134 (3484): 984–991.
- Science News-Letter*. 1934. New Deal in forestry aims at sustained yield management. 25 (675): 167.

- Shaw, David C., Jerry F. Franklin, Ken Bible, Jeffrey Klopatek, Elizabeth Freeman, Sarah Greene, and Geoffrey G. Parker. 2004. Ecological setting of the Wind River old-growth forest. *Ecosystems* 7 (5): 427-439.
- Shelford, V.E. 1945. The relative merits of the life zone and biome concepts. *The Wilson Bulletin* 57 (4): 248-252.
- Sherwood, Martha, and George Carroll. 1974. Fungal succession on needles and young twigs of old-growth Douglas fir. *Mycologia* 66 (3): 499-506.
- Shiva, Vandanna. 2008. *Soil not oil*. Cambridge, MA: South End Press.
- Sightline Institute. 2008. "Comments on The Western Climate Initiative's Draft Program Scope Recommendations", March 17. (Comment on the March 3, 2008 WCI Scope document.) Accessed from the WCI website. Public comments on WCI documents are archived at [www.westernclimateinitiative.org/public-comments/archived-comments](http://www.westernclimateinitiative.org/public-comments/archived-comments). Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.
- Simpson, Jeffrey, Mark Jaccard, and Nic Rivers. 2007. *Hot air: Meeting Canada's climate change challenge*. Toronto, ON: McClelland & Stewart.
- Slocombe, D. Scott. 2004. Applying an ecosystem approach. In *Resource and environmental management in Canada: Addressing conflict and uncertainty*, Third Edition, ed. Bruce Mitchell. Don Mills, Ontario: Oxford University Press. 420-441.
- Smith, Brett R., Robert W. Rice, and Peter J. Ince. 2003. Pulp capacity in the United States, 2000. United States Department of Agriculture, Forest Service, Forest Products Laboratory, General Technical Report FPL-GTR-139. Available at <http://www.fpl.fs.fed.us/documnts/fplgtr/fplgtr139.pdf> (accessed July 22, 2009).
- Smith, Herbert L. 1990. Untitled review of Ragin (1987), *The comparative method: Beyond qualitative and quantitative strategies*. *Population and Development Review*, 16, (4): 784-788.
- Smithwick, Erica A.H., Mark E. Harmon, Suzanne M. Remillard, Steven A. Acker, and Jerry F. Franklin. 2002. Potential upper bounds of carbon stores in forests of the Pacific Northwest. *Ecological Applications* 12 (5):1303-1317.
- Solid Waste Industry for Climate Solutions. 2008. "Draft Design Recommendations on Elements of the Cap-and-Trade Program Comments Submitted by the Solid Waste Industry for Climate Solutions (SWICS)", June 6. Available at <http://www.westernclimateinitiative.org/scope-comments> (last accessed September 27, 2009).
- Spalding, V.M. 1903. The rise and progress of ecology. *Science* 17 (423): 201-210.
- Sprinz, Detlef F. 2001. Comparing the global climate regime with other global environmental accords. In *International Relations and Global Climate Change*, eds. Urs Luterbacher and Detlef F. Sprinz. Cambridge, MA: MIT Press.
- State of Hawaii Department of Business, Economic Development & Tourism website. Available at <http://hawaii.gov/dbedt/info/energy> (accessed Aug 24, 2009).
- Statistics Canada. Portrait of the Canadian population in 2006: Highlights. Available at <http://www12.statcan.ca/census-recensement/2006/as-sa/97-550/p1-eng.cfm> (last accessed September 27, 2009).
- Stavins, Robert N. 1998. What can we learn from the grand policy experiment? Lessons from SO<sub>2</sub> allowance trading. *Journal of Economic Perspectives* 12 (3): 69-88.
- Stebbins, G. Ledyard. 1962. International Biological Program. *Science* 137 (3532): 768+770.

- Stokstad, Erik. 2005. Learning to adapt. *Science* 309 (5735): 688–690.
- Streck, C., A. Tuerk, and B. Schlamadinger. 2009. Forestry offsets in emissions trading systems: A link between systems? *Mitigation and Adaptation Strategies for Global Change* 14 (5): 455-463.
- Terassen Gas. 2008. “Comments on WCI Draft Recommendations”, June 5. (Comment on WCI *Draft Design Recommendations on Elements of the Cap-and-Trade Program*, May 16, 2008.) Available at <http://www.westernclimateinitiative.org/scope-comments>
- Thomas, Jack Ward. 1996. Forest Service perspective on ecosystem management. *Ecological Applications* 6 (3): 703-705.
- Thomas, Jack Ward. 2000. From managing a deer herd to moving a mountain: One pilgrim’s progress. *The Journal of Wildlife Management* 64 (1): 1-10.
- Thomas, Jack Ward, and James Burchfield. 2000. Science, politics, and land management. *Rangelands* 22 (4): 45–48.
- Thomas, Jack Ward, Leonard F. Ruggiero, R. William Mannan, John W. Schoen, and Richard A. Lancia. 1988. Management and conservation of old-growth forests in the United States. *Wildlife Society Bulletin* 16 (3): 252-262.
- Thomassin, Paul J. 2003. Canadian agriculture and the development of a carbon trading and offset system. *American Journal of Agricultural Economics* 85 (5): 1171–1177.
- Tucson Electric Power Company. 2008. “Comments to the *Draft Recommendations for the Scope and Electricity Subcommittees*”, March 20 (This document is erroneously dated March 20, 2007.) Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.
- UN (United Nations). 1992. *United Nations Framework Convention on Climate Change*. Available at <http://unfccc.int/resource/docs/convkp/conveng.pdf> (last accessed October 16, 2009).
- UN (United Nations). 1998. *Kyoto Protocol to the United Nations Framework Convention on Climate Change*. Available at <http://unfccc.int/resource/docs/convkp/kpeng.pdf> (accessed June 30, 2009).
- US Census Bureau. State & County QuickFacts. Available at <http://quickfacts.census.gov/qfd/states/37000.html> (accessed July 22, 2009).
- US Census Bureau. Foreign Trade Statistics: State Export Data. Available at <http://www.census.gov/foreign-trade/statistics/state/data/index.html> (accessed June 26, 2008).
- US Department of State. 1949. “International Convention on the Regulation of Whaling.” Treaties and Other International Acts Series, No. 1849 (Publication 3383). *American Journal of International Law* 43 (4): 174–185.
- Vallance, William Roy. 1937. The International Convention for Regulation of Whaling and the act of Congress giving effect to its provisions. *American Journal of International Law* 31 (1): 112-119.
- van Kooten, G. Cornelis. 2003. Smoke and mirrors: The Kyoto Protocol and beyond. *Canadian Public Policy* 29 (4): 397-415.
- van Kooten, G. Cornelis, and Grant Hauer. 2001. Global climate change: Canadian policy and the role of terrestrial ecosystems. *Canadian Public Policy* 27 (3): 267-278.

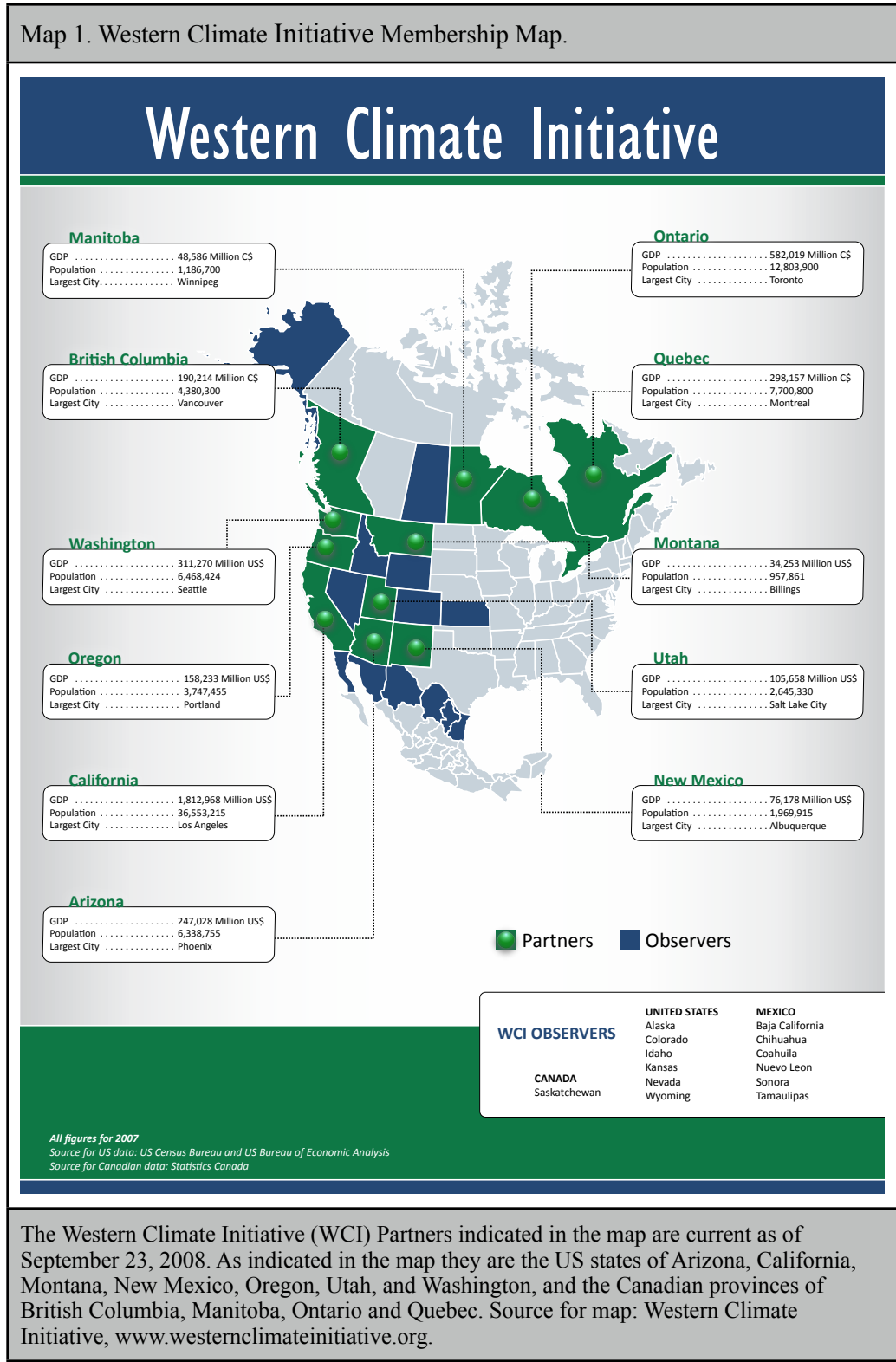
- van Kooten, G. Cornelis, and Sen Wang. 1998. Estimating economic costs of nature protection: British Columbia's forest regulations. *Canadian Public Policy* 24 (Special Supplement 2 on Forestry Issues in Canada): S63-S71.
- van Mantgem, P.J., Nathan L. Stephenson, John C. Byrne, Lori D. Daniels, Jerry F. Franklin, Peter Z. Fulé, Mark E. Harmon, Andrew J. Larson, Jeremy M. Smith, Alan H. Taylor, and Thomas T. Veblen. 2009. Widespread increase of tree mortality rates in the Western United States. *Science*, 323, 521–524.
- Vasi, Ion Bogdan. 2007. Thinking globally, planning nationally and acting locally: Nested organizational fields and the adoption of environmental practices. *Social Forces* 86 (1): 113–136.
- Victor, David G. 2001. *The collapse of the Kyoto Protocol and the struggle to slow global warming*. Princeton and Oxford: Princeton University Press.
- WFPA (Washington Forest Protection Association) website. Available at <http://www.wfpa.org> (accessed June 3, 2009).
- Waste Management. 2008. Untitled, undated comment in response to *WCI Draft Program Scope Recommendations* (March 3, 2008). Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.
- Weaver, Andrew. 2008. *Keeping our cool: Canada in a warming world*. Toronto, ON: Viking.
- Weber, Robert Philip. 1985. *Basic content analysis*. Beverly Hills, California: Sage Publications, Inc.
- WEST Associates. 2008. “WEST Associates Comments Western Climate Initiative (WCI) Scope Subcommittee Recommendations”, March 17. Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are “currently being migrated” from an older site. It seems that some documents, including the one cited here may be temporarily unavailable on-line.
- Westerling, A.L., H.G. Hidalgo, D.R. Cayan, and T.W. Swetnam. 2006. Warming and earlier spring increase Western U.S. forest wildfire activity. *Science* 313: 940-943.
- WeCAN (Western Climate Advocates Network). 2008. Untitled comment, June 6. (Comment on *Western Climate Initiative Draft Design Recommendations on Elements of the Cap-and-Trade Program*, May 16, 2008). Available at <http://www.westernclimateinitiative.org/scope-comments> (last accessed September 27 2009).
- WeCAN (Western Climate Advocates Network). 2008. Untitled comment, 17 March. (Comment on *WCI Draft Program Scope Recommendations*, March 3, 2008). Accessed from the WCI website. Public comments on WCI documents are archived at [www.westernclimateinitiative.org/public-comments/archived-comments](http://www.westernclimateinitiative.org/public-comments/archived-comments). Comments are being moved from an older site, and it seems that some documents, including the one cited here may be temporarily unavailable on-line.
- WCI (Western Climate Initiative) Scope Subcommittee. 2008. “Summary of Major Design Options Under Consideration”, January 2. Available through the Legislative Library of British Columbia, at [www.llbccat.leg.bc.ca](http://www.llbccat.leg.bc.ca) Legislative Library of British Columbia (accessed September 27, 2009).
- WCI. 2007. “Five Western Governors Announce Regional Greenhouse Gas Reduction Agreement” (Press Release), February 26. Available at <http://www.governor.wa.gov/news/news-view.asp?pressRelease=499&newsType=1> (last accessed Sept 27, 2009).
- WCI. 2007. “Western Climate Initiative Statement of Regional Goal”, August 22. Available through the Legislative Library of British Columbia, at [www.llbccat.leg.bc.ca](http://www.llbccat.leg.bc.ca) (accessed September 27, 2009).

