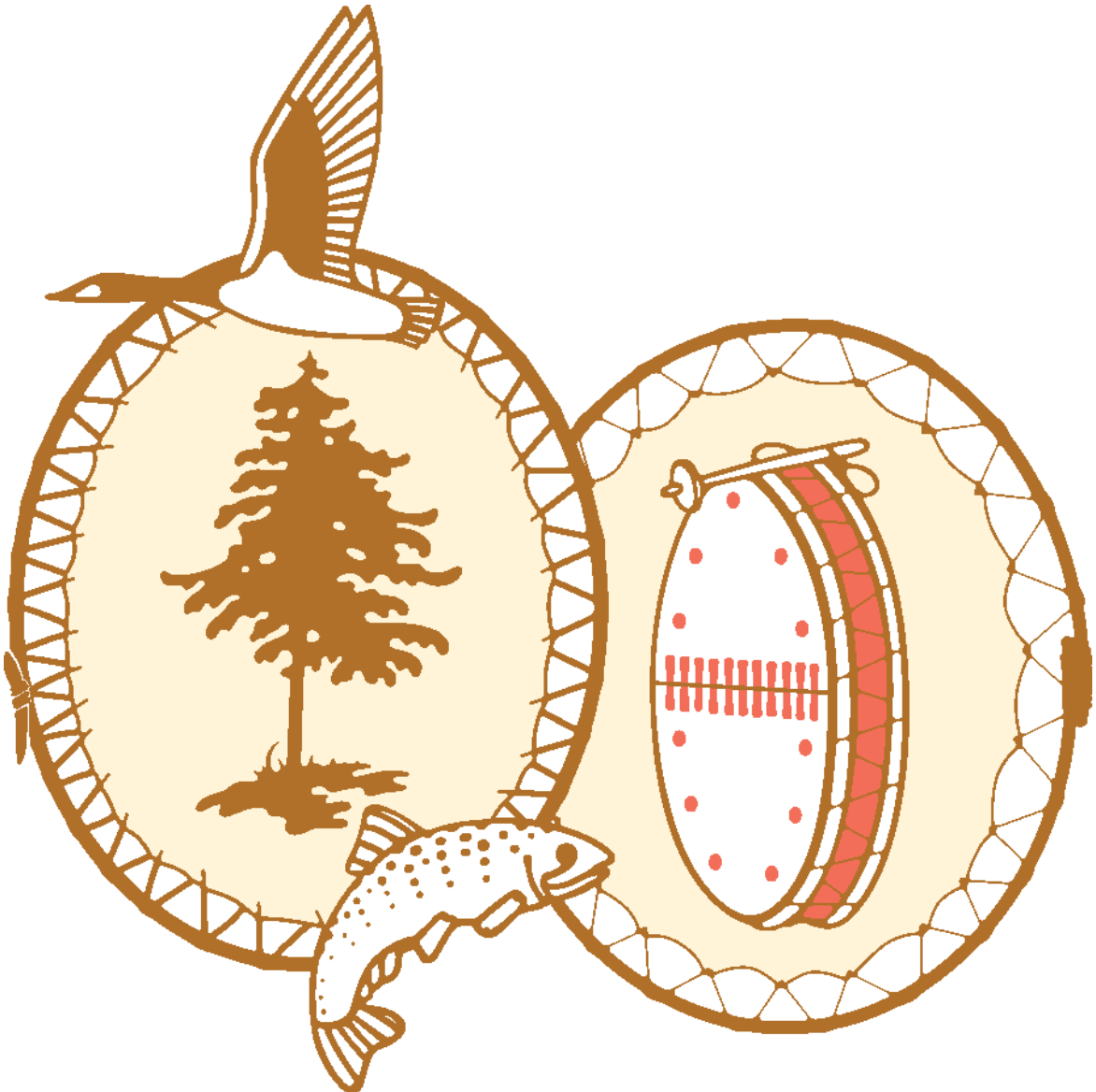
CLIMATE CHANGE

PARTICIPANTS BOOKLET

REGIONAL FORUM - EASTMAIN
NOVEMBER 6 & 7 2018



INTRODUCTION

Cree of Eeyou Istchee have always experienced changes in the environment and have always demonstrated a strong capacity to respond to these changes to pursue their traditional use and occupancy of the land to ensure their survival and well-being. This resilience has been a strength for the Cree and is deeply-rooted in their traditional knowledge passed on from one generation to the next. This knowledge is in constant evolution, influenced among other things by the continuous observations of the land. However, climate change now raises new challenges and opportunities for the Cree Nation.

The Cree Nation Government has supported over the recent years some Cree communities in their local actions for monitoring CC impacts and developing adequate responses. The Cree Nation Government wants to plan for short, medium and long term local and regional actions to prepare for adaptation. Some initiatives have been undertaken to update information to guide territorial priorities regarding climate change adaptation[1]. However, it is now essential that the Cree Nation Government establishes a strategic plan for coordinating upcoming actions to be taken to identify and monitor CC and to adapt to CC impacts using Cree knowledge combined with scientific research. Promoting sustainable opportunities for future generations is essential to our continued resilience.

The Climate Change Regional Forum provides the opportunity to establish a regional conversation in order to build a strategy rooted in the community members' priorities for maintaining the Cree culture and way of life. The Regional Forum will allow community members to identify orientations and actions to develop a coherent regional approach to assist in preparing for potential and current climate change impacts in Eeyou Istchee, while responding to the needs of each community.

