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First Nations Carbon Collaborative— Indigenous Peoples and Carbon Markets: An annotated bibliography

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Indian and Northern Affairs Canada
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First Nations Carbon Collaborative—Indigenous—Indigenous Peoples and Carbon Markets: An annotated bibliography

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The First Nations Carbon Collaborative is comprised of the International Institute for Sustainable Development, Centre for Indigenous Environmental Resources, Carrier Sekani Tribal Council, Poplar River First Nation and Tâichô Nation. The collaborative is working together to build capacity within First Nations to access existing and emerging carbon markets. All members of the collaborative must be acknowledged for their participation in moving this work forward.

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Executive Summary

This annotated bibliography was written to support the First Nations Carbon Collaborative, an initiative spearheaded by the Centre for Indigenous Environmental Resources and the International Institute for Sustainable Development in collaboration with the Carrier Sekani Tribal Council, Poplar River First Nation and T'licho Nation. The goal of the project is to build capacity within the First Nations of Canada by providing unbiased information on carbon markets so that they can position themselves to take advantage of the economic opportunities offered by land-based existing and emerging carbon markets if they so choose to.

The emergence of carbon markets have created a unique opportunity for indigenous communities to develop an economic sector that can be aligned with traditional lifestyles and sustainable forest management goals. It is also an opportunity for governments and industry to build meaningful partnerships and develop relevant policies with indigenous peoples.

Globally, indigenous communities are concerned with a general lack of effort to involve them in carbon markets or to consider the social impacts that these markets, and related policies, can and have had on communities. Indigenous peoples require that their free, prior and informed consent be obtained as governments develop carbon market policies and regulations.

The United Nations Declaration on the Rights of Indigenous Peoples provides a framework for meeting minimum international standards for the protection and inclusion of indigenous peoples' rights in government-led carbon policy development; ensuring indigenous land and carbon rights is the first step in meaningful joint planning and implementation of emissions cap-and-trade policies/regulations.

Consequently, indigenous peoples should have equal and meaningful involvement in developing carbon markets that may impact their traditional and current territories.¹ It is also important to recognize the contributions that indigenous peoples have made and do make towards conserving forests and biodiversity.

The objective of this annotated bibliography is to provide an introduction to indigenous peoples' land and carbon rights, carbon offset regimes and carbon accounting from a broad international perspective. The following reference categories are provided at the end of each section for the reader to access more information:

¹ Indigenous peoples generally occupy certain areas that may or may not encompass their traditional territories. Their lands typically cover a greater area and are treated differently with regards to their resource rights.

- Peer-reviewed materials: This information comes from peer-reviewed journals and may be available online for free, or for a fee from a journal host.
- “Grey” literature: This information comes from working papers, government publications, NGOs, books and technical reports that have not gone through an official peer-review and publishing process.
- Media: This information was sourced primarily from newspapers and online news websites that have been written after 2004. Some of this literature may be biased based on the views of the organizations or authors.

These reference categories were selected to provide the reader with a spectrum of information sources ranging from academic to more popular and accessible resources. We hope that this annotated bibliography will help policy-makers, researchers and educators shed some light on the potential positive and negative impacts that carbon markets could have on indigenous peoples.

To conclude, the literature surveyed revealed that, although there is a reasonable amount of information on indigenous peoples and carbon markets, there seems to be very little information on First Nations in Canada and carbon markets. This indicates that an information void may need to be filled for First Nations to become active participants in current and emerging carbon markets.

1.0 Introduction

The emergence of carbon markets has created a unique opportunity for governments to support sustainable economic development within indigenous communities that is compatible with their needs, interests and aspirations (Gerrard, 2008; Krcmar, et al., 2005; Altman, 2001). However, many indigenous communities are concerned with the general lack of concerted effort to involve them in the development of climate change policies and potential carbon markets (Algonquin Nation of Wolf Lake, et al., 2010; Goldtooth, 2010; Gerrard, 2008). Effective and equitable environmental governance must take into account multiple cultural perspectives, which should be incorporated within the constructs of carbon offset regimes (Baldwin, 2009). Furthermore, carbon trading schemes that support the well-being of indigenous peoples can help respond to past injustices that still affect them today (Dubois, 2006; Miranda, et al., 2002; Saunders, et al., 2002).

Many indigenous peoples have a physical and spiritual connection to the land and their traditional and ecological knowledge is valuable for finding solutions to address climate change (Gerrard, 2008). Indigenous traditional knowledge and land management regimes have historically been undervalued, even though they could assist with implementing adequate climate change mitigating conservation measures (Algonquin Nation of Wolf Lake, et al., 2010; Gerrard, 2008; Chapin, 2004; Altman, 2001). Indigenous land management regimes are highly sophisticated. For instance, land classifications based on topography, soils and vegetation have helped indigenous peoples manage resources in a sustainable manner for thousands of years (Sheehan, 2010). For this reason, carbon sequestration practices should be jointly developed with and complimentary to indigenous land management practices (Sheehan, 2010).

Globally, indigenous peoples have raised many concerns regarding the loss of traditional livelihoods and land use through agroforestry regimes sparked by emerging ecosystem-based carbon markets (Gerrard, 2008; Powers, 2009; Goldtooth, 2010). In addition, there are concerns that forests may only be reduced to areas according to their carbon sequestration ability and not cherished for their sacred and natural values (Gerrard, 2008).

2.0 Land and Carbon Rights

For indigenous peoples to fully participate in carbon markets, their rights to land and the carbon² must be secured and legally upheld (Goldtooth, 2010; Insley & Meade, 2008; Saunders, et al., 2002). Carbon rights for indigenous peoples are not commonly recognized by governments, nor are they extensively discussed at global climate conferences (Sheehan, 2010; Gerrard, 2008).

Many indigenous groups have had to assert their rights for participation in global and national discussions concerning climate change and carbon trading (Goldtooth, 2010; Gerrard, 2008). Indigenous peoples will be further marginalized if their carbon rights continue to remain unclear and unrecognized by governments (Sheehan, 2010; Chapin, 2004).

Indigenous rights to the carbon sequestered within traditional territories need to be recognized and protected in the face of emerging climate change policies and laws that may limit, suspend or extinguish native title (Goldtooth, 2010; Chapin, 2004; Gerrard, 2008; Sheehan, 2010). Designing equitable and effective carbon markets requires the participation of all relevant parties so they can equally and actively participate within carbon offset regimes (Miranda, et al., 2002; Saunders, et al., 2002).

Carbon markets are more likely to lead to forest loss, corruption and exploitation when regulations are unclear, enforcement inexistent and indigenous rights unrecognized (Goldtooth, 2010; Kant, 2010; Sandbrook, et al., 2010). Clear rights and responsibilities reduce corruption in carbon trading schemes. Decentralized governance models have, in many cases, protected forests and biodiversity, and lessened the chances of corruption versus a centralized scheme.

Indigenous peoples are concerned that setting aside land within traditional territories for carbon sequestration processes could impact their villages, sacred sites, burial grounds, and hunting and gathering spaces (Goldtooth, 2010; Gerrard, 2008; Saunders, et al., 2002). Under extreme circumstances they can be forced to leave their traditional territories to go to places where they may be unable to provide for themselves (Powers, 2009; Saunders, et al., 2002).

² Carbon rights are distinguished from other resource rights, as they represent the carbon content of standing and in-ground biomass that is to be maintained in its natural state. Other natural resources are typically prized for their extractive value as raw materials.

2.1 Additional Information Sources

2.1.1 Peer Reviewed

- Altman, J.C. (2001). Sustainable development options on Aboriginal land: The hybrid economy in the twenty-first century. *Centre for Aboriginal Economic Policy Research Discussion Paper Series*. 226(2001). 1–13. Retrieved from: <http://dspace-prod1.anu.edu.au/handle/1885/40104>

This paper explores the economic issues faced by Aboriginal people living in Australia on Aboriginal land. The author states that important contributions to the economy by Aboriginal people often go unrecognized in the mainstream calculations of economic worth. To address this, a proper understanding of this market should be pursued; this requires a framework that combines science, social sciences and indigenous knowledge systems. This paper briefly touches upon Aboriginal property rights, and emphasizes the importance of property rights in carbon credit trading.

- Baldwin, A. (2009, February 25). Carbon nullis and racial rule: Race, nature and the cultural politics of forest carbon in Canada. *Antipode*, 41(2), 231–255. Retrieved from: <http://onlinelibrary.wiley.com/doi/10.1111/j.1467-8330.2009.00671.x/abstract>

The author examines the role of race, culture and politics in forest carbon in Canada. Two perspectives of racialization are examined in light of the developing carbon markets and non-timber forest product sector. According to the author, the underlying racial issues in Canada have “positive” and “negative” effects on establishing Aboriginal rights over land, and these issues should be addressed and understood.

- Emily, G. (2008). Climate change and human rights: Issues and opportunities for indigenous peoples. *University of New South Wales Law Journal*, 31(3), 941–952. Retrieved from: http://heinonlinebackup.com/hol-cgibin/get_pdf.cgi?handle=hein.journals/swales31§ion=57

The author discusses indigenous peoples’ participation in local development opportunities through environment-based commercial activities such as carbon offset projects. This paper highlights the reoccurring issue of protecting land and resource rights for indigenous peoples in Australia and the importance of traditional knowledge in climate change mitigation. The report is written from an international and national (Australia) Aboriginal land and resource rights law perspective.

- Fairlie, K. & Boydell, S. (2010, April 11–16). *Representing carbon property rights*. Paper presented at FIG Congress 2010: Facing Challenges: Building Capacity, Sydney, Australia. Retrieved from: www.fig.net/pub/fig2010/papers/ts01e%5Cts01e_fairlie_boydell_4224.pdf

This paper is a collection of discussions that focus on property rights from different perspectives. The authors argue that, in the past, resources have been managed individually and that there is a need to manage land using holistic methods that include all of the resources, rights, responsibilities, restrictions and stakeholders relevant to the land. This can be done by accurately describing and representing the relationships and interdependencies between individual ecosystem elements. The paper outlines the challenges of methods that address these shortcomings and suggests methods of visual representation that take into account a variety of disciplines and perspectives.