- WCI. 2007. "Work Plan, October 2007 - August 2008", October 29. Available through the Legislative Library of British Columbia, at [www.llbccat.leg.bc.ca](http://www.llbccat.leg.bc.ca) (accessed September 27, 2009).
- WCI. 2008. "Design Recommendations for the WCI Regional Cap-and-Trade Program", September 23. Available through the Legislative Library of British Columbia, at [www.llbccat.leg.bc.ca](http://www.llbccat.leg.bc.ca) (accessed September 27, 2009).
- WCI. 2008. "Draft Design of the Regional Cap-and-Trade Program", July 23. Available through the Legislative Library of British Columbia, at [www.llbccat.leg.bc.ca](http://www.llbccat.leg.bc.ca) (accessed September 27, 2009).
- WCI. 2008. "Draft Offsets Design Recommendations", April 3. Available through the Legislative Library of British Columbia, at [www.llbccat.leg.bc.ca](http://www.llbccat.leg.bc.ca) (accessed September 27, 2009).
- WCI. 2008. "Draft Recommendations on Elements of the Cap-and-Trade Program", May 16. Available through the Legislative Library of British Columbia, at [www.llbccat.leg.bc.ca](http://www.llbccat.leg.bc.ca) (accessed September 27, 2009).
- WCI. 2008. "U.S. States, Canadian Provinces Announce Regional Cap-and-Trade Program to Reduce Greenhouse Gases", September 23. (Press Release). Available at <http://www.westernclimateinitiative.org/component/remository/general/> (accessed September 28, 2009).
- WCI. 2008. "Western Climate Initiative Draft Scope Recommendations, Public Review Draft", March 3. Available through the Legislative Library of British Columbia, at [www.llbccat.leg.bc.ca](http://www.llbccat.leg.bc.ca) (accessed September 27, 2009).
- WCI. Map (of the WCI). Available at [www.westernclimateinitiative.org](http://www.westernclimateinitiative.org) (accessed May 29, 2009).
- WCI. Overview. Accessed from the WCI website at [www.westernclimatenitiative.org](http://www.westernclimatenitiative.org)
- WCI. 2007. "Western Regional Climate Action Initiative", February 26. Available at <http://www.westernclimateinitiative.org/component/remository/general/> (accessed September 28, 2009).
- Weyerhaeuser. 2008. "Draft Design of the Regional Cap-and-Trade Program", August 13. (Comment on the *Draft Design of the Regional Cap-and-Trade Program*, July 23, 2008.) Available at <http://www.westernclimateinitiative.org/draft-design-recommendation-comments> (accessed June 6, 2009).
- Weyerhaeuser. 2008. "Comments on the Scope Draft Design Recommendations", March 17. (Comment submitted with regard to the *Draft Scope Recommendations*, March 3, 2008.) Public comments on WCI documents are available at <http://www.westernclimateinitiative.org/public-comments/archived-comments>. Comments are "currently being migrated" from an older site. It seems that some documents, including the one cited here may be temporarily unavailable on-line.
- WFLC (Western Forestry Leadership Coalition) website. Available at [www.wflccenter.org](http://www.wflccenter.org) (accessed June 3, 2009).
- Wheeler, William Morton. 1902. "Natural History", "Ecology" or "Ethology". *Science* 15 (390): 971–976.
- Whittaker, R.H. 1953. A consideration of the climax theory: The climax as a population and pattern. *Ecological Monographs*. 23: 41-78.
- Whittington, H.W. 2002. Electricity Generation: Options for Reduction in Carbon Emissions. *Philosophical Transactions: Mathematical, Physical and Engineering Sciences*, 360 (1797): 1653–1668.
- Wilbur, Sanford R. 1973. The California Condor in the Pacific Northwest. *The Auk* 90 (1): 196-198.

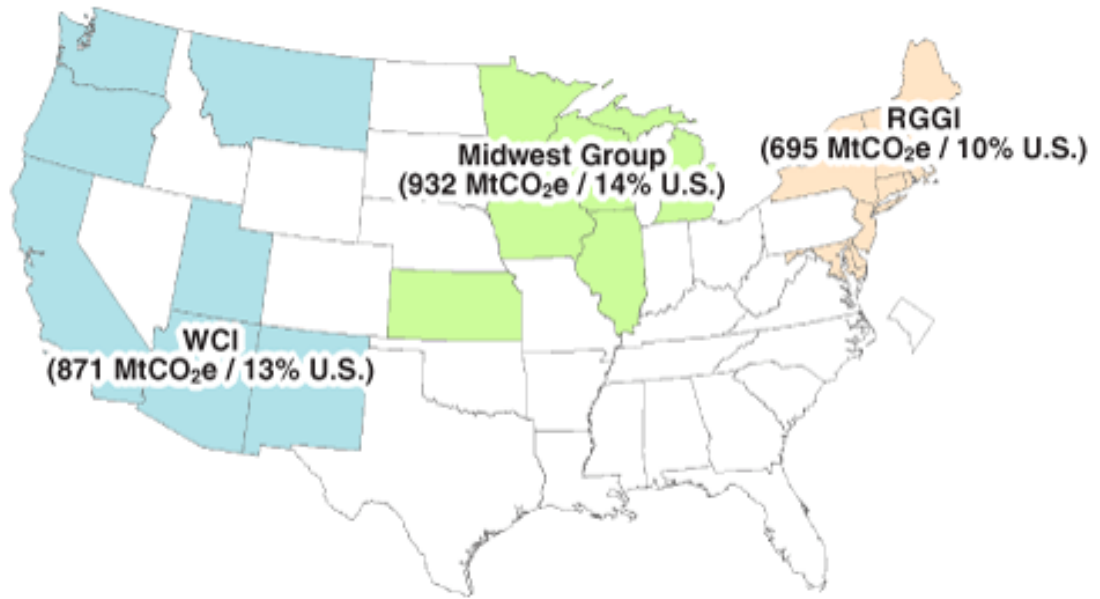
- Williams, Tim. 2009. "The Climate Change Convention and the Kyoto Protocol" (PRB 07-21E). Revised January 30, 2009. Parliamentary Information and Research Service, Library of Parliament. Available at <http://www.parl.gc.ca/information/library/PRBpubs/prb0721-e.htm> (accessed August 21, 2009).
- Wilman, Elizabeth A., and Mahen S. Mahendrarajah. 2002. Carbon offsets. *Land Economics* 78 (3): 405-416.
- Wilson, Jeremy. 1998. *Talk and log: Wilderness politics in British Columbia, 1965-96*. Vancouver BC: University of British Columbia Press.
- Wimberly, Michael C., and Thomas A. Spies. 2001. Influences of environment and disturbance on forest patterns in coastal Oregon watersheds. *Ecology* 82 (5): 1443-1459.
- Wirth, C., J.W. Lichstein, J. Dushoff, A. Chen, and F.S. Chapin. 2008. White spruce meets black spruce: dispersal, postfire establishment, and growth in a warming climate. *Ecological Monographs*, 78(4): 489-505.
- WPCF (*Water Pollution Control Federation Journal*). 1984. The Environmental Issue in the 1984 Elections. 56 (10): 1069-1072.
- WRI (World Resource Institute). Map of WCI Midwest Group and RGGI membership. Available at <http://www.wri.org/chart/u-s-state-climate-initiatives-mggra-rggi-wci> (accessed July 25, 2009).
- Yapp, R.H. 1922. The concept of habitat. *The Journal of Ecology* 10 (1): 1-17.
- Young, Audrey. 2007. How the emissions trading system works. *New Zealand Herald*, September 21. Available at [http://www.nzherald.co.nz/forestry/news/article.cfm?c\\_id=47&objectid=10465140](http://www.nzherald.co.nz/forestry/news/article.cfm?c_id=47&objectid=10465140) (accessed August 5, 2009).
- Zasloff, Jonathan. 2008. Massachusetts v. Environmental Protection Agency. *American Journal of International Law* 102 (1): 134-143.
- Zhang, ZhongXiang. 2004. Meeting the Kyoto targets: The importance of developing country participation. *Journal of Policy Modeling* 26 (1): 3-19.