- Fondahl, G. & Poelzer, G. (2001). Aboriginal land rights in Russia at the beginning of the twenty-first century. *Polar Record*, 39(2), 111–122. Retrieved from: <http://journals.cambridge.org/action/displayAbstract;sessionid=EF4A3C41DBC2CBD418E38AA71A0BFFA8.tomcat1?fromPage=online&aid=150703>

The authors discuss land and resource laws as they apply to Aboriginal people in Russia. After regular and systematic denial of the land and resource rights, several legislative changes from the early 1990s to 2001 have resolved some of those issues. The Russian government has made small changes to several laws and introduced several more comprehensive laws that directly address these issues. The authors compare several international requirements and how they are reflected in the national framework. The report briefly outlines several achievements of Aboriginal peoples in the circumpolar north and their achievements in land and resource rights in Canada, Norway, Sweden and the United States (Alaska).

- Miranda, M., Dieperink, C. & Glasbergen, P. (2002). The social meaning of carbon dioxide emission trading. *Environment, Development and Sustainability*, 4(1), 69–86. Retrieved from: www.springerlink.com/content/q4ylrjwrmxvabc6w/

The authors discuss the traditional economic view of the emerging carbon market and make the observation that it is far too simplistic and must include the socioeconomic impacts on local populations. The policies must make use of emerging carbon markets to improve both the living conditions of local people and the state of the climate. This paper explores the Costa Rican experience and its successes with including socioeconomic concerns in carbon sequestration policies.

- Ooft, M. (2008, September 8–12). *Indigenous peoples are rights-holders, not only stakeholders in sustainable forest management*. Presented at Country-Led Initiative on Financing for Sustainable Forest Management in Support of the UN Forum on Forests, Paramaribo, Suriname.

Historically, the resource rights of indigenous peoples that have inhabited the forest have not been respected; recognition of resource rights is particularly urgent as the global carbon market unfolds. The author discusses the importance of including the rights and interests of indigenous communities as being a part of a holistic and portfolio approach towards policies on forests. The forest economy is changing from just timber resources to carbon credit “gold mines.” There is an absence, or limited presence, of indigenous voices and perspectives in many of these newly emerging policies. The author makes eight recommendations for governments and NGOs along the theme of the rights of indigenous peoples and the responsibilities of policy-makers.

- Saunders, L.S., Hanbury-Tenison, R. & Swingland, I.R. (2002). Social capital from carbon property: Creating equity for indigenous people. *Philosophical Transactions of the Royal Society*, 360(1), 1763–1775. Retrieved from: <http://www.jstor.org/pss/3066589>

The authors outline the potential of carbon-emission trading as an economic tool for managing landscapes. Exploiting forests for timber resources in traditional indigenous peoples’ territories has been the norm for many years, thus raising the concern that this may be another way to exploit indigenous populations. This article emphasizes the importance of including indigenous peoples in profit-sharing and decision-making processes in emerging carbon markets. This article argues that, through international treaties and agreements, trade can be constrained and national governments obliged to observe the rules of trade; if the rules are not observed, then the value of tradable carbon credits could be discounted. Carbon trading without infringing on the rights of indigenous peoples is possible, but to achieve this, governing bodies must be accountable, transparent and inclusive of the features discussed in this report.

- Sheehan, J. (2010, January 25). *Indigenous carbon property rights*. Paper presented at the 16th Annual Pacific Rim Real Estate Society (PRRES) conference, Wellington, New Zealand. Retrieved from: <http://sites.thomsonreuters.com.au/carbon/2010/08/indigenous-carbon-property-rights/>

The author examines existing carbon rights laws that have been modified and new laws in Australia. An emerging carbon market will raise both the issues of past disregard of indigenous resource ownership and liability for compensation. This article lists several key policy issues, followed by tools that can be applied internationally to achieve meaningful dialogue and balance between indigenous and State resource management and the carbon sequestration processes.

2.1.2 Grey Literature

- Barnes, G. & Quail, S. (2009, March 9–10). *Property rights to carbon in the context of climate change*. Paper presented at the Land Governance in Support of Millennium Development Goals: Responding to New Challenges, FIG, World Bank Conference, Washington, D.C., U.S.A.

The authors offer a well-rounded discussion of property rights in an emerging carbon market, emphasizing the experience of several communities. The authors provide a background of what carbon is, how it is stored and who currently owns world forest carbon rights. This report emphasizes the importance of indigenous and forest-dwelling people as being primary right-holders, stakeholders and stewards of forest carbon.

- Chapin, M. (2004). A challenge to conservationists. *World Watch Magazine*, 17(6), 17–31. Retrieved from: www.worldwatch.org/system/files/EP176A.pdf

This report was intended to provoke discussion regarding the neglect of indigenous and traditional peoples' rights in conservation programs spearheaded by the “big three” global conservation groups. The author discusses several situations involving types of conservation planning that do not meaningfully engage indigenous populations. The author concludes with several recommendations for conservation groups for improving their policies and practises.

- Chiew, H. (2009). Carbon hopes and landless farmers in Indonesia and Malaysia. *Contemporary Review*, 291(1694), 361–364. Retrieved from: www.questia.com/community/reviewsRatingsPage?docId=5035987421&tableReset=true

The author tells the story of indigenous-occupied and cultivated land that was under a large-scale logging regime for several decades. In Indonesia, about 1,500 families occupied large pieces of land from 2002 to 2007. In 2007, they were evicted after PT Restorasi Ekosistem Indonesia (an Indonesian NGO) took possession of the land for an ecosystem restoration project, approved by the Government of Indonesia. The author emphasizes that this was not an official REDD+ project, but demonstrates what is possible when indigenous land becomes valuable. REDD and carbon trading markets may threaten indigenous peoples when countries do not have developed policies for indigenous resource rights.

- Dudenhofer, D. (2009). Vision quest: Who will control the future of the Amazon? A complex and high-stakes struggle over the Amazon forests and their resources heats up. *World Watch Magazine*, 22(6). Retrieved from: www.worldwatch.org/node/6295

The author discusses the political situation of indigenous peoples in the Amazon Basin and the recent history of their land and resource rights, with a focus on Peru. A discussion on REDD and the possible threats to indigenous land is included.

- Goldtooth, T.B.K. (2009). Indigenous perspective on CO₂ colonialism. *Canadian Dimension*, 43(6). Retrieved from: <http://canadiandimension.com/magazine/issue/november-december-2009/>

The author discusses Canada's role in Kyoto and why targets were not met. In preparation for COP 15 (2009), Goldtooth discusses several recommendations for the creation of a shared vision for climate change by indigenous peoples globally. The author expresses that REDD and other REDD-like initiatives may not be optimal for mitigating the effects of climate change. Many indigenous people reject market-based mitigation strategies.

- Griffiths, T. (2009). Seeing "REDD"? Forests, climate change mitigation and the rights of indigenous peoples. Retrieved from Forest Peoples Programme: www.forestrynepal.org/publications/reports/4227

The author emphasizes the importance of recognizing indigenous land rights based on the principle of free, prior and informed consent when formulating REDD proposals. The author discusses why it is imperative that indigenous peoples have an equal seat at the negotiating table in climate negotiations, nationally and internationally. This report is an updated version of two other reports that examine how these rights have manifested in national and international policies.

- Griffiths, T. (2007). Seeing "REDD"? "Avoided deforestation" and the rights of indigenous peoples and local communities. Retrieved from Forest Peoples Programme: www.forestpeoples.org/sites/fpp/files/publication/2010/01/avoideddeforestationredjun07eng_0.pdf

The author examines issues that have not been adequately addressed in REDD (or similar) schemes. This document describes REDD, case studies of existing schemes, issues and next steps for policy-makers. The author highlights that socioeconomic and land-rights issues for forest-dwelling and indigenous peoples are not adequately taken into account in many REDD (or similar) schemes; the author is calling upon policy-makers to debate these urgently overlooked issues that can have lasting, detrimental consequences.

- Indigenous Environmental Network. (2010). Reaping profits from evictions, land grabs, deforestation and destruction of biodiversity + plus industrial plantations, GMO trees and

protected areas. Retrieved from Indigenous Environmental Network:
www.ienearth.org/REDD/redd.pdf

This document is the Indigenous Environmental Network's response to the effects of REDD+ and the carbon credit trading market. The document outlines information on rights to pollute, colonization of forests, loss of land, plantations, forest management and human rights with a pro and con list of participating in REDD+ programs for indigenous peoples.

- Karst, A. (2010). Conservation value of the North American boreal forest from an ethnobotanical perspective. Retrieved from Canadian Boreal Initiative, David Suzuki Foundation and the Boreal Songbird Initiative:
www.davidsuzuki.org/publications/downloads/2010/conservation-value-of-the-north-american-boreal-forest.pdf

The author highlights the ethnobotanical importance of plants to indigenous peoples living in the circumpolar boreal forest. Traditional ecological knowledge of plants is emphasized and extensively catalogued. The article briefly discusses several land rights cases involving indigenous peoples in Canada.

- Ogonowski, M., Guimaraes, L., Ma, H., Movius, D. & Schmidt, J. (2009). Utilizing payments for environmental services for reducing emissions from deforestation and forest degradation (REDD) in developing countries: Challenges and policy options. Retrieved from Centre for Clean Air Policy:
www.indiaenvironmentportal.org.in/files/CCAP%20Using%20PES%20for%20REDD%20FINAL.pdf

The authors explore several key policies and issues with regard to payments for ecosystem services and REDD in developing countries. There is an emphasis on the issue of the effects of these types of markets on indigenous people. Several discussions throughout the paper emphasize the need for indigenous participation in markets, socioeconomic benefits for indigenous peoples and protection of their forest rights. This paper stresses that the benefits from such markets cannot be seen as just a reduction in carbon, but in all of the benefits that they can provide (land rights settlements, biodiversity protection) and must be integrated into planning.

- Schmidt, L. (2009). REDD from an integrated perspective. Retrieved from German Development Institute: [www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/\(ynDK_contentByKey\)/ANES-7S8GBA/\\$FILE/DP%204.2009.pdf](http://www.die-gdi.de/CMS-Homepage/openwebcms3.nsf/(ynDK_contentByKey)/ANES-7S8GBA/$FILE/DP%204.2009.pdf)

The author looks at a variety of issues that have been raised about REDD and evaluates what would need to happen for REDD schemes to become a widespread reality. The author emphasizes the importance of the acknowledgement and integration of socioeconomic development policy into local areas that are involved in the creation of REDD markets. The author discusses the importance of REDD, focusing on more than just carbon, and taking into account other national responsibilities and benefits such as protection of biodiversity, rebuilding social rights and confirmation of indigenous land rights.

- Smith, S.A., Madras, M.L. & Clarke, D.W. (Eds). (2009). Forest offset credits: A cornerstone of sustainable development on Aboriginal lands. *Gowlings*. Retrieved from: www.lexology.com/library/detail.aspx?g=0d0b8a3e-a871-4e3f-8507-e628c719441a

This article explores the issue of carbon credits and Aboriginal ownership from a legal perspective. The author states that the main issue that must be at the forefront of this emerging market is the settlement of Aboriginal land claims so that carbon rights are clearly defined. Aboriginal people in Canada have the opportunity to engage in self-sufficient sustainable development through the sale of carbon offset credits that are generated on their traditional territories. The development of this sector can help to mitigate climate change and serve as a global framework for other Aboriginal groups internationally.

- Takacs, D. (2009). *Forest carbon law + property rights*. Arlington, VA: Conservation International. Retrieved from: www.conservation.org/Documents/CI_Climate_Forest-Carbon_Law-Property-Rights_Takacs_Nov09.pdf

This guide is intended to help and support carbon projects starting from the ground up. It is intended to be a holistic guide that takes into account long-term benefits for both investors and local communities under an equitable model. The author outlines and describes forest carbon property rights in an emerging market and what all stakeholders should be aware of. The document takes the reader through several detailed examples from countries that have experience in carbon markets discussing the status of forest carbon projects, carbon ownership, strengths and unresolved legal issues.

2.1.3 Media

- Axworthy, L. & Innes, L. (2009). Our green carbon future. Retrieved from University of Winnipeg: www.uwinnipeg.ca/index/admin-president-boreal09

The authors explain that the First Nations of Manitoba can and will play an important role in the

formation of a “green collar” economy. Manitoba is already a leader in conservation and intends to assist in the nomination of a UNESCO World Heritage Site project for a 40,000 square km tract of land in the boreal forest that already does and will store carbon for years to come. One of the First Nations involved in the bid, Poplar River, is already exploring how much carbon storage exists on their traditional lands as a step towards participating in carbon-conservation agreements. They are also in the process of negotiating their carbon rights within their traditional territories.

- Canwest News Service. (2009). Forestry’s role in economic development: “Carbon Sink.” Retrieved from *National Post*: http://league.ca/updates/2009-11-18_forestrys_role_in_economic_development_national_post.pdf

The author outlines recent issues in carbon ownership and how it relates to the emerging interests in carbon markets. There has been no legislation by the Canadian government on First Nations’ carbon ownership, or even the settlement of many land claims. However, groups in British Columbia have been moving forward with participation in carbon markets; the province has set up the Pacific Carbon Trust, which has been purchasing offset credits for public service organizations.

- Goldtooth, T. (2010). Carbon markets violate indigenous peoples’ rights and threaten cultural survival. Retrieved from Global Justice Ecology Project: www.globaljusticeecology.org/pressroom.php?ID=345

At the Second Annual Carbon Trading Summit, indigenous peoples denounced the purchase and selling of carbon credits. REDD or REDD+ is not the proper solution to reduce emissions.

- Keen, J. (2009). For Indian tribes, economic needs collide with tradition. Retrieved from *USA Today*: www.usatoday.com/money/industries/energy/2009-03-03-reservation_N.htm

On the Cheyenne Reservation in the United States, employment is extremely low, but the coal resources are not. There is potential for coal resource exploitation and the generation of carbon credits for leaving the coal untouched. Through new leadership, new economic pursuits, such as mining the coal, are being explored on the reservation. Some residents on the reservation are for coal exploration and mining, and some are against it. The Yellow Bird, which is a non-profit group on the reservation promoting respect for land and environment, are interested in participating in the carbon market.

3.0 Carbon Offset Regimes

A number of carbon offset programs have emerged and are emerging in various places around the globe through international, national and regional efforts (Clean Development Mechanism, Reduced Emission from Deforestation and Degraded Ecosystems, European Union Emission Trading System, Regional Greenhouse Gas Initiative). Within the Canadian context, a number of provinces (British Columbia, Manitoba, Ontario and Quebec) are assisting with developing carbon offset regimes and protocols within the Western Climate Initiative. Alberta has developed a number of carbon offset protocols, including an afforestation protocol, which is currently under review. Although some carbon offset regimes may not currently include protocols to accommodate land-based carbon offsets, they continue to evolve and may eventually expand to include them.

Decentralized governance models can lead to more effective natural resources management. Local forest governance regimes have proved to be as effective, if not more so, than centralized ones (Sandbrook, et al., 2010; Miranda, et al., 2002; Saunders, et al., 2002). Many local governance regimes have cost-effectively improved livelihoods by enhancing forest ecosystem services such as biomass production and carbon sequestration and storage (Sandbrook, et al., 2010; Miranda, et al., 2002; Saunders, et al., 2002). Communal localized forest governance in the Amazon and Costa Rica have improved forest conservation and restoration (Sandbrook, et al., 2010; Miranda, et al., 2002). The implementation of carbon offset regimes such as REDD+ programs need to be designed so as not to undermine decentralized governance that effectively supports local livelihoods and carbon sequestration and storage (Sandbrook, et al., 2010).

Revenues from carbon offset projects should create legitimate employment opportunities for local forest dwellers. Forest conservation and restoration can be labour-intensive and should generate a range of employment opportunities, such as: scientists and technicians to measure carbon, foresters to ensure sustainable forest management, and rangers to keep out illegal loggers and poachers (Powers, 2009; Krčmar, et al., 2005; Miranda, et al., 2002). Carbon offset projects that only provide financial incentives for carbon sequestration and preservation have, at times, led to violent rivalries in the past, while projects that offer compensation through employment have reduced the occurrence of corruption (Kant, 2010). Consequently, carbon offset projects that lead to the development of local employment opportunities will be less risky and less prone to illegal logging and corruption (Powers, 2009; Saunders, et al., 2002).

Indigenous people are well placed to fulfill forest stewardship roles, as they often have valuable traditional ecological knowledge (Kant, 2010). In the Noel Kempf Mercado National Park, many of the indigenous Chiquitanos people in the Amazon lost their forestry jobs when the area was turned

into a park, but gained employment in ecotourism, guiding, measuring forest carbon and protecting the park boundaries (Powers, 2009). A study on the effect of carbon trading schemes on the socioeconomic status of the Maori in New Zealand concluded that it would give them more options to develop economically. The same study also found that economic activities would change for the Maori and that there would be more jobs overall (Insley & Meade, 2008). Indigenous communities that have participated in small-scale agroforestry projects have been successful in providing for themselves and their families (Saunders, et al., 2002).

3.1 Additional Information Sources

3.1.1 Peer Reviewed

- Altman, J. (2003). People on country, healthy landscapes and sustainable indigenous economic futures: The Arnhem Land case. *The Drawing Board: An Australian Review of Public Affairs*. 4(2), 65–82. Retrieved from: www.australianreview.net/journal/v4/n2/altman.pdf

The author examines a group of Aboriginal people in remote Arnhem Land in Northern Australia. The groups of people living in the area were moved to a centralized township, and in the 1970s, decided to move back into smaller communities, locally called “outstations,” on areas of their traditional land. The author poses three questions about how the economics of the area have changed, and makes predictions to changes in the future. One of the future industries that may emerge from alignment of the conservation goals of Australia and indigenous populations may be the participation in a carbon market and other conservation-aligned initiatives.

- Brown, H.C.P. (2009). Climate change and Ontario forests: Prospects for building institutional adaptive capacity. *Mitigation and Adaptation Strategies for Global Change*, 14(6), 513–536. Retrieved from: <https://springerlink3.metapress.com/content/t707np3120t27867/resource-secured/?target=fulltext.pdf&sid=ajvaxb45tckcvxqns5dt1nil&sh=www.springerlink.com>

The author reviews the collective response of different institutions (government, industry, First Nations, community, civil society) to climate change in the forest sector in Ontario, including the formation of a carbon credit market. First Nations and forest-dependent communities are the most important stakeholder groups to network with and include in decision-making processes. If all of these institutions collaborate, this could foster the transfer, receipt and integration of knowledge across networks, and ultimately build long-term collaborative problem-solving capacity in the Ontario forest sector.

- Dubois, L. R. (2006). Curiosity and carbon: Examining the future of carbon sequestration and the accompanying jurisdictional issues as outlined in the Indian Energy Title of the 2005 Energy Policy Act. *Energy Law Journal*, 27(2), 603–620. Retrieved from: <https://litigation-essentials.lexisnexis.com/webcd/app?action=DocumentDisplay&crawlid=1&doctype=cite&docid=27+Energy+L.+J.+603&srctype=smi&srcid=3B15&key=70bf4560f3045776231732aa46a91655>

The author discusses the new addition of a section of the U.S.’s 2005 Energy Policy Act. The section was included to enable policy- and program-makers to include plans to develop carbon sequestration programs for Indian tribes on Indian land. This paper examines three strategies for carbon sequestration and explores the local jurisdictional issues surrounding supervision and control over carbon trading by Indian tribes. The paper gives an overview of related laws, carbon sequestration strategies, carbon trading markets and describes several important legal cases involving Indian tribes and carbon.

- Fearnside, P.M. (2004). Indigenous peoples as providers of environmental services in Amazonia: Warning signs from Mato Grosso. In *Global Impact* (pp. 187–198). Retrieved from: http://philip.inpa.gov.br/publ_livres/mss%20and%20in%20press/Indigenous%20peoples%20CEISAL.pdf

The author discusses the state of forest degradation in Mato Grosso and the possible role of indigenous peoples in the maintenance of the forest for carbon credit trading and other ecosystem goods and services. Mato Grosso is the state in Brazil where deforestation is the most rapid. Many of the Amazonian indigenous peoples gain almost no reward for the environmental services that they provide by maintaining the forests. The forests that are actively protected by indigenous Amazonian peoples cover approximately 20 per cent of the Amazon forest. They have, on average, elevated levels of conservation than those 80 per cent of forests that are not protected by indigenous populations. Indigenous ownership is not an automatic indication of better protection; some indigenous populations have allowed encroachment of agriculture (for a fee) onto forested land. Many of Brazil’s indigenous groups support the inclusion of forest maintenance for carbon credit trading and the author argues that including indigenous peoples in forest planning could be very successful.