# Appendices

## Appendix A: Maps

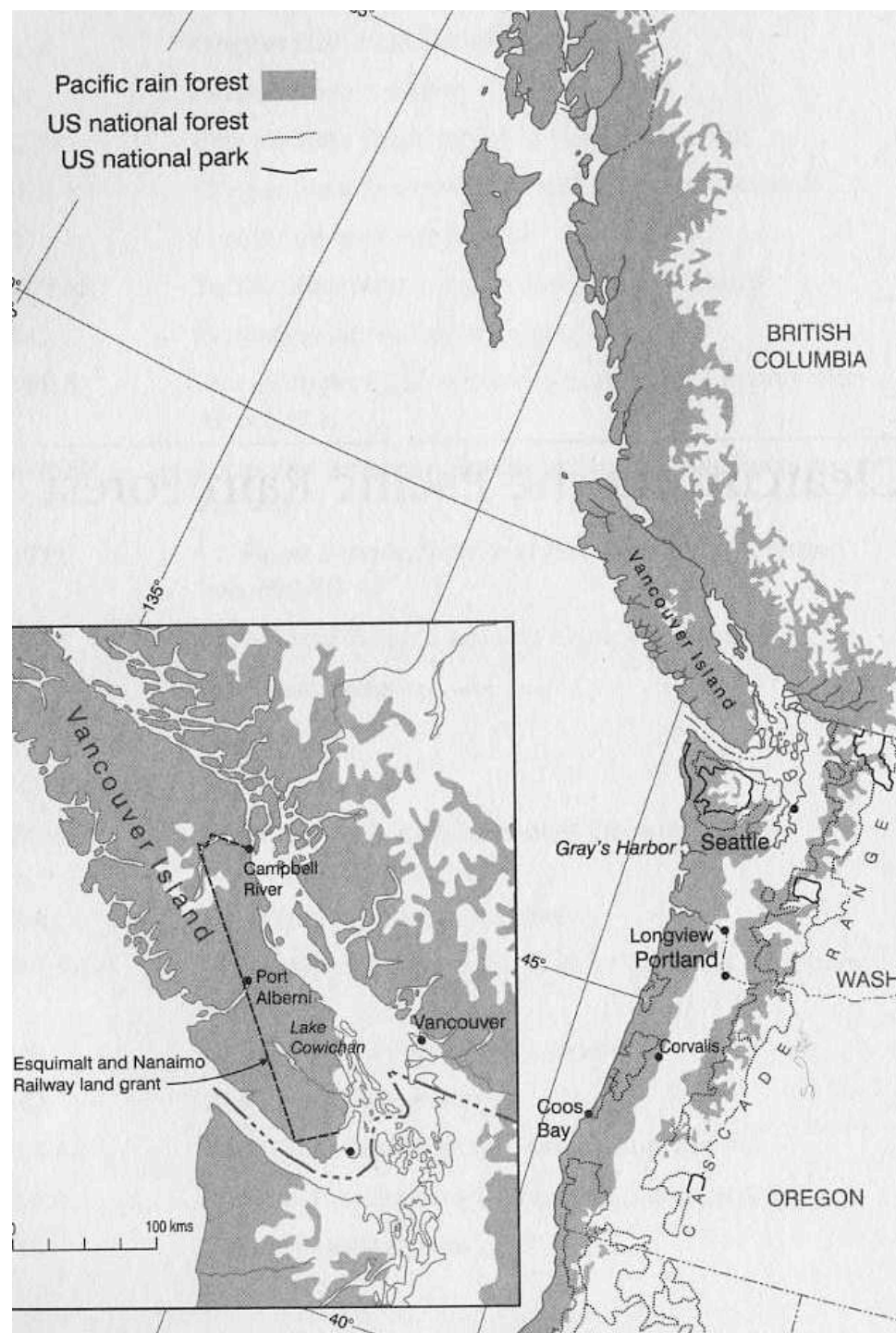


Map 2. Regional Climate Initiative Membership Map.



The map shows the US membership of the Western Climate Initiative (WCI), Midwest Group and Regional Greenhouse Gas Initiative (RGGI) participants. Source for map: World Resources Institute. Available at <http://www.wri.org/chart/u-s-state-climate-initiatives-mggra-rggi-wci> (accessed July 25, 2009).

Map 3. Pacific Rain Forest Site Map



The shaded area in the map indicates the general geographic range of the Pacific rain forest ecosystem type. Some of the first ecological definitions of old-growth forest were applied to stages of forest development in moist temperate forests (or coastal temperate rainforest) of the West Coast. This map is only intended to provide a general idea of forest ecosystem location for one of the forest types that is important to the discussion in the main text. Source for map: Rajala (1998, p. xvi).

## Appendix B: Western Climate Initiative GHG Reduction Targets

Table B1. Western Climate Initiative (WCI) Greenhouse Gas Reduction Targets Compared to Kyoto Targets (Million Metric Tons from Fossil Fuel Combustion)						
	1990	2005	2007	Kyoto Target (2012)	WCI target (2020) (Hypothetical, uniform application of the WCI target to each state)	% WCI target exceeds Kyoto target
Arizona	62.87	96.26	101.51	58.4691	81.821	39.938874
California	364.32	390.29	402.77	338.8176	331.7465	-2.0869931
Montana	28.24	35.39	37.70	26.2632	30.0815	14.538594
New Mexico	52.57	58.92	58.55	48.8901	50.082	2.4379169
Oregon	31.07	41.08	43.52	28.8951	34.918	20.844019
Utah	53.80	65.91	69.23	50.034	56.0235	11.9708598
Washington	72.02	78.75	82.56	66.9786	66.9375	-0.0613629
US WCI	664.89	766.6	795.84	618.3477	651.61	5.3792227
California, Oregon, and Washington	467.41	510.12	528.85	434.6913	433.602	-0.2505916
Arizona, Montana, New Mexico, and Utah	197.48	256.48	266.99	183.6564	218.008	18.704276

Data for CO<sub>2</sub> emissions are from the EPA. The EPA estimates “are based on energy consumption data from EIA’s State Energy Consumption, Price, and Expenditure Estimates (SEDS) released Spring/Summer 2009 (available online at: [http://www.eia.doe.gov/emeu/states/\\_seds.html](http://www.eia.doe.gov/emeu/states/_seds.html)).” The EPA estimates were accessed at [http://epa.gov/climatechange/emissions/downloads/CO2FFC\\_2007.pdf](http://epa.gov/climatechange/emissions/downloads/CO2FFC_2007.pdf), Aug. 25, 2009. The US Kyoto Protocol target was a 7% reduction in GHG emissions from a 1990 level by 2012 (Zhang 2004). The Western Climate Initiative target is a 15% reduction below a 2005 baseline by 2020 (WCI, Aug 22, 2007). CO<sub>2</sub> emissions values in the table only included emissions from fossil fuels; sinks and sources associated with forests are not included. The US reduction commitment under Kyoto was 7% below 1990 levels; however the US never did ratify the Kyoto Protocol.

## Appendix C: Choosing Explanatory Factors

This appendix provides background material related to the choice of explanatory factors for the qualitative comparative analysis.

### C.1. Per Capita Greenhouse Gas Emissions

The EU ETS was established before any GHG cap-and-trade system at the federal level in the US or Canada. At the same per capita GHG emissions for European countries are lower than those for the US and Canada. Likewise, a GHG cap-and-trade system was designed in New Zealand (and then delayed) before in Australia (at least at the national level). Again, New Zealand's per capita emissions are lower than Australia's.<sup>76</sup> If a cap-and-trade system is intended to 'put a price' on carbon emissions, it would seem that jurisdictions with higher per capita emissions may be reluctant to join an initiative would make them pay more than other jurisdictions with lower per capita emissions. Per capita GHG emissions seem a likely candidate proxy for presumed 'cost' of joining a cap-and-trade system. For the US states, the categories of 'HIGH' or 'low' per capita emissions are designated by membership in the set of the 25 states with the highest per capita emissions, or the set of the 25 states with the lowest per capita

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<sup>76</sup> The future of the New Zealand's GHG cap-and-trade system seems uncertain: "The Government is waiting on the report back from the Review Committee before committing to any decisions on the future of New Zealand's ETS [emissions trading scheme]" (Government of NZ website). New Zealand's total emission for 2007 were 61,852.8 Gg CO<sub>2eq</sub> (NZ Ministry for the Environment 2009), Or 61.85 Tg or 61.85 million metric tons. New Zealand's population for 2007 was estimated at 4,230,700 (Statistics New Zealand). This makes New Zealand's 2007 per capita GHG emissions 14.62 metric tons per capita. This is close to Oregon's per capita emissions, and compared to the range of emissions for US states, would make New Zealand a low emissions jurisdiction. The estimate for Australia's population at the end of 2008 is 21,644,000 (Australian Bureau of Statistics). Australia GHG emissions for 2008 were 553Mt (Australian Department of Climate Change 2009). This makes Australia 2008 per capita emissions 25.55 metric tons, significantly higher than New Zealand's. REFERENCES: Australian Bureau of Statistics. Australian Demographic Statistics, Dec 2008. Accessed 5 Aug 2009: <http://www.abs.gov.au/ausstats/abs@.nsf/mf/3101.0> ; Australian Government Department of Climate Change. 2009. National Greenhouse Gas Inventory. Published May 2009. Accessed 5 Aug 2009. <http://www.climatechange.gov.au/inventory/2007/index.html> ; Government of New Zealand. Website. Accessed 5 Aug 2009. <http://www.climatechange.govt.nz/emissions-trading-scheme/index.html> ; New Zealand Ministry for the Environment. New Zealand's Greenhouse Gas Inventory 1990-2007: Fulfilling reporting requirements under the United Nations Framework Convention on Climate Change and New Zealand's voluntary submission under Article 7.1 of the Kyoto Protocol. Submitted to the United Nations Framework Convention on Climate Change 15 April 2009. Accessed on-line August 5, 2009: <http://www.mfe.govt.nz/publications/climate/greenhouse-gas-inventory-2009/new-zealands-greenhouse-gas-inventory.pdf> .

emissions. Per capita emissions, regional initiative participation, and coal producing states are listed in Table C1 below:

Table C1. GHG Emissions per Capita for U.S. States (2007)			
	National Rank in GHG emissions per capita, highest to lowest		National Rank in GHG emissions per capita, highest to lowest
Wyoming	1	Georgia	26
North Dakota	2	Minnesota (MGGRA)	27
West Virginia	3	Illinois (MGGRA)	28
Alaska	4	Hawaii	29
Louisiana	5	Wisconsin (MGGRA)	30
Montana (WCI)	6	Michigan (MGGRA)	31
Kentucky	7	South Dakota	32
Indiana	8	North Carolina	33
Alabama	9	Virginia	34
Oklahoma	10	Nevada	35
New Mexico (WCI)	11	Arizona (WCI)	36
Iowa (MGGRA)	12	New Jersey (RGGI)	37
Texas	13	Maine (RGGI)	38
Kansas (MGGRA)	14	New Hampshire (RGGI)	39
Utah (WCI)	15	Florida	40
Nebraska	16	Maryland (RGGI)	41
Missouri	17	Washington (WCI)	42
Ohio	18	Massachusetts (RGGI)	43
Mississippi	19	Oregon (WCI)	44
Arkansas	20	Connecticut (RGGI)	45
Pennsylvania	21	California (WCI)	46
Tennessee	22	Idaho	47
South Carolina	23	Rhode Island (RGGI)	48
Colorado	24	Vermont (RGGI)	49
Delaware (RGGI)	25	New York (RGGI)	50

States are ranked according to per capita GHG emissions. “RGGI”, “WCI” and “MGGRA” indicate participation in the Regional Greenhouse Gas Initiative, Western Climate Initiative, or Midwestern Greenhouse Gas Reduction Accord. Source for GHG emissions data: EPA (2009). Available at [http://epa.gov/climatechange/emissions/state\\_energyco2inv.html](http://epa.gov/climatechange/emissions/state_energyco2inv.html). Population data for calculating per capita values: US Census Bureau, Population Division. Table 1: Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2008 (NST-EST2008-01). Last Accessed Aug 25, 2009.

## **C.2. Politics: Environmental Voting Record**

Revesz (2001), citing LCV (2000), has ranked the US states according to their voting record on environmental legislation (Table C2 below). The threshold chosen for membership in the set of states with a strong voting record on the environment is the top 25 states. Because of a tie, South Carolina is included in the set of states with a strong voting record, meaning that in fact 26 states are included.

To the extent that the environment is a partisan issue, an alternative causal condition could be a measure of the partisan alignment of jurisdictions (for example the vote in the 2008 US presidential election). There is strong agreement between whether a state voted Democrat or Republican in the 2008 US federal election, and whether that state has joined a regional climate initiative. However, the environmental voting records of states is highly partisan, suggesting that including both past environmental voting, and partisan politics, as basic possible explanatory factors would be redundant. (See C2 on next page.) Further investigation of political factors would no doubt be interesting, but it is beyond the scope of this study. States' past environmental voting records seem more directly related to climate policy than general political leanings.