- Karjala, M.K. & Dewhurst, S.M. (2003). Including aboriginal issues in forest planning: A case study in central interior British Columbia, Canada. *Landscape and Urban Planning*, 64(1), 1–17. Retrieved from: <http://people.stfx.ca/rmespi/Lars/BibliographycheckifitisinBIBTEXJUNE2005/Karjala2003.pdf>

Sustainable forest management should determine practices based on a bottom-up approach when partnering with First Nations communities, rather than a standardized framework for dealing with multiple stakeholders. The indigenous knowledge possessed by First Nations people that is distinct from culture to culture makes unique contributions to sustainable forest management and should be accounted for in management plans. Sustainable forest planning should therefore highlight, and not assimilate, this knowledge and First Nations culture into their planning regime. This document takes several cases from British Columbia and showcases First Nations' involvement with sustainable forestry planning.

- Krcmar, E. & van Kooten, G.C. (2005). Boreal forest carbon sequestration strategies: A case study of the Little Red River Cree First Nation land tenures. *Canadian Journal of Agricultural Economics*, 53(4), 325–341. Retrieved from: <http://ideas.repec.org/a/bla/canjag/v53y2005i4p325-341.html>

The authors explore the feasible opportunities for creating and selling carbon credits in the forested areas managed by the Little Red River Cree First Nation in Alberta, Canada. The Little Red River Cree First Nation is a forest tenure holder in Northern Alberta that produces carbon credits. This report examines three different scenarios to better understand how to include carbon credits in their forest management and post-harvest processing strategies. These scenarios include carbon offset credits for carbon sequestered in forest ecosystems, along with carbon stored in products or CO₂ emission reduction credits from biomass energy production. Depending on the economy, different strategies will yield different financial outcomes.

- Powers, W. (2009). The forest for the trees: Building a carbon ranching market. *World Policy Journal*, 26(3), 81–86. Retrieved from: www.mitpressjournals.org/doi/abs/10.1162/wopj.2009.26.3.81

The author gives a view on international forest policies and makes recommendations to how they can work for indigenous and forest-dependent communities. A thorough critique from the assumed point of view of indigenous peoples in the Amazon Basin is given. Williams emphasizes how essential it is to directly include forest-dwellers in decision-making processes around carbon market and REDD-related policies.

- Sandbrook, C., Nelson, F., Adams, W.M. & Agrawal, A. (2010). Carbon, forests and the REDD paradox. *World Policy Journal*, 44(3), 330–334. Retrieved from: <http://journals.cambridge.org.proxy2.lib.umanitoba.ca/action/displayFulltext?type=1&fid=7852122&jid=ORX&volumeId=44&issueId=03&aid=7852120&bodyId=&membershipNumber=&societyETOCSession=>

The author discusses the concept of local, centralized governments and REDD policies. The decentralization of forestry practises has been shown to be more effective than centralized regimes. Putting the rights and responsibilities of forest management in the hands of the local indigenous peoples or otherwise forest-dependent communities has shown improvements to biomass and carbon storage, as well as having made positive contributions to the livelihoods of the local, marginalized populations in a given area.

- Wunder, S. (2010). Forest decentralization for REDD? A response to Sandbrook, et al. *Oryx*, 44(3), 335–337. Retrieved from: <http://journals.cambridge.org/action/displayAbstract;jsessionid=B62E3EF5A9C56F55349957C9FC693F38.tomcat1?fromPage=online&aid=7852168>

The author expresses an opposing view to the Sandbrook, et al. article on forest management, decentralization and REDD. The author argues that it may not be true that decentralized forest management yields the positive results that Sandbrook, et al. present in their report. The author does agree that a decentralized forest management model can work, but it is not always the case.

3.1.2 Grey Literature

- Aboriginal Strategy Group and Mushkegowuk Environmental Research Council. (2008). *Carbon cap and trade concepts and discussion*. Aboriginal Strategy Group. Retrieved from: www.merc.ontera.net/reports/ccco.pdf

This report was created to assist the Mushkegowuk First Nations to conceptualize their lands from an economic carbon perspective and to give communities a brief overview of land-use projects and climate change should they decide to research it further. The report briefly discusses the basics of carbon credit trading: carbon, climate change, Kyoto, cap-and-trade schemes, trade markets and how First Nations may fit into this. Threats, opportunities and impacts regarding First Nations in the carbon credit trading market are discussed. Different tools and strategies for carbon credit trading and ownership of carbon is also briefly discussed.

- Angelsen, A. (2010). *Realizing REDD+ national strategies and policy options*. Borogor, Indonesia: Centre for International Forestry Research, p. 361. Retrieved from: www.cifor.cgiar.org/Knowledge/Publications/Detail?pid=2871

The authors attempt to answer the following questions with respect to developing REDD+ national strategies and policy options: How are participating countries going to reduce emissions and increase carbon stocks that they hope to be paid for through global mechanisms? What new institutions,

processes, policies and projects are needed? What are the options in these areas, and how do they compare? The systems proposed are examined in terms of their effectiveness, cost efficiency and equity (3E+), and co-benefits, including biodiversity and other environmental services, livelihoods, governance, and rights and climate change adaptability. The book concludes with cautious optimism that national REDD+ programs can be realized and that large scale REDD+ performance-based payments can be successfully implemented.

- Barnsley, I. (2009). *A carbon guide for northern indigenous Australians*. Retrieved from North Australian Indigenous Land and Sea Management Alliance: www.nailsma.org.au/nailsma/publications/downloads/Carbon_Guide_LR.pdf

This guide was created for northern Australian indigenous groups that may be interested in participating or learning more about carbon emissions trading. The guide is split into four sections: 1) an outline of climate change and the international response; 2) a description of the carbon market in Australia and possible opportunities for indigenous people; 3) an examination of the role of Australian indigenous fire management; and 4) an examination of case studies of the international indigenous experience with carbon sequestration projects.

- Barnsley, I. (2008). *Emissions trading, carbon financing and indigenous peoples*. Retrieved from United Nations University Institute for Advanced Studies: www.ias.unu.edu/resource_centre/UNU-CARBONMARKET.pdf

This author directs an explanation of the basics of climate change and carbon trading as it applies to the global and indigenous communities to governments and non-governmental organizations (NGOs). There is a wide variety of in-depth international case studies involving indigenous groups that are engaged in the carbon sequestration process. It is a compliment to *A carbon guide for northern indigenous Australians* by Ingrid Barnsley, which is written for indigenous people.

- BC First Nations Mining and Energy Council. (2010). *Carbon 101: Carbon credit opportunity overview for First Nations*. Version 2. Retrieved from First Nations British Columbia: <http://www.fnbc.info/sites/default/files/fck-uploads/file/FNEMC/Carbon%20101%20Final%20version%20November%2023%202009.pdf>

The report provides general knowledge required to understand climate change negotiations and carbon markets and provides some description as to the opportunities that they pose for First Nations. The report concludes by making the following recommendations:

1. Establish rights to carbon within First Nations lands
2. Establish biofuel manufacturing in areas affected by pine beetle infestations
3. Generate carbon credits by restoring cleared forests
4. Promote fuel switching to cleaner energy systems within remote communities
5. Develop efficient technologies to meet community heat and power requirements;

First Nations must work towards gaining maximum benefits from carbon credit markets so they can generate employment, increase standard of living for their people and improve self-sufficiency and sustainability for their communities.

- BC Forestry Roundtable. (2008). *Carbon credit opportunities for First Nations in BC*. Retrieved from First Nations of British Columbia Forestry Council: www.fnforestrycouncil.ca/downloads/carboncreditopportunities.pdf

The paper provides the rationale for involving First Nations in British Columbia in the development and participation of current and emerging carbon markets related to forest management activities. As most traditional territories are covered in forests, First Nations in British Columbia are well positioned to take advantage of the potential revenues that carbon markets could provide them. Policies in the province should be designed to facilitate the involvement and participation of First Nations in carbon markets, and the paper concludes by providing a number of key recommendations to achieve this.

- Dyer, S., Grant, J., Lesack, T. & Weber, M. (2008). *Catching up: Conservation and biodiversity offsets in Alberta's boreal forest*. Retrieved from The Pembina Institute: www.pembina.org/pub/1650

This document gives an overview of the potential opportunities and outcomes of biodiversity offsets in Alberta's boreal forest. The document examines the different types of markets and programs in Alberta and their feasibility on public and private lands. It also uses case studies to compare with other projects from international governments. A number of interviews and opinions from a variety of sources are presented throughout the document.

- EcoSecurities Ltd. (2009). *Challenges for a business case for high-biodiversity REDD projects and schemes*. Retrieved from EcoSecurities Limited: www.illegal-logging.info/uploads/ecosecuritiesREDD.pdf

This report explores a variety of activities that promote biodiversity within the REDD scheme. There are several recommendations to show how these policies can and will work, including the involvement of local and indigenous communities in the formation of policy and benefit sharing.

- Eliasch, J. (2008). Climate change: Financing global forests. *Eliasch Review*. Retrieved from: www.official-documents.gov.uk/document/other/9780108507632/9780108507632.pdf

This independent report was commissioned by the United Kingdom to serve as a comprehensive analysis of international financing to reduce forest loss. It examines the socioeconomic impacts that different schemes can have with emphasis on the ways policy can make a positive impact on forest-dwelling and indigenous communities that are dependent on the forest. The document also highlights the positive role that forest-dwelling and indigenous communities have on conservation of forests when forest governance is organized in a decentralized system.

- Erni, C. & Tugendhat, H. (Eds). (2010). What is REDD? A guide for indigenous communities. Retrieved from International Work Group for Indigenous Affairs and Tebtebba: www.iwgia.org/sw40375.asp

This three-part document outlines climate change, Reduced Emissions from Deforestation and Ecosystem Degradation (REDD), the United Nations Declaration on the Rights of Indigenous Peoples (UNDRIP) and a REDD checklist for indigenous communities. The first section outlines climate change from the basics of the carbon cycle to the effects on the human populations. The second section outlines REDD schemes, financing and the impacts on social and natural systems. The third section is a synopsis on the UNDRIP, from how it was formed to what rights it holds for indigenous people. It is recommended that the UNDRIP should be the background to how REDD and other initiatives with indigenous peoples operate. In the appendix, the authors have included a checklist for indigenous groups that are approached to be a part of a project or program involving the carbon market. The checklist is a minimum set of questions for indigenous communities to ask about a project and is intended to empower groups that have had little or no participation in carbon markets.

- First Nations of Wolf Lake, Nak'azdli, Tl'azt'en, Tanka Lake and the Carrier Sekani Tribal Council. (2010). *Forests, climate change and the new low carbon economy*. Carrier Sekani Tribal Council.

This document was written to provide information and stimulate discussion among First Nations communities in Canada regarding possible participation in carbon markets. This document covers the basics of climate change and carbon storage, government action and mitigation, and several different policy approaches related to carbon markets. The document ends with the potential opportunities for First Nations to enter into the carbon market, initial first steps and a list of discussion questions for consideration.

- Kant, P. (2010). REDD should create jobs, not merely bring compensation. Retrieved from Institute of Green Economy: www.2degreesnetwork.com/preview/document/redd-should-create-jobs-merely-bring-compensation-3131/

This article gives a critical perspective on REDD policies, briefly outlines several of the shortcomings of REDD and offers ideas on how REDD can be used with positive outcomes. According to this document, the real benefit to REDD is job creation for developing communities in forest management.

- Karamea, I.C. & Meade, R. (2008). *Maori impacts from the emissions trading scheme*. New Zealand: New Zealand Ministry for the Environment, Manatu Mo Te Taiao. Retrieved from: www.mfe.govt.nz/publications/climate/maori-impacts-analysis-conclusions-jan08/maori-impacts-analysis-conclusions-jan08.pdf

This document gives an overview of the socioeconomic status of the Maori people and their collective role in the creation and mitigation of carbon emissions. The document looks at the possible impacts of a carbon market on Maori and non-Maori people in New Zealand, weighing both the “positive” and “negative.” The final conclusion is that a proposed emissions trading scheme would give more options to Maori people to develop economically; and that if they were to go forward, the benefits may be disproportionately in their favour compared to non-Maori people participating in the same market.

- Krcmar, E., Nelson, H., van Kooten, G.C., Vertinsky, I. & Webb, J. (2005). *Can forest management strategies sustain the development need of the Little Red River Cree First Nation?*³. Retrieved from University of Victoria: <https://web.uvic.ca/~repa/publications/REPA%20working%20papers/WorkingPaper2005-04.pdf>

This report goes through the current forest management strategy and several proposed forest management strategies in pursuing economic development. It outlines the natural history of the area and the socioeconomics of the Little Red River Cree First Nation, and provides a brief overview of their timber-related industry. The report concludes that forestry sustains their economic development goals, but not their environmental preservation goals.

³ Background paper to Krcmar, E. & van Kooten, G.C. (2005). *Boreal forest carbon sequestration strategies: A case study of the Little Red River Cree First Nation land tenures*. Retrieved from: <http://ideas.repec.org/a/bla/canjag/v53y2005i4p325-341.html>

- Nez Perce Tribal Forestry. (2008). *Activity on the Nez Perce Reservation*. National Wildlife Federation: Tribal Energy Solutions to Climate Change Workshop. Retrieved from: <http://tribalclimate.org/PDFsBillings/Pres-Kummet.pdf>

This PowerPoint presentation at the National Wildlife Federation: Tribal Energy Solutions to Climate Change Workshop outlines the experience of the Nez Perce Reservation in the United States when they became involved in the carbon trading market. The document also outlines several other initiatives that have been launched or are pending for other tribes involved in the carbon market.

- Parker, C., Mitchell, A., Trivedi, M. & Mardas, N. (2008). *The Little REDD Book: A guide to governmental and non-governmental proposals for reducing emissions from deforestation and degradation*. Global Canopy Programme. Retrieved from: www.amazonconservation.org/pdf/redd_the_little_redd_book_dec_08.pdf

This guide, intended for a wide range of audiences, presents information about governmental and non-governmental approaches on the implementation of REDD schemes. There is a one-page synopsis given for each organization with a key giving the reader an at-a-glance understanding of the country's scope, reference level, distribution, financing and the scale of their proposals. In this guide, there are many countries that have constructed approaches, but only Australia and Norway emphasized indigenous rights.

- Rosendal, K., Schei, P.J., Eikland, P.O. & Gulbrandsen, L. (2008). *International payment for forest conservation special case: Compensation for leaving the oil in the ground in Yasuní National Park, Ecuador*. Retrieved from Norwegian Ministry of the Environment: www.fni.no/doc&pdf/FNI-R0208.pdf

This document was created in order to evaluate a proposal to have the international community compensate Ecuador for not exploiting oil reserves in the Yasuní National Park. It contains a discussion on indigenous rights and the socioeconomic and environmental pros and cons of leaving the oil in the ground. Afforestation, reforestation, the Ecuadorian government and the national park itself are discussed.

- Seppälä, R., Buck, A. & Katila, P. (Eds.). (2009). *Adaptation of forests and people to climate change*. Retrieved from International Union of Forest Research Organisations: www.iufro.org/download/file/4485/4496/Full_Report.pdf

This document provides a broad assessment of climate change, vulnerabilities, impacts, adaptation measures and policies. The section on adaptation options includes information in current adaptation measures and government policies. The paper discusses the importance of cooperation of stakeholders at all levels and the role of sustainable forest management. Decentralization of forest governance and policy that is geared towards local forest communities is outlined as being significant in successful sustainable management.

- Zhu, X., Ravnkilde Møller, L., De Lopez, T. & Zaballa Romero, M. (Eds.). (2010). *Pathways for implementing REDD+: Experiences from carbon markets and communities*. Retrieved from United Nations Environment Programme: <http://cd4cdm.org/Publications/PathwaysImplementingREDDplus.pdf>

This document showcases the research of several authors on the topics of: experiences with carbon markets, the future role of the carbon market in the private sector and community engagement. This document has a broad scope, and includes a large amount of general, up-to-date international information about the implementation of REDD+. Some sections highlight case studies from projects where indigenous peoples have been included as stakeholders, or make recommendations about how policy-makers should engage with indigenous populations.

3.1.3 Media

- CBC News. (2009). Haida to sell forest preservation as carbon offset. Retrieved from *Canadian Broadcasting Corporation*: www.cbc.ca/canada/british-columbia/story/2009/12/15/bc-haida-gwaii-carbon-offsets.html

The Haida First Nation in British Columbia, Canada, will set aside 25 per cent of its forested regions to sell in the up-and-coming carbon market. It is projected that this project could generate millions of dollars in profit, which would likely be shared with the British Columbia government.

- CSRwire. (2006, October 30). Mohawk sustainability initiatives help neutralize carbon footprint; Mohawk Fine Papers offsets nearly a million miles worth of carbon emissions. Mohawk Fine Papers Press Release. Retrieved from: www.asria.org/news/press/1162524167

Mohawk Fine Papers, an American Indian owned paper company, partnered with Native Energy to offset their carbon emissions. Mohawk calculated how much carbon their sales team emits, and purchased offset credits. This article gives a bit of background on the Native Energy Corporation.

- Halter, R. (2010). The real value of B.C.'s old-growth forests: Wooded areas are a gold mine for worldwide carbon offset markets. Retrieved from the *Vancouver Sun*: www.vancouversun.com/business/real+value+growth+forests/3532239/story.html

After a peak in the forestry industry in British Columbia, Canada, there is a low. Much of the province's old-growth forests have been logged extensively. There are some areas within traditional Aboriginal lands wherein the provincial government has offered payments in order to keep the forests as a tourist attraction. The author of this article argues that the remaining forests are a gold mine for carbon credits and should be used as such.

- Helms, K. & Bureau, D. (2010). Hopi carbon capture project opposed. Retrieved from *Grand Canyon Trust*: www.grandcanyontrust.org/news/2010/08/hopi-carbon-capture-project-opposed/

The Hopi Tribal Council approved a carbon capture project without consulting people of the Hopi or Navajo Nations, and this approval has now been reversed. The two nations hold equal rights to the area in question and are unsure of the research that was proposed. The quality and safety of the two nations' water source could be compromised by drilling necessary for research and carbon storage.

- Johnston, A. & Serratore, P. (2010). Carbon offset scheme aims to use indigenous land. Retrieved from *ABC News*: www.abc.net.au/news/stories/2010/10/26/3048380.htm

Centrefarm Aboriginal Horticulture is a not-for-profit group that is encouraging Australians to purchase carbon credits derived from Aboriginal land. Centrefarm believes that many people in Australia want to back Aboriginal people and see them living in healthy communities with strong culture and a stronger economic base.

- Koven, A., Williams, J. & Clark, T. (2010). Open the timber market to save Ontario's forest industry. Retrieved from *Northern Ontario Business*: www.northernontariobusiness.com/columns/unassigned/Open-the-timber-market-to-save-Ontario%E2%80%99s-forest-industry.aspx

The authors suggest that to save the failing forestry industry in Ontario, governmental controls should be loosened and localized forest management corporations should be created. Non-timber values of the forest like carbon storage are becoming more mainstream, and thus, the Ontario government should broaden the non-timber forest product market. They also suggest that Aboriginal participation should be meaningful and that localized forest management corporations

could help reduce the unprecedented levels of poverty in northern communities; without Aboriginal participation, the reform of the industry will be jeopardized.

- Lloyd, G. (2010). Noel Pearson's plan to unlock the carbon riches of Cape York. Retrieved from *The Australian*: www.theaustralian.com.au/national-affairs/pearsons-plan-to-unlock-the-carbon-riches-of-cape-york/story-fn59niix-1225936213871

Noel Pearson, an Aboriginal leader in Australia, called for the creation of a fund worth millions of dollars for Aboriginal peoples to move forward with environmentally conscious economic activities, mainly carbon credit trading. The government is committed to working with Aboriginal landowners to develop carbon price mechanisms.

- Torstar Syndication Services. 2010. Nisga'a hope to profit from carbon. *Terrace Standard*.

New legislation amending the Forest Act by the Nisga'a Lisims Government has two purposes: to restore parts of Nisga'a land that was extensively logged in the 1960s and 1970s, and to derive economic benefits from the carbon stored on that land.

- Robbins, J. (2007). Sale of carbon credits helping land-rich, but cash-poor, tribes. Retrieved from *New York Times*: www.nytimes.com/2007/05/08/science/earth/08carb.html

The Nez Perce reservation is converting previously cleared land into a polyculture forestry operation to sell the carbon credits that they sequestered by growing trees. Other tribes in the U.S. have also sold carbon credits through reforestation projects, although the sale of carbon credits is not only restricted to reforestation.