Vermont (RGGI)	D	1	South Carolina	R	24
Massachusetts (RGGI)	D	2	Iowa (MGGRA)	D	27
Hawaii	D	3	North Carolina	D	27
New Jersey (RGGI)	D	3	Ohio	D	27
Rhode Island (RGGI)	D	3	Virginia	D	27
Connecticut (RGGI)	D	6	Arkansas	R	31
Oregon (WCI)	D	7	Indiana	D	31
Maine (RGGI)	D	8	Colorado	D	33
New York (RGGI)	D	9	Georgia	R	33
Delaware (RGGI)	D	10	Nebraska	R	33
Maryland (RGGI)	D	11	Tennessee	R	33
Minnesota (MGGRA)	D	11	Utah (WCI)	R	33
Wisconsin (MGGRA)	D	11	Texas	R	38
Michigan (MGGRA)	D	14	Arizona (WCI)	R	39
Illinois (MGGRA)	D	15	Kansas (MGGRA)	R	39
Washington (WCI)	D	16	Kentucky	R	39
California (WCI)	D	17	New Mexico (WCI)	D	39
North Dakota	R	18	Alaska	R	43
Pennsylvania	D	19	Idaho	R	43
West Virginia	R	19	Montana (WCI)	R	43
Nevada	D	21	South Dakota	R	43
Mississippi	R	22	Wyoming	R	43
Missouri	R	22	Alabama	R	48
Florida	D	24	Louisiana	R	48
New Hampshire (RGGI)	D	24	Oklahoma	R	48

Ranking correspond to the tendency of states to vote for environmental legislation at the US federal level. 'R' and 'D' refer to supporting the Republican or Democrat candidate in the 2008 US federal election. RGGI, WCI, and MGGRA refer to participation in the Regional Greenhouse Gas Initiative, the Western Climate Initiative, or the Midwest Greenhouse Gas Accord. Sources: Revesz (2001), citing LCV (2000), for ranking of voting records; RGGI, WCI, and MGGRA participation determined from the websites for these initiatives; Election Results Source: New York Times, Election Results 2008. Tuesday, December 09, 2008. Accessed online July 22, 2009. <http://elections.nytimes.com/2008/results/president/map.html>

Ties in rankings are due to ties in the voting record. Washington DC is included in the Revesz study. A Wilcoxon rank sum test with continuity correction on the rank of environmental voting records of states participating vs. not participating in one of the three cap-and-trade initiatives yields a W value of 447.5, and a p-value of 0.0009748. (With the exact p-value being uncomputable due to ties in rank.)

### **C.3. Energy Resources**

**Coal Production.** Relative to other fossil fuels (such as oil and natural gas), coal has a high ratio of GHG emissions to unit of energy produced. Moreover, coal mining is particularly carbon intensive. Goulder (1992) models that each dollar of a US carbon tax, per metric ton of carbon, has the following percent production cost increases: 2.734 for coal mining, but only 0.612 for crude petroleum and natural gas. It might therefore be supposed that states which are major coal producers would be reluctant to join a cap-and-trade system, and thereby be compelled to buy permits for coal associated emissions. However, because there is a very high agreement between jurisdictions which produce coal, and those with high per capita GHG emissions, it has been deemed that including coal production as a causal factor would be redundant.

While having any coal production in a state is closely related to having high per capita GHG emissions, it is only for states with very high per capita coal production (perhaps the top ten states) for which coal production and per capita GHG emissions are very closely related. For states with somewhat lower coal production values, the high per capita emissions are likely associated with burning coal for electricity. See Table C3.

	Coal production per capita (2007) – rank among the 50 US states	GHG emissions per capita (2001) – rank among the 50 US states		Coal production per capita (2007) – rank among the 50 US states	GHG emissions per capita (2001) – rank among the 50 US states
Wyoming	1	1	Ohio	14	21
West Virginia	2	3	Alaska	15	4
North Dakota	3	2	Texas	16	13
Montana (WCI)	4	5	Arizona (WCI)	17	29
Kentucky	5	7	Mississippi	18	12
New Mexico (WCI)	6	8	Louisiana	19	6
Utah (WCI)	7	15	Oklahoma	20	10
Colorado	8	31	Tennessee	21	20
Indiana	9	9	Maryland (RGGI)	22	39
Pennsylvania	10	23	Kansas	23	17
Alabama	11	11	Missouri	24	19
Virginia	12	36	Arkansas	25	14
Illinois (MGGRA)	13	35			

Coal producing states which have joined a regional climate initiative are indicated by the initiative they have joined (WCI, RGGI, or MGGRA) are highlighted in yellow. Coal production data source: US Energy Information Association, “Coal Production and Number of Mines by State and Mine Type.” ( Report No.: DOE/EIA 0584 (2007). Report Released: September 2008). Available at <http://www.eia.doe.gov/cneaf/coal/page/acr/table1.html> (last accessed Aug. 19, 2009.) Per Capita GHG emissions data: California Energy Commission. 2006. Inventory of California Greenhouse Gas Emissions and Sinks: 1990 to 2004, p18. Population data for calculating per capita coal production: US Census Bureau population estimates <http://quickfacts.census.gov/qfd/states/06000.html> . For the coal producing states Kendall’s rank correlation test yields T=204, tau=0.36, and p-value=0.01137, for a correlation between coal production per capita and per capita GHG emissions.

The median rank for per capita coal production among the coal producing states which have joined a regional climate initiative is 10, while the median for states which have not joined a regional climate initiative is 12. It is only for the top few producing states (per capita), that quantity of coal production alone seems a likely factor associated with regional cap-and-trade initiative non-participation. Among the coal producing states that have joined a climate initiative the median rank of GHG emissions per capita is 22, only slightly above the median for all US states of 25.5. The median for states which have not joined a regional initiative is 12, well above the national median. The apparent effect whereby states that produce coal are less likely to join a regional climate initiative is likely mostly related to coal combustion for electricity generation,

rather than directly to the amount of coal produced. Coal producing states likely tend to be in areas where coal is accessible, and may generally be inclined to use coal to generate electricity. This would explain the effect whereby the states with the highest 15 per capita emissions values are all coal producers. With regard to coal based electricity combustion, GHG emissions per capita is a useful measure that incorporates coal combustion and other economic factors related to GHG emissions.

**Hydroelectricity Production.** Hydroelectric generation is the largest renewable source of electricity in North America. When hydro is used instead of fossil fuels for electricity generation, it can be related to low per capita emissions.<sup>77</sup> However, jurisdictions with low emissions due to highly urbanized, non-industrial, or non-resource extracting industries, may tend to have low per capita emissions, but not necessarily much hydroelectric production. While including both coal production and per capita GHG emissions as causal factors may be largely redundant, it seems that it may be useful to include hydroelectricity production.

**Natural Gas Production.** Natural gas production is included as a causal factor since ‘pricing carbon’ may induce fuel switching from coal and petroleum to natural gas. This might mean that natural gas producing states could favor climate change legislation. On the other, hand natural gas production is energy intensive and producers might be reluctant to pay for emissions.

Table C4 below shows national rankings for hydroelectricity, natural gas, crude petroleum, and coal production.

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<sup>77</sup> An account of the land-use emissions that may be associated with hydroelectric projects is outside the scope of this study.

Table C4. US National Ranking in Energy Production– Total Production

	Coal Production (2007)	Oil Production (2007)	Natural Gas (2007)	Hydro (2008)	Per capita emissions (2007)– lowest to highest
1	Wyoming	Texas	Texas	<b>Washington</b>	<b>New York</b>
2	West Virginia	Alaska	Alaska	<b>Oregon</b>	<b>Vermont</b>
3	Kentucky	<b>California</b>	Wyoming	<b>New York</b>	<b>Rhode Island</b>
4	Pennsylvania	Louisiana	Oklahoma	<b>California</b>	Idaho
5	<b>Montana</b>	Oklahoma	<b>New Mexico</b>	Idaho	<b>California</b>
6	Texas	<b>New Mexico</b>	Louisiana	Alabama	<b>Connecticut</b>
7	Colorado	Wyoming	Colorado	<b>Arizona</b>	<b>Oregon</b>
8	Indiana	North Dakota	<b>Utah</b>	<b>Montana</b>	<b>Massachusetts</b>
9	<b>Illinois</b>	<b>Kansas</b>	<b>Kansas</b>	Tennessee	<b>Washington</b>
10	North Dakota	<b>Montana</b>	<b>California</b>	<b>Maine</b>	<b>Maryland</b>
11	Virginia	Colorado	Alabama	Oklahoma	Florida
12	<b>New Mexico</b>	Mississippi	Mississippi	Arkansas	<b>New Hampshire</b>
13	<b>Utah</b>	<b>Utah</b>	<b>Michigan</b>	North Carolina	<b>Maine</b>
14	Ohio	<b>Illinois</b>	Arkansas	Pennsylvania	<b>New Jersey</b>
15	Alabama	Alabama	West Virginia	<b>Maryland</b>	<b>Arizona</b>
16	<b>Arizona</b>	Arkansas	Pennsylvania	South Dakota	Nevada

States in bold font have joined a regional climate initiative, including the WCI, RGGI, or MGGRA. Energy data compiled from US Energy Information Administration Statistics. Per capita calculations were made by 2008 population estimates. Coal Production Data from EIA: “Coal Production and Number of Mines by State and Mine Type.” Report No.: DOE/EIA 0584 (2007) Report Released: September 2008) Last Accessed at: <http://www.eia.doe.gov/cneaf/coal/page/acr/table1.html> Last Accessed Aug 19, 2009. Total Crude Oil Production, EIA (2009a): [http://tonto.eia.doe.gov/dnav/pet/pet\\_crd\\_crpdn\\_adc\\_mbb1\\_a.htm](http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdn_adc_mbb1_a.htm) Accessed July 17, 2009; Natural Gas production: [http://tonto.eia.doe.gov/dnav/ng/ng\\_prod\\_sum\\_dc\\_u\\_sak\\_a.htm](http://tonto.eia.doe.gov/dnav/ng/ng_prod_sum_dc_u_sak_a.htm) Accessed Aug 15, 2009; US hydroelectric production data source: Energy Information Administration, Official Energy Statistics from the U.S. Government. Hydroelectric. The original source for the data was: Energy Information Administration, Form EIA-923, “Power Plant Operations Report.” Accessed 18 July 2009: [www.eia.doe.gov/cneaf/solar\\_renewables/page/hydroelec/hydroelec.html](http://www.eia.doe.gov/cneaf/solar_renewables/page/hydroelec/hydroelec.html). States were ranked according to total production by the author.

Table C5. US National Ranking in Energy Production (Top 16 States) Per Capita

	Coal Production (2007) per capita	Oil Production (2007) per capita	Natural Gas (2007) per capita	Hydro (2008) per capita	Per capita emissions (2007) per capita, lowest to highest
1	Wyoming	Alaska	Alaska	<b>Washington</b>	<b>New York</b>
2	West Virginia	Wyoming	Wyoming	<b>Oregon</b>	<b>Vermont</b>
3	North Dakota	North Dakota	<b>New Mexico</b>	<b>Montana</b>	<b>Rhode Island</b>
4	<b>Montana</b>	<b>Montana</b>	Oklahoma	Idaho	Idaho
5	Kentucky	<b>New Mexico</b>	West Virginia	South Dakota	<b>California</b>
6	<b>New Mexico</b>	Louisiana	Louisiana	<b>Maine</b>	<b>Connecticut</b>
7	<b>Utah</b>	Oklahoma	Texas	North Dakota	<b>Oregon</b>
8	Colorado	Texas	Colorado	Alabama	<b>Massachusetts</b>
9	Indiana	<b>Kansas</b>	<b>Utah</b>	Alaska	<b>Washington</b>
10	Pennsylvania	<b>Utah</b>	<b>Kansas</b>	<b>Vermont</b>	<b>Maryland</b>
11	Alabama	Mississippi	<b>Montana</b>	<b>New York</b>	Florida
12	Virginia	<b>California</b>	North Dakota	Arkansas	<b>New Hampshire</b>
13	<b>Illinois</b>	Colorado	Arkansas	<b>New Hampshire</b>	<b>Maine</b>
14	Ohio	Arkansas	Mississippi	<b>Arizona</b>	<b>New Jersey</b>
15	Alaska	South Dakota	Alabama	Oklahoma	<b>Arizona</b>
16	Texas	Alabama	<b>Michigan</b>	Tennessee	Nevada

States in bold font have joined a regional climate initiative, including the WCI, RGGI, or MGGRA. Energy data compiled from US Energy Information Administration Statistics. Per capita calculations were made by 2008 population estimates. Coal Production Data from EIA: "Coal Production and Number of Mines by State and Mine Type." Report No.: DOE/EIA 0584 (2007) Report Released: September 2008). Available at: <http://www.eia.doe.gov/cneaf/coal/page/acr/table1.html> (last accessed Aug 19, 2009). Total Crude Oil Production: [http://tonto.eia.doe.gov/dnav/pet/pet\\_crd\\_crpdn\\_adc\\_mbb1\\_a.htm](http://tonto.eia.doe.gov/dnav/pet/pet_crd_crpdn_adc_mbb1_a.htm) Accessed July 17, 2009; Natural Gas production: [http://tonto.eia.doe.gov/dnav/ng/ng\\_prod\\_sum\\_dcu\\_sak\\_a.htm](http://tonto.eia.doe.gov/dnav/ng/ng_prod_sum_dcu_sak_a.htm) Accessed Aug 15, 2009; US hydroelectric production data source: Energy Information Administration, Official Energy Statistics from the U.S. Government. Hydroelectric. The original source for the data was: Energy Information Administration, Form EIA-923, "Power Plant Operations Report." Accessed 18 July 2009: [www.eia.doe.gov/cneaf/solar.renewables/page/hydroelec/hydroelec.html](http://www.eia.doe.gov/cneaf/solar.renewables/page/hydroelec/hydroelec.html); Source for GHG emissions data: US Environmental Protection Agency. [http://epa.gov/climatechange/emissions/state\\_energyco2inv.html](http://epa.gov/climatechange/emissions/state_energyco2inv.html). Population data for calculating per capita values: US Census Bureau, Population Division. Table 1: Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2008 (NST-EST2008-01). Last Accessed Aug 25, 2009. The states were ranked by per capita production by the author. Population for calculating per capita values are from the US Census Bureau. Table 1: Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2008 (NST-EST2008-01). [www.census.gov/popest/states/NST-ann-est.html](http://www.census.gov/popest/states/NST-ann-est.html) Last Accessed Aug. 26, 2009.

**Pulp and Paper Production.** After hydroelectricity, biomass combustion is the second largest source of ‘renewable’ electricity production in the US. Much of biomass electricity generation is by the pulp and paper sector. There are several different ways that pulp and paper production may be related to an incentive or disincentive towards joining a regional cap-and-trade system. It does not seem obvious, *a priori*, what a general relationship might be.

The cost of pricing carbon for the pulp and paper sector would depend on whether biomass combustion emissions are considered ‘carbon neutral.’ If a regional cap-and-trade system were to require compliance credits for biomass emissions, it could be a disincentive for a major pulp and paper producing jurisdiction to join. As an indicator of the extent of forested land in a jurisdiction, pulp production may be related to the capacity of a jurisdiction to benefit from the provision of forest carbon offsets. As a consumer of electricity, the pulp and paper sector may be wary of rising electricity prices that may come with joining a regional cap-and-trade program. Pulp production capacities for the year 2000 are shown in Table C6:

Table C6. Pulp Production Capacities of U.S. States		
	Pulp Production Capacity (2000) in Short tons Per Day	GHG emissions per capita (2001)
Georgia	20,859	30
Alabama	19,913	11
Washington (WCI)	13,269	41
South Carolina	11,433	22
Mississippi	9,595	12
Virginia	9,521	36
Maine (RGGI)	8,796	26
North Carolina	8,653	32
Oregon (WCI)	8,100	42
Arkansas	7,634	14
Texas	7,580	13
Florida	6,738	34
Wisconsin (MGGRA)	4,982	24
Tennessee	4,875	20
Minnesota (MGGRA)	3,992	33
Michigan (MGGRA)	3,675	27
Kentucky	2,400	7
Pennsylvania	2,330	23
Oklahoma	2,200	10
New York (WCI)	2,020	49
Montana (WCI)	1,800	5
California (WCI)	1,350	47
Idaho	1,300	38
New Hampshire (RGGI)	610	40
Indiana	300	9
Arizona (RGGI)	210	29
Iowa (MGGRA)	150	16

States highlighted in yellow have joined a regional climate initiative as of September 23, 2008, are indicated by the initiative they have joined (WCI, RGGI, or MGGRA). Source for pulp production data: Smith (2003). While coal producing states tend to have higher per capita GHG emissions than non-coal producing states, the effect of pulp production on state GHG inventories is less pronounced. Overall participation in regional climate initiatives is more closely associated with low per capita GHG emissions than with high or low pulp production capacities.

**Other possible explanatory factors.** Other possible explanatory factors for regional climate initiative participation might include a variety of environmental risks, or the potential to benefit from selling offset credits. One might consider whether states are coastal or not as a possible causal factor, due to the risks associated with sea level rise. Or air quality might be considered as a possible proxy for the co-benefits that might be gained through joining a regional climate initiative. Environmental risks associated with global warming, and benefits that might come from providing agricultural offsets are not considered as causal factors in the truth table, in part because these risks and benefits may be difficult to quantify. The goal is not to construct a completely explanatory truth table, but rather to examine the potential explanatory value of some of the more easily quantifiable factors, and to see where they seem useful or inadequate.

## **Appendix D: Stakeholder Organization Types**

The Washington Forest Protection Association (WFPA) is a trade association (WFPA website). The Western Forestry Leadership Coalition (WFLC) “is comprised of 34 members from across the federal and state agencies of the west” (WFLC website). The Port of Seattle is also a government organization: “Five Commissioners, elected at large by the voters of King County, serve four-year terms and establish Port policy”(Port of Seattle website).

Some organizations have been classified as offset providers. The National Carbon Offset Coalition’s purpose is to “help farmers, ranchers, private forest owners, and tribal and state governments tap into a new revenue stream - the sale of carbon credits derived from their land”(NCOC Website). As a non-profit organization, The Climate Trust could be classified as an NGO, however, the statement that, “The sole mission of The Climate Trust is to promote climate change solutions by providing high quality greenhouse gas offset projects and advancing sound offset policy”(Climate Trust Website), means that it is sensible to classify it as an offset provider. EcoSecurities “specialises in sourcing, creating and trading emission reductions from greenhouse gas emission reduction targets”(EcoSecurities Website).

Two organizations have been categorized as “Other.” The California Climate Action Registry (CCAR) is hard to categorize as an organization type. It is “a private non-profit organization”; however, as an NGO, it is atypical in the sense that it was “originally formed by the State of California”; moreover, it was “formed in 2001 when a group of CEOs, who were investing in energy efficiency projects that reduced their organizations’ greenhouse gas emissions, requested the state create a place to accurately report their greenhouse gas emissions...”(CCAR website). That is to say CCAR is an ENGO that was created by the State of California, at the request of industry. Like CCAR, the Industry Provincial Offsets Group defies categorization. Its membership seems to indicate it to be a joint government, industry organization, with some NGO involvement. On the comment, it is indicated that the Alberta Ministry of Environment is a member of the IPOG Executive Committee, as well as the Ontario

Ministry of the Environment, JD Irving, Petro-Canada, and the Soil Conservation Council of Canada.

The next round of stakeholder comments, in response to the May 16, 2008, WCI document, also includes some stakeholders which are difficult to classify. Three organizations seem primarily concerned with renewable energy, the Business Council for Sustainable Energy, the Renewable Northwest Project, and the Center for Energy Efficiency and Renewable Technologies (now “Clean Power”). Because of the combination of industries, utilities, and NGOs involved, these three organizations have been classified as “Renewable Energy.” The organization EcoTrust has been classified as an NGO. It’s focus seems to be more on financing sustainable economic projects, rather than a focus on lobbying or legal action that may be thought of as more of the role taken on by many typical environmental NGOs. The Soil Carbon Coalition has been classified as “Agriculture”. It advocates for the storage of carbon in soils. It does not appear to be acting primarily as a carbon broker.

## Appendix E: Comparison of Major Natural Gas Producing States

Table E1. Comparison of States with ‘High per Capita GHG Emissions’, ‘Weak Environmental Voting Records’, and ‘High Natural Gas Production.’			
	Rank in Per Capita Emissions (2007)	Rank in Environmental Voting (Revesz 2001)	Rank in per capita Natural Gas Production (2007)
Wyoming	1	48	2
Alaska	4	43	1
Louisiana	5	48	6
Texas	13	38	7
New Mexico (WCI)	11	39	3
Utah (WCI)	15	33	9
Kansas (MGRRA)	14	39	10
Colorado	24	33	8
<p>Although the thresholds chosen for the truth table do not distinguish between the states listed in the table, it is the states with the lower per capita emissions, and stronger past voting records on the environment that have joined regional climate initiatives. Source for GHG emissions data: US Environmental Protection Agency. Available at <a href="http://epa.gov/climatechange/emissions/state_energyco2inv.html">http://epa.gov/climatechange/emissions/state_energyco2inv.html</a>. Population data for calculating per capita values: US Census Bureau, Population Division. Table 1: Annual Estimates of the Resident Population for the United States, Regions, States, and Puerto Rico: April 1, 2000 to July 1, 2008 (NST-EST2008-01). Last Accessed Aug 25, 2009. The states were ranked by per capita production by the author. Revesz (2001), citing LCV (2000), is the source for the ranking of voting records. Source for Natural Gas production data: the US Energy Information Administration: <a href="http://tonto.eia.doe.gov/dnav/ng/ng_prod_sum_dcu_sak_a.htm">http://tonto.eia.doe.gov/dnav/ng/ng_prod_sum_dcu_sak_a.htm</a> (accessed Aug 15, 2009).</p>			

## Appendix F: Comments on Scope and Forests

(Addressing 3 March and 16 May 2008 WCI documents)

Table F1. Summary of Comments on Scope which Mention Forests (3 March and 16 May 2008 WCI documents)			
	Opposed regulation of emissions from Forests	In favour of regulation of emissions from forests	Indirectly opposed to regulation of forest emissions
Utility Comments		Clark Public Utilities	WEST Associates (agrees forest should be offsets for the first compliance period), Tuscon Electric Power
Industry Comments	Industrial Customers of Northwest Utilities		Solid Waste Industry for Climate Solutions
NGO Comments		League of Women Voters of Washington, Oregon Wild, Pacific Forest Trust, Pembina Institute, Western Climate Advocates Network	
Forestry Comments	Northwest Pulp & Paper Association, Weyerhaeuser		
Natural Gas Distribution			El Paso Pipeline Group
Stakeholder comments have been classified according to the policy positions which have been adopted relative to the role of forests. Comments were made in response to the March 3, 2008, and the May 16, 2008 WCI documents.			

## **Appendix G: Comments Addressing Forests and Scope (I)**

(Addressing March 3, 2008, WCI Documents)

This appendix lists stakeholder comments that address the issue of forests and scope, which were submitted in response to the *WCI Draft Program Scope Recommendations* (March 3, 2008), and the *Western Climate Initiative Draft Design Recommendations on Elements of the Cap-and-Trade Program* (May 16, 2008).

### **Organization and Position on Forests and Scope of the WCI cap-and-trade design**

**Northwest Pulp and Paper Association (Forestry Sector)** – Comment on March 3, 2008 Recommendations.

This comment “...supports the concept that the forest sector should not be a regulated entity under WCI,” and, “seeks biomass carbon neutrality for our co-generation facilities using biomass” (NWPPA, 17 March 2008, p1). A statement is made in support of the Weyerhaeuser, and the Industrial Customers of Northwest Utilities comments.

**Weyerhaeuser (Forestry Sector)** – Comment on March 3, 2008 Recommendations.

This comment is opposed to WCI regulating forest sector emissions, and calls for the carbon neutrality of biomass combustion: “Weyerhaeuser agrees that forest land should fall outside the cap and therefore, not be regulated by the WCI. However, we do feel that managed forests and forest products can play a significant role in the offsets markets” (Weyerhaeuser, 17 March 2008, p1); “...Weyerhaeuser recommends that the use of biomass as a fuel, or biomass derived fuels, not be counted as a source GHG emissions (carbon dioxide) in any future cap-and-trade program” (Weyerhaeuser, 17 March 2008, p2).

This statement seems to be supported by the Northwest Pulp & Paper association comment above. Weyerhaeuser has been a member of the Industrial Customers of Northwest Utilities.