- Vanderklippe, N. (2006). Aboriginal group eyes carbon credits: B.C.'s Haida aim to replant old forest clearcuts. Retrieved from *Haida Climate Forest*: www.haidaclimate.com/content/view/20/29/

The Haida Nation in British Columbia is exploring the sale of carbon credits as a part of their forest management plan by replanting previously forested areas with hemlock and cedar, which absorb more carbon than the alder that has encroached on the bare post-harvest land. The forestry industry accounts for approximately CAD\$3.3 billion dollars, which may be difficult to match with carbon credits; although, the two can coexist. There has been much effort over a few years put into understanding the feasibility of this on Haida Nations forestry area.

4.0 Land-Based Carbon Accounting

Accurate land-based carbon stock measurements are essential to develop viable carbon offsets that can be credibly sold in carbon markets. There are several models for estimating land-based carbon stocks that use an integrated approach, often with the aid of remote sensing information (Wang, et al., 2010; Carr, et al., 2009; Rokityanskiy, et al., 2007; Dong, et al., 2003). Other modelling efforts have been created on a statistical basis, which may not factor in land-use change from various disturbances, such as fire or insects (Volney, et al., 2000).

This section focuses on carbon accounting methods for the boreal forest region, which has unique ecological dynamics that must be considered. For example, in some areas of the boreal, defoliation and carbon sequestration loss is attributed to insects rather than fire. Most models have not included the impacts of forest fires and insect infestations in the calculations of current and future carbon stocks (Volney, et al., 2000). More specifically, the carbon accounting methodologies examined refer to reforestation, afforestation, avoided deforestation and sustainable forest management within the boreal forest region.

Localized moisture conditions have a significant impact on the amounts of carbon stored in an area and modelling should be supported with site visits and core samples (Yorova, et al., 2007). If the climate continues to warm, conditions in the boreal may become favourable to pests and forest fires (Volney, et al., 2000). Modelling carbon stocks must include all relevant variables to estimate carbon sequestration and storage potential of an area. Extensive efforts should be expended on developing capacity within indigenous communities to accurately measure carbon sequestration abilities so that fair and precise carbon offset credits can be sold within carbon markets (Yorova, et al., 2007; Volney, et al., 2000).

For many communities the carbon models and research efforts needed to assess their potential in participating in carbon markets may be economically out of reach. Nevertheless, several existing guides and Geographic Information Systems (GIS) tools are available for free or at a low cost. NatCarb GIS and several guides on climate change and REDD cater to indigenous populations (Carr, et al., 2009; Voluntary Carbon Standard Association, 2008).

4.1 Additional Information Sources

4.1.1 Peer Reviewed

- Anderson, R.B. (1997). Corporate/indigenous partnerships in economic development: The First Nations in Canada. *World Development*, 25(9), 1483–1503. Retrieved from: http://indigenouspeoplesissues.com/index.php?option=com_content&view=article&id=329:corporateindigenous-partnerships-in-economic-development-the-first-nations-in-canada&catid=52:north-america-indigenous-peoples&Itemid=74

The author notes several ways that business in Canada is changing. There has been an increase in partnerships formed between Aboriginal and non-Aboriginal groups. There are four main reasons for this: 1) society's changing expectation about what constitutes socially responsible behaviours; 2) laws and regulations; 3) a growing Aboriginal population; and 4) a growing pool of natural and financial resources available to the Aboriginal population. First Nations have also become more active in economic development. The author outlines the core values of Tahltan First Nations economic development, which is echoed by many First Nations groups in Canada. This document includes several case studies of partnerships in economic development.

- Apps, M.J., Kurz, W.A., Beukema, S.J. & Bhatti, J.S. (1999). Carbon budget of the Canadian forest product sector. Ottawa: Natural Resources Canada, Canadian Forest Service, Northern Forestry Centre. Retrieved from: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VP6-43GBRDB-4&_user=10&_coverDate=02%2F28%2F1999&_rdoc=1&_fmt=high&_orig=gateway&_orig=gateway&_sort=d&_docanchor=&view=c&_searchStrId=1672100400&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=89192d78c0c34640308ebb4b53f4d624&searchtype=a

The authors evaluate an exhaustive list of management decisions regarding how to use timber resources harvested from the forests of Canada and what impact those decisions have on forest carbon. Changes in timber management can contribute significantly to the carbon sequestration process.

- Cairns, R.D. & Lasserre, P. (2006). *Implementing carbon credits for forests based on green accounting*. Retrieved from Department of Economics, McGill University: <http://www.er.uqam.ca/nobel/r25314/publications/PDF/CairnsLasserre05.pdf>

The authors construct a realistic carbon-accounting method that can be applied in specific scenarios. They examine several pieces of methodology literature on carbon accounting and take their method

through several scenarios. There is a discussion on investing in carbon credits and methods of calculating carbon credits in the face of credit loss through fire or insect damage.

- Carr, T.R., Iqbal, A., Callaghan, N., Adkins-Heljeson, D., Look, K., Saving, S. & Nelson, K. (2009). A national look at carbon capture and storage: National carbon sequestration database and geographical information system (NatCarb). *Energy Procedia*, 1(1), 2841–2847. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B984K-4W0SFYG-F3&_user=10&_coverDate=02/28/2009&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1554914144&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=2ad6b61bc63e6bcdde8834abb35f5aca&searchtype=a

This paper describes the emergence of a GIS designed to integrate carbon storage potential data in North America. By using key data (land use, carbon sources, etc.) users can evaluate the potential for carbon credits or emerging carbon markets. All data used will be pulled from public sources, and will be for public use; this will keep it accessible to all users, and will be especially useful for those that are in the beginning stages of a carbon accounting.

- Corey J., Bradshaw, A., Warkentin, I.G. & Sodhi, N.S. (2009). Urgent preservation of boreal carbon stocks and biodiversity. *Trends in Ecology and Evolution*, 24(10), 541–548. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VJ1-4X03JDR-1&_user=10&_coverDate=10/31/2009&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1553371359&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=82e598f521544107125da210e2775266&searchtype=a

The authors examine carbon storage in the circumpolar boreal forest. The preservation and restoration of the boreal forest is crucial in climate change mitigation. Current management practises will not be sufficient for this goal; the authors suggest several strategies for preserving biodiversity and carbon storage in the boreal forest.

- Cornelis van Kooten, G., Eagle, A.J., Manley, J. & Smolak, T. (2004). *How costly are carbon offsets? A meta-analysis of carbon forest sinks*. Retrieved from University of Victoria: <https://web.uvic.ca/~repa/publications/REPA%20working%20papers/WorkingPaper2004-01.pdf>

This study analyzed 981 estimates from 55 studies on the costs of creating carbon offsets using forestry methods. It was found that tree planting and agroforestry increased the costs of creating

carbon credits substantially, but that those average costs could be lowered by changing the end-use of the timber by substituting wood biomass for fossil fuels or the post-harvest storage of carbon in wood products. This document is meant to serve as an indication of the possible costs involved with creating certain types of carbon credits.

- Dong, J., Kaufman, R.K., Myneni, R.B., Tucker, C.J., Kauppi, P.E., Liski, J., Buermann, W., Alexeyev, V. & Hughes, M.K. (2003). Remote sensing estimates of boreal and temperate forest woody biomass: carbon pools, sources and sinks. *Remote Sensing of Environment*, 84(1), 393–410. Retrieved from: <http://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1042&context=usdafsfacpub>

The authors estimate the difference between the amount of carbon stored in forest woody biomass that has been calculated from satellite and inventory estimates from 167 countries. Differences in estimates varied substantially from country to country. The ways of calculating forest woody biomass are somewhat accurate, but could be improved with the use of LiDAR and other similar technologies.

- Jane, W., Volney, A. & Fleming, R.A. (2000). Climate change and impacts of boreal forest insects. *Agriculture, Ecosystems and Environment*, 82(1), 283–294. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T3Y-41P172D-S&_user=10&_coverDate=12/31/2000&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1556358312&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=7165cdc9e733585135afc53893ad752d&searchtype=a

The changes that forest-pest insects bring to the boreal forest can and will affect the carbon storage in an affected area by the loss of woody biomass. In some areas of Canada, this loss can be greater than the loss from fire. Global climate change may create more a suitable habitat for forest pests by expanding their ranges in Canadian forests, which could cause losses to carbon stocks. The development of carbon budget models have often overlooked the significant losses that can occur due to forest-pest outbreaks and the amount of carbon forecasted for the future. This study looks at three different forest pests (forest tent caterpillar, spruce budworm and jack pine budworm) and how climate change may favourably alter their lifecycle, range and available forage. Although difficult to manage and predict, the impacts of forest pests need to be accounted for in carbon stock assessments.

- Jandl, R., Lindner, M., Vesterdal, L., Bauwens, B., Baritz, R., Hagedorn, F., Johnson, D.W., Minkinen, K. & Byne, K.A. (2007). How strongly can forest management influence soil

carbon sequestration? *Geoderma*, 137 (3–4), 253–268. Retrieved from: www.sierraforestlegacy.org/Resources/Conservation/FireForestEcology/ThreatsForestHealth/Climate/CI-Jandl_etal2007.pdf

The authors reviewed experimental evidence for long-term carbon sequestration in soils as a consequence of specific forest management strategies. The effects of harvesting, thinning, fertilization application, drainage, tree species selection and control of natural disturbances were all evaluated in terms of their effects on carbon storage. Reforestation and minimal disturbance to the stand and soils have the highest rates of carbon accumulation and retention.

- Kurz, W.A., Dymonda, C.C., White, T.M., Stinson, G., Shaw, C.H., Rampley, G.J., Smyth, C., Simpson, B.N., Neilson, E.T., Trofymow, J.A., Metsaranta, J. & Apps, M.J. (2008). CBM-CFS3: A model of carbon-dynamics in forestry and land-use change implementing IPCC standards. *Ecological Modelling*, 220(4), 480–504. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VBS-4V7D5S7-2&_user=10&_coverDate=02/24/2009&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1554944606&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=6ab80f887059fc34bf819076d211a6fb&searchtype=a

Over the last two years there have been changes implemented to the Carbon Budget Model of Canadian Forest Sector. These changes include a best practises approach for reporting on carbon stocks and carbon stock changes that occur from land use, land-use change and forestry. This generic modelling framework was developed primarily for Canadian forests and can be applied at stand, landscape and national levels.