**El Paso Pipeline Group (Industry)** – Comment on March 3, 2008 Recommendations.

This comment makes an incidental reference to the forestry sector: “For reasons similar to excluding the agricultural and forestry sectors, we urge the WCI not to include fugitive emissions from natural gas systems into the eventual regional cap-and-trade program” (El Paso, 17 March 2008, p1).

**Industrial Customers of Northwest Utilities (Industry)** – Comment on March 3, 2008 Draft.

The Industrial Customers of Northwest Utilities is opposed to the WCI regulating forest sector emissions: “ICNU agrees that forestry and agriculture should not be included in the program” (ICNU 17 March 2008, p2).

**Waste Management Inc. (Industry)** – Comment on March 3, 2008 Recommendations.

In this comment, GHG emissions from biomass are mentioned, but with a focus on waste management rather than forestry: “As widely documented, CO<sub>2</sub> emissions from landfills are ‘biogenic’ and should not be subject to emissions reporting. Neither the CO<sub>2</sub> that is inherently generated by the biological decomposition of biogenic materials in the landfill (~50% of the landfill gas is CO<sub>2</sub>), nor the CO<sub>2</sub> generated from the combustion of methane should be included as emissions subject to the cap and trade program” (Waste Management, undated document, p2).

**Rio Tinto (Industry)** – Comment on 16 May Draft.

This comment mentions forest offsets: “We recommend that the WCI provide for unlimited use of credits and offsets from domestic, extra-regional (outside WCI) and

international sources, including forest carbon offsets that meet appropriate verification and qualitative criteria” (Rio Tinto, June 16, 2008, p3).

**Solid Waste Industry for Climate Solutions (SWICS) (Waste Management)** – Comment on May 16 Draft.

The scope of the cap-and-trade design is not mentioned directly. However putting forests in the offset category would most likely, de facto, take them out of the scope of the system. The comment states, “We urge WCI to recognize carbon sequestration from a variety of sources, including landfills, forest and agricultural soils, and through composting”(SWICS, June 6, 2008, p7).

This comment also addresses GHG emissions from biological sources (although the focus is waste management rather than forestry): “...biogenic sources of emissions should be carbon neutral and anthropogenic sinks of carbon should be encouraged” (SWICS, June 6, 2008, p8).

**League of Women Voters of Washington (NGO)** – Comment on the May 16 Draft.

Forests are mentioned: “Land use change and forest emissions and sequestration should be included in an economy-wide cap and trade design as soon as possible” (League of Women Voters of Washington, June 6, 2008, p1).

The League of Women Voters of Washington is a signatory of the WeCAN statement on the May 16, 2008 WCI document, but not a signatory on the WeCAN comment on the March 3, 2008 WCI document.

**Nature Conservancy (NGO)** – Comment on March 3, 2008 Recommendations.

The Nature Conservancy makes a statement regarding forests: “The Nature Conservancy agrees that capping emissions from the conversion of forests, grassland and other wildlands

presents some challenges, but [...] we recommend that you consider phasing policies to reduce emissions from this sector generated from the conversion of forests, grasslands and other wildlands to other land uses” (Nature Conservancy, Undated comment regarding the March 3, 2008 Recommendations, p2)

This comment “recommend[s] that offsets from forest and other land-based projects be included in the WCI program for the many benefits they can provide as described by the WCI offsets subcommittee” (Nature Conservancy, Undated comment regarding the March 3, 2008 Recommendations, p2).

This comment does not mention biomass combustion. The Nature Conservancy is not a signatory on the WeCAN comment concerning the March 3, 2008 WCI Recommendations, or the May 16 Draft.

**Oregon Wild (NGO)** – Comment on March 3, 2008 Recommendations.

This comment suggests “accounting for the carbon/climate consequences of land use through something like a **severance tax**” (Oregon Wild, 17 March, 2008, p1). Oregon Wild is a signatory on the WeCAN comment on the May 16, 2008 Draft, but not on the March 3, 2008, Recommendations.

**Pembina Institute (NGO)** – Comment on March 3, 2008 Recommendations.

This comment states, “**The WCI should develop measurement, reporting, and verification protocols for the forestry sector**, so that this sector can play a full role in achieving the region’s emission reduction goals. Similarly, because emissions from land-use change and forest carbon-stock depletion are significant, we ask WCI to explore measurement, reporting, and cap design elements, so that the forest sector can be included under the cap as soon as practical ...” (Pembina Institute, March 18, 2008, p1).

The Pembina Institute is not a signatory on either the WeCAN statement on the March 3, 2008, or the May 16, 2008, WCI documents. This comment does not mention biomass combustion.

**Pacific Forest Trust (NGO) – Comment on March 3, 2008 Recommendations.**

The Pacific Forest Trust comment states that it would like to see forestry within design of WCI program, eventually: “...PFT strongly encourages WCI to include forestry and land use change within the cap design of a regional cap and trade program, if not at the start of the program, then as soon as practical thereafter” (Pacific Forest Trust, March 17, 2008, p1).

It is also stated that the Pacific Forest Trust, “Would like to see ‘full accounting of emissions associated with biomass and wood products, which may be substituted for more GHG intensive fuels and materials for ultimate climate benefits’ ” (Pacific Forest Trust, March 17, 2008, p3). Pacific Forest Trust is a signatory on the WeCAN comment in response to the March 3, 2008 Recommendations, and the May 16, 2008 Draft.

**Sightline Institute (NGO) – Comment on March 3, 2008 Recommendations.**

This comment recommends that the WCI should develop a model that would include “[L]ikely changes in terrestrial carbon storage that would result from foreseeable land use changes” (Sightline Institute, March 17, 2008, p9).

The Sightline Institute is a signatory on both the WeCAN comment on the March 3, 2008 WCI document, and the comment on the May 16, 2008 WCI document.

**Western Climate Advocates Network (WeCAN) (NGO) – Comment on March 3, 2008 Recommendations.**

This comment states that land-use emissions should be accounted for: “WCI should develop measurement, reporting, and verification protocols for the forestry sector, so that this

sector can play a role in achieving the region's emission reductions goals. Similarly, because emissions from land-use change and forest carbon-stock depletion are significant, we ask WCI to explore measurement, reporting, and cap design elements, so that the forest sector can be included as soon as possible" (WeCAN, March 17, 2008, p2). This comment does not mention biomass combustion.

**Western Climate Advocates Network (WeCAN) (NGO)– Comment on May 16, 2008 Draft.**

Likewise, this comment states that land-use emissions should be accounted for:

“We encourage the WCI to establish an official working group on the forest sector that includes participants from all member jurisdictions. The WCI should leverage ongoing efforts at the California Climate Action Registry (CCAR) to develop measurement, reporting, and verification protocols for the forest sector, so that this sector can play a role in achieving the region's emission reductions goals. Because emissions from land-use change and forest carbon-stock depletion are significant, we think the WCI should explore measurement, reporting, and cap design elements so that the forest sector can be included as soon as practical. The WCI should expeditiously bring forest emissions and sequestration into an economy-wide cap and trade design” (WeCAN, June 6, 2008, p1).

**Clark Public Utilities (Electric Utility Sector) – Comment on March 3, 2008 Recommendations.**

This comment calls for regulation of GHG emissions from the forestry sector:

“It is important to include all known emitting sectors and not exempt them specifically or via thresholds i.e. passenger cars and light duty trucks, agriculture, forestry, some natural gas users, industrial and fossil fuel production, waste management and fugitive emissions, etc.” (Clark Public Utilities 2008, p1). Biomass combustion is not specifically mentioned.

**Pacific Gas & Electric Company (Electric Utility Sector) – Comment on March 3, 2008 Recommendations.**

Forests are not mentioned, but agriculture is. Agriculture is mentioned as a potential source of offsets. The focus of this comment is on including transportation fuels. Biomass combustion is not mentioned, except that biofuels are listed in a table as a possible alternative transportation fuel.

**Salt River Project (Electric Utility Sector) – Comment on May 16, 2008 Draft.**

In this comment forests are only mentioned with regard to offsets. The comment supports having no quantitative limit on the use of offsets, while forest offset projects are mentioned as one of the types of offset under consideration. Thus, this comment implicitly supports the use of forest offsets (Salt River Project, June 6, 2008).

**Tucson Electric Power (Electric Utility Sector) – Comment on March 3, 2008 Recommendations.**

This comment agrees that a good rationale for not including the forest sector in the WCI cap-and-trade has been provided by the WCI: “The paper provides convincing rationale only for excluding large transportation fleets, and agricultural, forestry and land use related carbon emissions.” [...] (Tucson Electric Power, March 20, 2008, p2). This comment does not mention biomass combustion.

**WEST Associates (Electric Utility Sector) – Comment on March 3, 2008 Recommendations.**

This comment is opposed to regulating forestry emissions, and in favour of using forest offset projects:

“...WEST believes the administrative and measurement difficulties illustrate, and support, why WEST strongly recommended in its initial comments that Ag and Forestry sectors be primarily available for creation of offsets (sinks and sequestration), whereby measurement issues would be overcome by protocols developed for quantifying and verifying offsets creation and use for compliance by covered sources” (WEST, March 17, 2008, p3).

## **Appendix H: Comments Addressing Forests and Scope (II)**

A few (11) organizations submitted comments on scope regarding both the April 3, and the May 16, 2008, WCI documents: the Air Transport Association, Chelan PUD, Chevron, Independent Energy Producers Association, Northwest Pulp and Paper Association (NWPPA), PNGC Power, Public Power Council, Puget Sound Energy, Southern California Edison, WeCAN, and WEST Associates. 30 comments were submitted on the subject of scope in the 16 May 2008 design recommendations. (The second NWPPA comment was missing from the WCI website due to the repeat of the comment by another stakeholder.) Of these 30 comments, only 5 have been identified which mention forests. (One possible reason for the low number of comments mentioning forests is that at this point in the design process forest carbon may be considered as having been eliminated from possible inclusion in the scope of the cap-and-trade system.)

Five comments on scope in the 16 May document mention forests; WeCAN is the only organization that submitted comments concerning both the April 3, 2008 and the May 16, 2008 WCI documents and which mention scope and forests; four are new comments. There is little substantial change between the WeCAN comments submitted on the April 3, 2008 and the May 16, 2008 documents. There is only a slight change in the NGOs that have signed onto the WeCAN statement. The second comment states, “We encourage the WCI to establish an official working group on the forest sector.” The second comment also mentions the California Climate Action Registry: “The WCI should leverage ongoing efforts at the California Climate Action Registry (CCAR) to develop measurement, reporting, and verification protocols for the forest sector [...]” (WeCAN, 6 June 2008).

Given that the 16 May 2008 consolidated draft is consistent with the earlier 3 April 2008 Scope Subcommittee recommendations, and that stakeholder comments have treated it as such, comments, in response to the two papers, regarding scope have been pooled and summarized in a single list (Appendix G).

### **H.1. Forest Sector Comments on Scope (3 March and 16 May 2008 Recommendations on Scope)**

The stakeholder comments on the 3 March and 16 May 2008 WCI documents do not include a large number of comments submitted by the forest industry on whether forests should be included in the scope of the cap-and-trade design. Forest industry opinion has apparently been consolidated in the ICNU and NWPPA submissions.

The forestry sector comments are clear in advocating that changes in forest carbon stock should not be included under the cap of the WCI cap-and-trade system. The comment by Weyerhaeuser states, “Weyerhaeuser agrees that forest land should fall outside the cap and therefore, not be regulated by the WCI” (Weyerhaeuser, 17 March 2008). The Northwest Pulp and Paper Association states that it “...supports the concept that the forest sector should not be a regulated entity under WCI” (NWPPA, 17 March 2008). Although many company types are members of the Industrial Customers of Northwest Utilities (ICNU), the ICNU membership does include several forest products companies, including (as of 17 March 2008), Boise Cascade, Georgia-Pacific, Weyerhaeuser, Blue Heron Paper Company, Grays Harbor Paper, Simpson Paper & Timber, SP Newsprint, and West Linn Paper Company (ICNU Petition 2008). The ICNU comment states: “ICNU agrees that forestry and agriculture should not be included in the program” (ICNU 17 March 2008, p2).