- Leboeuf, A., Beudoin, A. Fournier, R.A., Guindon, L., Luther, J.E. & Lambert, M.-C. (2007). A shadow fraction method for mapping biomass of northern boreal black spruce forests using QuickBird imagery. *Remote Sensing of Environment*, 110(4), 488–500. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V6V-4NYSHBW-1&_user=10&_coverDate=10/30/2007&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1555956101&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=b81f47f1c72bc7028dd2e5ab44a2f218&searchtype=a

In the newly emerging carbon market, accurate estimates of biomass will be vital to cataloguing carbon stocks. This document outlines a procedure that was developed and tested by the authors for estimating the biomass of a black spruce forest. Three different methods were used to test the accuracy of the system, and were found to not be significantly statistically different.

- Notzke, C. (1995). A new perspective in Aboriginal natural resource management: Co-management. *Geoforum*, 26(2), 187–209. Retrieved from: http://www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6V68-3YF4DVJ-S&_user=10&_coverDate=05%2F31%2F1995&_rdoc=1&_fmt=high&_orig=gateway&_orig=gateway&_sort=d&_docanchor=&view=c&_searchStrId=1672103246&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=45d02c26a2c53411f1f13e84c92fa182&searchtype=a

The author explores the variety of reasons for the formation of co-management relationships in Canada and the success rates of different types of co-management regimes. Success of an agreement is greatly enhanced by the settlement of land claims. The process of creating relationships between two nations with different systems of resource management is difficult at best. The work has assisted First Nations in Canada to regain considerable influence and independence over the management of resources in traditional territories. The author makes some brief recommendations on creating successful partnerships.

- Palmer, C.J., Smith, W.D. & Conkling, B.L. (2002). Development of a protocol for monitoring status and trends in forest soil carbon at a national level. *Environmental Pollution*, 116(1), 209–219. Retrieved from: www.ingentaconnect.com/content/els/02697491/2002/00000116/90000001/art00253

The rapid changes in carbon content from horizon to horizon in soils makes it essential for core sampling to find the exact amount stored. A previously published study overestimated the carbon stocks in forest soils in these same forest sites. Sampling by depth using bulk density core samplers has been recommended for national implementation.

- Pelletier, J., Kirby, K.R. & Potvin, C. (2009). Significance of carbon stock uncertainties on emission reductions from deforestation and forest degradation in developing countries. *Forest Policy and Economics*, 11. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VT4-508XBC3-1&_user=10&_coverDate=06/11/2010&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1556014752&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=848525ec8ad7aff8db7ef1a06fe0c414&searchtype=a

The authors use Panama as an example of the impacts that the current levels of uncertainty in carbon stock estimation can have on estimates of carbon stock worth. The global default value of the carbon stocks calculated for Panama were always much lower than what localized testing for

carbon stocks revealed. The inaccurate accounting for carbon stocks could have detrimental effects on the carbon market in Panama or other developing countries that do not accurately measure carbon.

- Pelly, J. (2003). Taking credit for forest carbon sinks. *Environmental Science and Technology*, 10, 59–63. Retrieved from: <http://pubs.acs.org/doi/pdfplus/10.1021/es032368c>

The author argues that there is a need for a standardized carbon storage estimation calculation, as there is no standard set in Canada. The absence of a standard could make it difficult for some jurisdictions to participate in carbon credit trading. Currently, there are many models available for calculating the amount and worth of carbon credits, but none completely agree on amounts measured. Several tools, technologies and methods are discussed to measure the levels of carbon sequestered in forests.

- Peng, C., Liu, J., Dang, Q., Zhou, X. & Apps, M. (2002). Developing carbon-based ecological indicators to monitor sustainability of Ontario's forests. *Ecological Indicators*, 1, 235–246. Retrieved from: http://flash.lakeheadu.ca/~qdang/Peng_etal_EI.pdf

The authors evaluate the carbon stored or emitted from Ontario forests in the last 70 years. Changes in carbon storage can be attributed to forestry activities; from 1920 to 1980, Ontario's forests were a carbon sink, and from 1981 to 1990 they were a carbon source. The current assessment is that Ontario's forests have the potential to become a powerful carbon sink, if disturbances were reduced and more areas were reforested. There are seven main criteria that Ontario has developed for sustainable forest management and 68 related indicators; following these guidelines are an important step towards managing carbon and towards meeting UNCED criteria for sustainable forest management.

- Peng, C., Liu, J., Dang, Q., Zhou, X., Apps, M. & Jiang, H. (2002). TRIPLEX: A generic hybrid model for predicting forest growth and carbon and nitrogen dynamics. *Ecological Modelling*, 153(1), 109–130. Retrieved from: www.crc.uqam.ca/Peng/PDF/TRIPLEX_EM_02.PDF

The authors formulated a three-input model to predict total tree volume and above-ground biomass. The model is intended to be accurate, and not overly complicated; it was tested in jack pine stands in Northern Ontario and was found to be somewhat accurate over a period of 30 years. There are three main purposes to this model: making forest management decisions, quantifying forest carbon budgets and assessing the effects of climate change in both the short and long term.

- Ramachandran Nair, P. K., Nair, V.D., Mohan Kumar, B. & Showalter, J.M. (2010). Carbon sequestration in agroforestry systems. *Climate Policy*, 2(4), 3667–3777. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B7CSX-50XV797-9&_user=10&_coverDate=12/31/2010&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=d08e44215f92c94450e202bb461058da&searchtype=a

The authors give a broad and general definition of agroforestry and how these systems can be used to sequester carbon. The document also outlines several methods of carbon stock measurement and gives suggestions for management considerations for silvicultural practises. Agroforestry systems have a very high potential for carbon sequestration if managed properly.

- Rokityanskiy, D., Benítez, P.C., Kraxner, F., McCallum, I., Obersteiner, M., Rametsteiner, E. & Yamagata, Y. (2007). *Geographically explicit global modeling of land-use change carbon sequestration, and biomass supply*. Retrieved from: http://yoshi.o.oo7.jp/_userdata/082.pdf

The authors study the effects of land-use policies on carbon sequestration. The evaluation used a spatially explicit model to quantify the economic potential of global forests. This model will choose the type of land-use process that would be the most appropriate (afforestation, reforestation, deforestation, conservation or other management options) based on current land use, cost of forest production, cost of harvesting, site productivity, population density and estimates of economic growth. The model Dynamic Integrated Model of Forestry and Alternative Land Use (DIMA) would be a useful planning aid for areas where groups are interested in participating in carbon markets.

- Seely, B., Welham, C. & Kimmins, H. (2002). Carbon sequestration in a boreal forest ecosystem: Results from the ecosystem simulation model, FORECAST. *Forest Ecology and Management*, 169(1–2), 123–135. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6T6X-46G3RGG-F&_user=10&_coverDate=09/15/2002&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1556212704&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=9d9975e27cb575228216aea7b2448356&searchtype=a

The authors investigate three different alternative harvesting methods and the effect on long-term ecosystem productivity and carbon sequestration using the FORECAST ecosystem simulation model. Three different tree species and three different rotation lengths were used in consideration of outcomes. It was found that soil storage was a large and relatively stable pool of carbon, regardless

of harvest regime. However, tree biomass and litter pools fluctuated widely depending on the harvest regime. What this implies for management of carbon is that certain harvest practises can help to store significantly more carbon than others; from this model, a manager could choose their management objective (carbon storage, harvest) and be presented with options.

- Wang, J., Chen, J., Ju, W. & Li, M. (2010). IA-SDSS: A GIS-based land use decision system with consideration of carbon sequestration. *Environmental Modelling and Software*, 25(4), 539–553. Retrieved from: www.institute.redlands.edu/emds/manuscripts/pdf/wang%20et%20al%202010.pdf

The authors present a GIS-based approach for integration of carbon models with remotely sensed data to assess the carbon sequestration potential of a given area in order to support the decision-making process. This study takes into account several areas not yet fully assessed by other GIS-based approaches for carbon management like: modelling for carbon sequestration at different land-use conditions at regional scales, integration of a process-based carbon model that considers disturbance and non-disturbance factors and the inclusion of a GIS-based integrated assessment as a part of a decision-making tool. The system was developed to provide local government an effective, spatially-based tool to make efficient decisions for sustainable forestry land use with the consideration of carbon sequestration benefits.

- Wong, G.Y. & Alavalapati, J.R.R. (2002). The land-use effects of a forest carbon policy in the US. *Forestry Policy and Economics*, 5(3), 249–263. Retrieved from: <http://www.sciencedirect.com/science/article/B6VT4-46V4JIT-1/2/8441c873b9173fa5a23ccba8a3064c6a1/2/8441c873b9173fa5a23ccba8a3064c6a>

The authors consider the potential economy-wide impacts of a carbon market in the U.S. over the next 20 years. This study assumes that market stimulation in the carbon sequestration process will be either tax credits or a subsidy to grow trees on agricultural land. The study examines the scenarios with and without U.S. participation and the effects on both changes in land use and investments. The authors found that the establishment of carbon plantations will likely have a small and favourable impact across all land-use types on the overall economy, particularly in agriculture and forestry sectors.

- Woodbury, P.B., Smith, J.E. & Heath, L.S. (2007). *Carbon sequestration in the U.S. forest sector from 1990 to 2010*. Retrieved from US Forest Service: http://nrs.fs.fed.us/pubs/jrnl/2007/nrs_2007_woodbury_001.pdf

The authors estimated the rate of carbon sequestration in the U.S.'s forest sector from 1990 to 2010

using data collected from research sites and carbon sequestration modelling. There was substantial regional variation in carbon storage: the Pacific Northwest consistently stores the most carbon, while the Midwest and Northeast saw the most significant fluctuations in storage. The estimates for both carbon storage and fluxes are significantly higher than other reports that have a more local focus. These estimates are based on national inventories and if there are initiatives in place to calculate local carbon for the sale of carbon credits, more extensive information should be compiled. In the future, the authors estimate that the national rate of carbon sequestration from forests the U.S. will stay approximately the same as they have been in recent years.

- Yurova, A.Y. & Lankreijer, H. (2007). Carbon storage in the organic layers of boreal forest soils under various moisture conditions: A model study for Northern Sweden sites. *Ecological Modelling*, 204(3), 475–484. Retrieved from: www.sciencedirect.com/science?_ob=ArticleURL&_udi=B6VBS-4NB38JR-2&_user=10&_coverDate=06/16/2007&_rdoc=1&_fmt=high&_orig=search&_origin=search&_sort=d&_docanchor=&view=c&_searchStrId=1557287695&_rerunOrigin=google&_acct=C000050221&_version=1&_urlVersion=0&_userid=10&md5=bb715d3a9c2f64d1a9dbb53fb7543b69&searchtype=a

This study examined northern forests in Sweden using the coupled ecosystem-soil organic matter model GUESS-ROMUL to test the carbon storage between mesic and mesic-to-wet sites. GUESS is a terrestrial ecosystem model that simulates vegetation dynamics, carbon and water exchange. ROMUL is a modelling program for soil organic matter dynamics. It was found that moisture had a large effect on amounts of carbon stored, partially due to the decrease in forest fire frequency. Soil moisture is an important part of estimating the carbon sequestration ability of an area and should not be overlooked.

4.1.2 Grey Literature

- Voluntary Carbon Standard Association. (2008). REDD methodology modules. Retrieved from Voluntary Carbon Standard: www.v-c-s.org/methodology_rmm.html

The Voluntary Carbon Standard (VCS) Association is working towards establishing standards in carbon credit trading and have several objectives aimed towards creating a fair, accountable and transparent global carbon credit market. Eighteen concisely written methodological documents have been released for groups who would like to calculate their carbon potentials to the VCS. These modules and tools can be used to create general methodology for activities to reduce emissions from planned and unplanned deforestation and for activities to reduce emissions from forest degradation caused by extraction of wood for fuel. A full list and downloads can be found at the URL provided.

- Carlson, M., Wells, J. & Roberts, D. (2009). The carbon the world forgot: Conserving the capacity of Canada's boreal forest region to mitigate and adapt to climate change. Canadian Boreal Initiative and Boreal Songbird Institute. Retrieved from: www.borealbirds.org/resources/carbon/report-full.pdf

The authors discuss the boreal forests that have been often overlooked as being integral to global carbon sequestration, knowing that boreal forests and peatlands store more carbon than any other biome on Earth. There are many threats to these areas of high-carbon storage. This paper outlines several strategies to mitigate the loss of forests, and ultimately, global carbon storage.

- Campbell, A., Milkes, L., Lysenko, I., Gibbs, H. & Hughes, A. (2008). *Carbon storage in protected areas: Technical report*. Retrieved from United Nations Environment Programme World Conservation Monitoring Centre: www.unep-wcmc.org/climate/pdf/Carbon%20storage%20in%20protected%20areas%20technical%20report.pdf

This document provides a discussion and technical assessment of carbon storage in many of the world's protected areas. Indigenous peoples' involvement is not extensively discussed, but the document does support the participation of indigenous peoples and local communities as being vital to the implementation of REDD strategies. According to the authors, the lands that are in the traditional territories of indigenous peoples have been even more effective in carbon reduction than many other protected areas.

5.0 Conclusion and Recommendations

If implemented appropriately and fairly, existing and emerging carbon markets offer opportunities for indigenous peoples, governments and industry to benefit. For indigenous communities, land-based carbon offset projects offer the potential for economic development that may be compatible with their interests and traditions. Governments may benefit from tax revenues and improved relationships with indigenous peoples. Industries are provided with more options to meet their greenhouse gas reduction requirements by purchasing carbon credits. The references in this document provide additional considerations for planning carbon offset projects with indigenous peoples that will generate shared benefits amongst all partners.

To conclude, the literature surveyed revealed that, although there is a reasonable amount of information on indigenous peoples and carbon markets, there seems to be very little information on First Nations in Canada and carbon markets. This indicates that an information void may need to be filled for First Nations to become active participants in current and emerging carbon markets. To engage First Nations in the development and participation of carbon markets, the following recommendations are made based on a brief literature review of 21 references (see the reference list):

Indigenous Carbon Rights

- Equal, meaningful and respectful dialogue between the State and the indigenous peoples that may be impacted by the development of carbon markets in their traditional territories (Algonquin Nation of Wolf Lake, et al., 2010; Sheehan, 2010; Power, 2009; Gerrard, 2008; Chapin, 2004)
- There must be clear, genuine, free, prior and informed consent when negotiating carbon and land rights (Algonquin Nation of Wolf Lake, et al., 2010; Goldtooth, 2010; Sheehan, 2010; Gerrard, 2008; Saunders, et al., 2002).
- Lawful recognition and protection of indigenous land and carbon rights (Algonquin Nation of Wolf Lake, et al., 2010; Sheehan, 2010; Saunders, et al., 2002; Altman, 2001)
- Rights of local people must be recognized, legally protected and secured with clear definitions of user rights and responsibilities before any payments can come through (Algonquin Nation of Wolf Lake, et al., 2010; Kant, 2010; Sandbrook, et al., 2010; Gerrard, 2008; Miranda, et al., 2002; Saunders, et al., 2002).

Carbon Offset Regimes

- Carbon sequestration practices must be aligned with the traditions, land management regimes and the socioeconomic goals of the indigenous peoples involved (Algonquin Nation

of Wolf Lake, et al., 2010; Sheehan, 2010; Gerrard, 2008; Krcmar, et al., 2005; Miranda, et al., 2002; Saunders, et al., 2002; Altman, 2001).

- Adequate and appropriate protection, recognition and respect towards indigenous peoples' traditional ecological knowledge and intellectual property (Algonquin Nation of Wolf Lake, et al., 2010; Gerrard, 2008; Altman, 2001)
- Decentralized forest management regimes where local people are trained and paid to work for local carbon sequestration projects (Algonquin Nation of Wolf Lake, et al., 2010; Sandbrook, et al., 2010; Kant, 2010; Powers, 2009; Krcmar, et al., 2005; Saunders, et al., 2002; Miranda, et al., 2002)
- A best practises guide and international standards need to be established for land-based carbon offset projects within indigenous traditional territories (Algonquin Nation of Wolf Lake, et al., 2010; Gerrard, 2008; Saunders, et al., 2002).
- Local socioeconomic status must be taken into account and the possible impacts on indigenous populations should be thoroughly assessed to understand and plan for potential adverse impacts (Sheehan, 2010; Baldwin, 2009; Insley & Meade, 2008).

Carbon Accounting

- Accurate measurement of carbon stocks are essential to entrance and success in the carbon market. These measurements should be calculated using an integrated approach that includes the use of a GIS and all contributing factors to carbon storage (Wang, et al., 2010; Carr, et al., 2009; Rokityanskiy, et al., 2007; Dong, et al., 2003).

6.0 References

Algonquin Nation of Wolf Lake, et al. (2010). Forests, climate change and the new low carbon economy.

Altman, J. (2001). *Sustainable development options on Aboriginal land: The hybrid economy in the twenty-first century*. Discussion Paper No. 226. Australia: Centre for Aboriginal Economic Policy Research, Australian National University.

Baldwin, A. (2009). Carbon nullis and racial rule: Race, nature and the cultural politics of forest Ccarbon in Canada. *Antipode*, 41(2), 231–255.

Carr, T.R., Iqbal, A., Callaghan, N., Adkins-Heljeson, D., Look, K., Saving, S. & Nelson, K. (2009). A national look at carbon capture and storage: National carbon sequestration database and geographical information system. *Energy Procedia*, 1(1), 2841–2847.

Chapin, M. (2004). A challenge to conservationists. *World Watch Magazine*, pp. 17–31.

Dong, J., Kaufmann, R., Mynemi, R., Tucker, C., Kauppi, P., Liski, J., Buermann, W., Alexeyev, V. & Hughs, M. (2003). Remote sensing estimates of boreal and temperate forest woody biomass: Carbon pools, sources and sinks. *Remote Sensing of Environment*, 84(3), 393–410.

Dubois, L. R. (2006). Curiosity and carbon: Examining the future of carbon sequestration and the accompanying jurisdictional issues as outlined in the Indian Energy Title of the 2005 Energy Policy Act. *Energy Law Journal*, 27(2), 603–620.

Gerrard, E. (2008). Climate change and human rights: Issues and opportunities for indigenous peoples. In *Forum: Climate Change and Human Rights*, 941–952.

Goldtooth, T. B. (2010). Indigenous perspective on CO2LONIALISM. Retrieved from Global Justice Ecology Project: www.globaljusticeecology.org/pressroom.php?ID=345

Insley, C. K. & Meade, R. (2008). Maori impacts from the emissions trading scheme: Detailed analysis and conclusions. New Zealand: New Zealand Ministry for the Environment.

Kant, P. (2010). REDD should create jobs, not merely bring compensation. IGREC Web Publication No. 13/2010. Retrieved from Institute of Green Economy: www.2degreesnetwork.com/preview/document/redd-should-create-jobs-merely-bring-compensation-3131/

- Krcmar, E. & van Kooten, G.C. (2005). Boreal forest carbon sequestration strategies: A case study of the Little Red River Cree First Nation Land Tenures. *Canadian Journal of Agricultural Economics*, 53(4), 325–341.
- Miranda, M., Dieperink, C. & Glasbergen, P. (2002). The social meaning of carbon dioxide emission trading. *Environment, Development and Sustainability*, 4(1), 69–86. Retrieved from: www.springerlink.com/content/q4ylrjwrmxvabc6w/
- Powers, W. (2009). The forest for the trees: Building a carbon ranching market. *World Policy Institute*, 26(3), 81–89.
- Rokityanskiy, D., Benitez, P.C., Kraxner, F., & McCallum (2007). Geographically explicit global modeling of land-use change carbon sequestration and biomass supply. *Technological Forecasting and Social Change*, 74(7), 1057–1082.
- Sandbrook, C. Nelson, F., Adams, W.M., & Agrawal, A. (2010). Carbon, forests and the REDD Paradox. *World Policy Journal*, 44(3), 330–334.
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- Wang, J., Chen, J., Ju, W. & Li, M. (2010). IA-SDSS: A GIS-based land use decision support system with consideration. *Environmental Modelling and Software*, 25(4), 539–553.
- Yorova, et al. (2007). Carbon storage in the organic layers of boreal forest soils under various moisture conditions: A model study for Northern Sweden sites. *Ecological Modelling*, 204(3), 475–484.