### **H.2. Summary of ENGO Comments on Scope (3 March and 16 May 2008 Recommendations on Scope)**

The environmental NGO comments on forests and the WCI cap-and-trade system scope are somewhat more diverse than those made by the forest industry. ‘Scope’ seems to be used in ENGO comments broadly, with inclusion in the ‘scope’ of the WCI system meaning that forest carbon emissions should be regulated, not necessarily by inclusion in the scope of the WCI cap-and-trade system *per se*, but rather regulated through the cap-and-trade system *or* by complementary means.

The comments by the Western Climate Advocates Network (WeCAN) are signed by multiple NGOs. The WeCAN comment on the 3 March 2008 scope recommendations is signed by 31 groups, and the comment on the 16 May 2008 recommendations is signed by 30 groups. Both comments are signed by the Environmental Defense Fund, National Wildlife Federation, Natural Resources Defense Council, and Sierra Club. WeCAN states that, “Because emissions from land-use change and forest carbon-stock depletion are significant, we think the WCI should explore measurement, reporting, and cap design elements so that the forest sector can be included as soon as practical. The WCI should expeditiously bring forest emissions and sequestration into an economy-wide cap and trade design”(WeCAN, 6 June 2008, p1). A virtually identical statement was made in the earlier WeCAN comment (WeCAN March 17 2008, p2).

Several organizations submitting comments about forests and the scope of the cap-and-trade system are also signatories to one or both of the two WeCAN statements on scope (responding to the 3 March and 16 May WCI documents). These organizations include: the League of Women Voters of Washington, Oregon Wild, Pacific Forest Trust, and the Sightline Institute. The Sightline Institute’s comment notes that it endorses the WeCAN position, it also mentions possible deforestation associated with biofuel production. The focus of the Sightline comment is on the Low Carbon Fuel Standard (Sightline March 17, 2008). This leaves the Nature Conservancy and the Pembina Institute as NGOs that have submitted comments on scope and forests, but have not signed one of the WeCAN statements.

Although the Pembina Institute is not a signatory on the two WeCAN statements on scope<sup>78</sup>, the March 18, 2008 Pembina Institute comment remarks that, “This submission is largely in alignment with comments submitted by the Western Climate Advocates Network (WeCAN)” (p1). With regard to forests and scope the Pembina Institute comment quotes from

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<sup>78</sup> In a joint comment on offsets, the Pembina Institute and the David Suzuki Foundation note that they have been working with WeCAN, but have submitted a separate comment because of a divergence of opinion— one point of divergence being whether offsets should be restricted geographically. With regard to forests and the scope of the cap-and-trade system, the position taken by the Pembina Institute is similar to that of WeCAN.

the WeCAN statement: “**The WCI should develop measurement, reporting, and verification protocols for the forestry sector**, so that this sector can play a full role in achieving the region’s emission reduction goals. Similarly, because emissions from land-use change and forest carbon-stock depletion are significant, we ask WCI to explore measurement, reporting, and cap design elements, so that the forest sector can be included under the cap as soon as practical ...”(p1).

The Nature Conservancy comment states “...we recommend that you consider phasing policies to reduce emissions from [the land-use] sector generated from the conversion of forests, grasslands and other wildlands to other land uses” (Nature Conservancy, comment March 3, 2008 WCI document, p2).

The Oregon Wild comment calls for emissions from the land use sector to be regulated, and suggests “accounting for the carbon/climate consequences of land use through something like a **severance tax**” (Oregon Wild, March 17, 2008, p1). Oregon Wild is a signatory on the second of the two WeCAN comments discussed here (on the May 16 WCI document), however, the Oregon Wild comment is more specific than the WeCAN statement. The Oregon Wild seems to argue for a policy complementary to the cap-and-trade system, since the use of a severance tax to account for emissions associated with land use would not seem to actually put land-based emissions under the cap of the system.

The Pacific Forest Trust comment states that, “PFT strongly encourages WCI to include forestry and land use change within the cap design of a regional cap and trade program, if not at the start of the program, then as soon as practical thereafter”(PFT 17 March 2008, p1). The Pacific Forest Trust (PFT) describes itself as “the only organization solely dedicated to conserving America’s working forests for all their public benefits – wood, water, wildlife and a well balanced climate” (PFT website). (It may not be immediately clear whether the PFT should be categorized as an ENGO or as being in the forestry sector.)

Environmental NGO comments have taken two different types of positions on the inclusion of forests in the WCI cap-and-trade design. The major divergence of opinion is between the Western Climate Advocates Network which is opposed to allowing forest offsets,

and the Nature Conservancy and EcoTrust, which are in favour of allowing forest offsets (with the comment by the Pacific Forest Trust perhaps in the middle). The ENGO comments are consistent in saying that forest carbon emissions should somehow be accounted for, but there is a difference of opinion as to how this should be done.

### **H.3. Summary Electric Utility Comments on Forests and Scope**

WEST Associates is an association of electric utilities, including many of those that have individually commented on the WCI system design. The WEST Associates comment on scope states, “[...] WEST believes the administrative and measurement difficulties illustrate, and support, why WEST strongly recommended in its initial comments that Ag and Forestry sectors be primarily available for creation of offsets (sinks and sequestration), whereby measurement issues would be overcome by protocols developed for quantifying and verifying offsets creation and use” (WEST 17 March 2008, p3). The Tucson Electric Power Company comment agrees with the WEST Associates position, stating that the WCI “provides [a] convincing rationale [...] for excluding large transportation fleets, and agricultural, forestry and land use change related carbon emissions” (Tucson Electric, March 20, 2008, p2). The only exception to the WEST Associates position on scope seems to be the Clark PUD comment, which advocates that forestry should be included in the scope of the cap-and-trade system design (Clark Public Utilities 17 March 2008, p1).

### **H.4. Other Comments**

Two comments have mentioned forests and scope incidentally: El Paso Pipeline Group, and Solid Waste Industries for Climate Solutions (SWICS). The SWICS comment states, “We urge WCI to recognize carbon sequestration from a variety of sources, including landfills, forest and agricultural soils, and through composting” (June 6, 2008, p7). Thus the primary interest of SWICS is likely with landfills and composting rather than with forests and agricultural soils. The comment by El Paso Pipeline Group and El Paso Pipeline Partners states that, “For reasons

similar to excluding the agricultural and forestry sectors, we urge the WCI not to include fugitive emissions from natural gas systems into the eventual regional cap-and-trade program” (March 17, 2008, p1). Here the primary interest of El Paso is likely with fugitive natural gas emissions.

## Appendix I: Comments on Offset Quantity Limits (I)

(On Draft Offsets Design Recommendations, 3 April 2008)

Organization Type	Position on Quantity Limits			
	No Limits	Limits	Phased Approach	No Position Stated
Utility	EPCOR, PacifiCorp, Pacific Gas & Electric, Tucson Electric Power, WEST Associates (5)	Calpine (1)	Chelan PUD (1)	Avista Corp., Independent Energy Producers Association, Oregon Municipal Electric Utilities Association (Salt River Project comment missing).
Industry				Waste Management Inc. (1)
NGOs	Nature Conservancy (1)	Western Climate Advocates Network, Canadian Parks and Wilderness Society, Lane Climate Change/ Peak Oil Coalition, Pembina Suzuki, Sierra Club/ Sierra Canada, Sightline (6)		
Forestry	BC Forestry Climate Change Working Group, Northwest Pulp and Paper Association, Washington Forest Protection Association (3)		Weyerhaeuser (1)	
Carbon Offsets Providers	Camco, Climate Trust, EcoSecurities (3)			National Carbon Offset Coalition (1)
Government				Port of Portland, Port of Seattle, Western Forestry Leadership Coalition, Oregon Department of Agriculture (4)
Other	Industry Provincial Offsets Group (1)			California Climate Action Registry (1)

Comments have been submitted in response to the WCI document *Draft Offsets Design Recommendations* (April 3, 2008). Comments have been classified according to whether or not they are in favor of placing a limit on the quantity of carbon offset credits which can be used for compliance purposes under the WCI GHG reduction cap-and-trade system. Some comments have advocated for quantity limits on the use of offsets to be phased in or out, or to vary with the price of GHG emissions permits in the cap-and-trade system. These comments have been classified in the 'Phased Approach' category.

## Appendix J: Parallel Quotes from Western Climate Initiative Documents

(April 3 and May 16, 2008)

J1. Parallel Quotes from WCI Documents	
Draft Offsets Design Recommendations (April 3, 2008)	Draft Design Recommendations on Elements of the Cap-and-Trade Program (16 May 2008)
“A primary role of the offset program could be to reduce the overall compliance costs for the cap-and-trade system...”(p2).	“The primary role of the offset program is to reduce the overall compliance costs for the cap-and-trade system...”(p19).
“In addition, by lowering overall costs, an offset program could support a more aggressive reduction cap than might otherwise be feasible for the cap and trade system”(p2).	“In addition, by lowering overall costs, an offset program can potentially offer greater environmental benefits”(p19).
“Another role could be to encourage innovation, co-benefits, greenhouse gas emission reductions from sources not covered by the cap and trade system and removals by sinks”(p2).	“The offset program can also serve to encourage innovation, co-benefits, greenhouse gas emission reductions from sources not covered by the cap-and-trade system and removals by sinks”(p19).
“...the WCI should limit the use of offsets and non-WCI tradable units for compliance by individual regulated entities”(p3).	“The WCI recommends limiting the use of offsets and non-WCI tradable units for compliance by individual regulated entities...”(p19)
Health benefits of emissions reductions are not explicitly mentioned.	Quantity limits on offsets are recommended: “[I]n recognition that foregoing emission reductions at facilities covered by the cap-and-trade program in the WCI states has the potential to forego health benefits and other benefits near those facilities”(p19).
“The WCI should consider a method that gives priority to offset projects located within WCI jurisdictions”(p3).	“The WCI should consider a method that gives priority to offset projects located within WCI jurisdictions”(p19).
Quotations are from the WCI documents <i>Draft Offsets Design Recommendations</i> (April 3, 2008) and <i>Draft Design Recommendations on Elements of the Cap-and-Trade Program</i> (May 16, 2008). The recommendations made with regard to offsets are essentially identical in the April 3 and May 16 WCI documents.	

**Appendix K: Comments on Quantity Limits (II)**  
 (Addressing to 16 May 2008 WCI Document)

Table K1. Comments on Quantity Limits (in regard to 16 May 2008 WCI Document)				
Organization Type	Position on Quantity Limits			
	No Limits	Limits	Phased Approach	No Position Stated
Utility	Salt River, FPL Energy, Southern California Edison, WEST Associates (4)		Chelan PUD (1)	Tacoma, Tri-State (2)
Industry	Associated Oregon Industries, Association of Washington Businesses, Canadian Cement, Chevron, Morgan Stanley (5)			Consultec Sustainable Urban Transport, Williams (2)
NGOs		Canadian Parks and Wilderness Society, Climate Solutions, League of Women Voters, Concerned Scientists, Washington Environmental, Western Climate Advocates Network (6)	EcoTrust (1)	
Forestry	Northwest Pulp and Paper Association (1)		Forest Protection Agency (1)	
Carbon Offsets Providers	Camco, Ecosecurities, Carbon Offset Providers Coalition (3)		Offset Quality Initiative (1)	Climate Trust (1) National Carbon Offset Coalition (1)
Government				City of Phoenix, Western Forestry Leadership (2)
Other	Industry Provincial Offsets Group, T. Wood (2)			Carbonic Acid, Misys Software (2)
Renewable Energy	Business Council for Sustainable Energy (1)	Center for Energy Efficiency and Renewable Technologies, Renewable Northwest Project (2)		
Agriculture				Soil Carbon Coalition (1)

Comments have been submitted in response to the WCI document *Draft Design Recommendations on Elements of the Cap-and-Trade Program* (May 16, 2008). Comments have been classified according to whether or not they are in favor of placing a limit on the quantity of carbon offset credits which can be used for compliance purposes under the WCI GHG reduction cap-and-trade system. Some comments have advocated for quantity limits on the use of offsets to be phased in or out, or to vary with the price of GHG emissions permits in the cap-and-trade system. These comments have been classified in the 'Phased Approach' category.

## Appendix L: Comments on Quantity Limits (III)

(Regarding 3 April 2008 and 16 May 2008 WCI Documents.)

Table L1. Comments on Quantity Limits (3 April 2008 and 16 May 2008 WCI Documents)				
Organization Type	Position on Quantity Limits			
	No Limits	Limits	Phased Approach	No Position Stated
Utility	Salt River, FPL Energy, Southern California Edison, WEST Associates, EPCOR, PacifiCorp, Pacific Gas & Electric, Tucson Electric Power (8)	Calpine (1)	Chelan PUD (1)	Tacoma, Tri-State, Avista, Independent Energy Producers Association, Oregon Municipal Electric Utilities Association (5). (Salt River comment missing.)
Industry	Associated Oregon Industries, Association of Washington Businesses, Canadian Cement, Chevron, Morgan Stanley, Alcoa, Industrial Customers of Northwest Utilities, International Climate Change Partnership, Navajo Refining, WSPA (10)			Consultec Sustainable Urban Transport, Williams, Waste Management Inc. (3)
NGOs	Nature Conservancy (1)	CPAWS, Climate Solutions, League of Women Voters, Concerned Scientists, Washington Environmental, WeCAN, Lane Climate Change/Peak Oil Coalition, Pembina/Suzuki, Sierra Club/Sierra Canada, Sightline Institute (10)	EcoTrust (1)	
Forestry	Northwest Pulp and Paper Association, BC Forestry Climate Change Working Group (2)		Washington Forest Protection Assoc., Weyerhaeuser (2)	
Carbon Offsets Providers	Camco, EcoSecurities, Carbon Offset Providers Coalition, Climate Trust (4)		Offset Quality Initiative (1)	
Government				City of Phoenix, Western Forestry Leadership, Port of Portland, Port of Seattle, Oregon Department of Agriculture (5)
Other	IPOG, T. Wood (2)			Carbonic Acid, Misys Software, California Climate Action Registry, Soil Carbon Association (3)
Renewable Energy	Business Council for Sustainable Energy (1)	Center for Energy Efficiency and Renewable Technologies, Renewable Northwest Project (2)		

Comments have been submitted in response to the WCI documents *Draft Offsets Design Recommendations* (April 3, 2008) and *Draft Design Recommendations on Elements of the Cap-and-Trade Program* (May 16, 2008). Comments have been classified according to whether or not they are in favor of placing a limit on the quantity of carbon offset credits which can be used for compliance purposes under the WCI GHG reduction cap-and-trade system. Some comments have advocated for quantity limits on the use of offsets to be phased in or out, or to vary with the price of GHG emissions permits in the cap-and-trade system. These comments have been classified in the 'Phased Approach' category.

## Appendix M: Stakeholder Groups Commenting on Offsets

(Regarding April 3, and May 16, 2008 WCI Document)

Table M1. Comments Submitted on 3 April and 16 May 2008 WCI Document, with Regard to Offsets.		
Organization Type	Comments Submitted on “Draft Offsets Design Recommendations”(WCI, 3 April 2008)	Comments Submitted on 16 May 2008 WCI Document, with Regard to Offsets.
Utilities and Associations of Utilities	Avista, Calpine, Chelan PUD, EPCOR, Independent Energy Producers Association, Oregon Municipal Electric Utilities Association, Pacific Gas & Electric, PacifiCorp, Salt River, Tucson Electric Power, WEST Associates (11 Comments)	Salt River, Chelan PUD, FPL Energy, Southern California Edison, Tacoma, Tri-State, WEST Associates (7 Comments)
Industry and Industry Associations	Alcoa, Associated Oregon Industries, Industrial Customers of Northwest Utilities, International Climate Partnership, Navajo Refining Company, Waste Management Inc. (6 Comments)	Associated Oregon Industries, Association of Washington Businesses, Canadian Cement, Consultec Sustainable Urban Transport, Williams, Business Council for Sustainable Energy (6 Comments).
Non-Governmental Organizations	Canadian Parks and Wilderness Society (CPAWS), Lane Climate Change, Nature Conservancy, Pembina/Suzuki, Sierra Club, Sightline, Western Climate Advocates Network (7 Comments)	CPAWS, Climate Solutions, EcoTrust, League of Women Voters, Union of Concerned Scientists, Washington Environmental Council, Western Climate Advocates Network, Center for Energy Efficiency and Renewable Technologies, Renewable Northwest Project (9 Comments).
Forestry Sector	BC Forest Industry, Northwest Pulp and Paper Association, Weyerhaeuser, Washington Forestry Protection Association (4 Comments)	Northwest Pulp and Paper Association, Western Forest Protection Association (2 Comments)
Oil and Gas Production	Western States Petroleum Association (1 Comment)	Chevron (1 Comment)
Carbon Trading	Camco, Climate Trust, EcoSecurities, National Carbon Offset Coalition (4 Comments).	Camco, Climate Trust, EcoSecurities, Carbon Offset Providers Coalition, Offset Quality Initiative, Soil Carbon Coalition (6 Comments)
Finance	Morgan Stanley (1 Comment)	Morgan Stanley (1 Comment)
Other	Oregon Department of Agriculture, Port of Portland, Port of Seattle, Western Forestry Leadership Coalition, California Climate Action Registry, Industry Provincial Offsets Group (6 Comments)	City of Phoenix, Western Forestry Leadership Coalition, Carbonic Acid Inc., Industry Provincial Offsets Group, Misys Software, T. Wood. (6 Comments)
All stakeholder groups are listed which have commented on WCI <i>Draft Offsets Design Recommendations</i> (WCI, April 3, 2008), or have submitted comments to the WCI Offsets Subcommittee with regard to the WCI <i>Draft Design Recommendations on Elements of the Cap-and-Trade Program</i> (May 16, 2008).		

## Appendix N: Stakeholder Comments on “Carbon Neutrality”

In earlier rounds of the WCI stakeholder comment process, forestry industry comments on scope also include statements arguing that biomass combustion should be considered ‘carbon neutral,’ that is to say that WCI cap-and-trade system emissions credits should not be required for biomass combustion. A Northwest Pulp and Paper Association comment “seeks biomass carbon neutrality for our co-generation facilities using biomass” (NWPPA, March 17, 2008). A Weyerhaeuser comment states that, “The draft design recommendations do not address the issue of biomass carbon neutrality. We want to make sure the WCI recognizes the numerous scientific and policy precedents that have been established affirming that the combustion of biomass is considered carbon neutral” (Weyerhaeuser, 17 March 2008).<sup>79</sup>

Prior to the July 23 WCI recommendations, there were few ENGO comments which directly addressed the issue of the ‘carbon neutrality.’ The WeCAN comments on the 3 March and 16 May, 2008 WCI documents do not directly address the issue of forest biomass combustion.<sup>80</sup> The NGO comments are less clear than the forestry sector on the issue of biomass combustion in response to the May 16, 2008 design recommendations. Oregon Wild perhaps addresses biofuels, and wood burning, in the most detail: “Recent scientific studies show that many biofuels are derived from clearing native vegetation and the carbon emissions caused by that clearing may not be recaptured for tens or hundreds of years” (Oregon Wild, March 17, 2008, pp1-2).<sup>81</sup> A Pacific Forest Trust comment states there should be “full accounting of emissions associated with biomass and wood products, which may be substituted for more GHG intensive fuels and materials for ultimate climate benefits” (Pacific Forest Trust, March 17,

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<sup>79</sup> While there are policy precedents for considering biomass combustion carbon neutral (Johnson 2009), it is not clear what is meant by ‘scientific precedent’ for considering biomass combustion carbon neutral.

<sup>80</sup> However, there is a reference to the Low Carbon Fuel Standard, and the possibility of forests being cleared to increase biofuel production (WeCAN, June 6, 2008).

<sup>81</sup> “...if natural gas and electricity generation are included in the cap-and-trade program and the prices rise (as they should), then homeowners may switch to wood heating. If that wood comes from converting old forests to tree farms or premature logging that prevents forest from reaching their biological potential for carbon storage, then there will be leakage that is not accounted for in the program” (Oregon Wild, March 17, 2008, pp1-2).

2008, p3).<sup>82</sup> The focus of a Sightline Institute comment is the Low Carbon Fuel Standard (LCFS), including a discussion of biofuels: “As the recent controversy over biofuels suggests, an improperly implemented LCFS could, at least in theory, do more harm than good—perhaps mistakenly encouraging greater emissions through inaccurate assessment of life cycle emissions”; however, in the Sightline comment there is no specific mention of the relation between forest carbon-stock, forest biomass combustion, and the scope of the WCI cap-and-trade system, except a mention that in some cases biofuel production may produce an incentive for deforestation (Sightline, March 17, 2008). In these comments, prior to the July 23 WCI recommendation that biomass combustion be considered carbon neutral, there is a general absence of clear statements by environmental NGOs to the effect that ‘biomass combustion is not carbon neutral’ to match the contrary statement made by forestry sector stakeholders.

In the WCI stakeholder process forestry sector stakeholders have been consistent in arguing for woody biomass combustion carbon neutrality. The Weyerhaeuser comment on the 23 July 2008 WCI draft design states that, “Carbon dioxide emissions from the combustion of biomass and biomass derived fuels should be treated as carbon neutral” (Weyerhaeuser, 13 August 2008, p1). The Northwest Pulp and Paper Association comment states that “NWPPA strongly supports the concept that combustion emissions of biomass or biofuel are not included in the cap-and-trade program” (NWPPA, 13 Aug 2008, p5). The Industrial Customer of Northwest Utilities (an association with several forestry sector members) comment states that “ICNU supports §1.3 excluding “combustion of biomass or biofuel” from the Cap and Trade program” (ICNU 13 Aug 2008, p2). The forestry sector also argues for the inclusion of forest

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<sup>82</sup> This comment comes short of clarifying whether emissions credits should be required for burning biomass, or whether credit should be given for burning biomass instead of other fuels (PFT, March 17, 2008).

offset projects as eligible WCI offset types, and against the inclusion of forest carbon stock depletion in the scope of sectors requiring emissions permits.<sup>83</sup>

Perhaps the only electric utility participating in the WCI stakeholder process to argue against the carbon neutrality of biomass combustion is Puget Sound Energy. The Puget Sound Energy comment “requests that the scope of the [WCI] program include the greenhouse gas emission associated with the combustion of biomass and biofuels. The exclusion of these fuels would pose a perverse incentive to bring more of these types of facilities on-line, and these sources are not necessarily net-zero emission sources” (PSE 2008, p3). The Puget Sound Energy website states, “Puget Sound Energy is the largest utility producer of renewable electricity in the Pacific Northwest” and mentions PSE’s hydro, solar, and wind energy projects, but not biomass (PSE website). In contrast, PacifiCorp’s website states that, “Renewable energy resources are beneficial to both business and the environment. Electricity from the company’s wind, geothermal, biomass and solar energy facilities is integrated into PacifiCorp’s system [...]”(PacifiCorp website). PacifiCorp’s comment on the 23 July 2008 WCI draft cap-and-trade design “concur[s]” with section 1.3 of the recommendations which states that “Carbon dioxide emissions from the combustion of biomass or biofuel are not included in the cap-and-trade program” and PacifiCorp additionally “believes GHG emissions from geothermal operations should be similarly exempted”(PacifiCorp). The Southern California Public Power Authority comments that “[...] it appears that the WCI intends to confer on the agriculture, forestry, and waste management sectors a double benefit” by exempting these sectors from regulation, but allowing them to benefit from offset projects (Southern California Public Power Authority). These comments suggest the possibility that arguments in favor of biomass combustion carbon neutrality may be motivated by stakeholder group interest, rather than the environmental validity of biomass combustion carbon neutrality.

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<sup>83</sup> Here and elsewhere “carbon depletion” is used to refer to the loss of carbon from forest ecosystems, relative to some baseline year. There is no universally accepted baseline for determining forest carbon losses and gains, and baselines could potentially vary between forest stands, if for example carbon offset projects are established at different times.