GENERAL PRESENTATION

Climate change can be defined as long-term changes in weather patterns occurring all around the globe as a result of human activities[2]. In the context of climate change, scientists are predicting a sustained rise in mean global temperature, however, it will bring about many different climatic impacts on a regional scale. Climate change is caused by the rise in the concentration of greenhouse gas (GHG) in the atmosphere, which has been increasing rapidly since the end of the 19th century due to the reliance on fossil fuel and large-scale land-use change[3].
The impacts of climate change are already being felt. The melting of the ice caps, the decrease in sea ice extent and duration, sea level rise, extreme climatic events and changes in precipitation patterns can all be attributable to climate change[4,5].
Furthermore, these climatic changes have also triggered natural cycles, called feedbacks, of which many will increase the extent of climate change impacts. Examples are the release of methane in the atmosphere, a powerful GHG stored in the permafrost[6].
In the face of climate change, it is becoming crucial for all societies to understand these impacts on a local scale and to learn how to increase their resilience to the coming changes.

GENERAL PRESENTATION

Based on climate model predictions, the impacts of climate change will be particularly intense in arctic and subarctic latitudes, thus they pose significant challenges for the Cree and their way of life. Since 1987, the mean annual temperature in Eeyou Istchee James Bay Territory has risen by 1.5oC, with the most significant differences being observed in the winter with increases of 2 to 3oC[7]. Winters are also becoming shorter while summers last longer, disrupting the season patterns and affecting the capacity of the Cree to predict the weather and plan harvesting activities accordingly. In terms of precipitation, there is now more rain and less snowfall on the territory, and snow tends to melt earlier[8]. In Hudson Bay, sea surface temperature has been rising six times faster than the global trend shows. These impacts are also observed in James Bay with earlier breakup and retreat of sea ice at the end of the winter[9,10]. Higher river discharges in the years to come have also been predicted by climatic models, which could disrupt marine ecosystems[11].
As a whole, climatic changes are responsible for further ecological and social impacts on the Cree territory. From the modification of local ecosystems, availability of flora and fauna, to changes in forest fire patterns, access to land and subsistence activities; all of these modifications will have substantial impacts on the day to day life of the Cree[12].

REFERENCES

1. Hennigs, R. & Bleau, S.,2017. State of Climate Change and Adaptation Knowledge for the
Eeyou Istchee James Bay Territory. Report presented to the James Bay Advisory Committee on the Environment, Montréal, Ouranos, 41 p. + appendices.

2. IPCC, 2013. Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Stocker, T.F., D. Qin, G.-K. Plattner, M. Tignor, S.K. Allen, J. Boschung, A. Nauels, Y. Xia, V. Bex and P.M. Midgley (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA, 1535 pp.

3. IPCC, 2013.

4. Hennigs, R. & Bleau, S.,2017. State of Climate Change and Adaptation Knowledge for the
Eeyou Istchee James Bay Territory. Report presented to the James Bay Advisory Committee on the Environment, Montréal, Ouranos, 41 p. + appendices.

5. IPCC, 2013.

6. IPCC, 2013.

7. Hennigs & Bleau 2017.

8. Brown, R., Barrette, C., Chaumont, D., Grenier, P., Frigon, A., Roy, R., & Savard, J.-P., 2014. Climate observations and projections for the Eeyou marine region. Paper presented at the Symposium on Science and Traditional Knowledge in the Eeyou Marine Region Montréal.

9. Brand, U., Came, R. E., Affek, H., Azmy, K., Mooi, R., & Layton, K., 2014. Climate-forced change in Hudson Bay seawater composition and temperature, Arctic Canada. Chemical Geology, 388, 78-86.

10. Galbraith, P. S., & Larouche, P., 2011. Sea-surface temperature in Hudson Bay and Hudson Strait in relation to air temperature and ice cover breakup, 1985-2009. Journal of Marine Systems, 87(1), 66-78.

11. Déry, S. J., Mlynowski, T. J., Hernández-Henríquez, M. A., & Straneo, F. (2011). Interannual variability and interdecadal trends in Hudson Bay streamflow. Journal of Marine Systems, 88(3), 341-351

12. Hennigs & Bleau, 2017.

FOREWARD

To introduce the activities that will take place during the Cree Regional Forum on Climate Change, the following sections of this document will focus on ecological and social changes, while highlighting impacts and opportunities associated with them. Participants in this forum will have the task to identify challenges and opportunities related to climate change and propose actions to respond to challenges and opportunities. The following sections each present one of the three main themes that participants will be requested to discuss. Activities will be organized according to the three main themes that have been identified to establish a regional conversation on climate change. The themes are: 1) impacts to the local flora and fauna, and to food security, 2) impacts on health and safety of the population, and 3) business and employment opportunities related to the ongoing environmental modifications.

CLIMATE CHANGE

FLORA, FAUNA AND FOOD SECURITY

BACKGROUND

The harvesting of wildlife species and plants to meet subsistence needs is an important aspect of Cree traditional way of life and identity. Hunting, fishing, trapping, along with the use of forest products are central activities imbued with historical meaning that shape the relationship with the land. Wildlife harvesting activities are intrinsic to Cree physical, mental, spiritual and community well-being as well as providing a source of nutritionally and culturally appropriate food and medicine. In the past, harvesting activities have adapted to environmental changes, which has been key to Cree survival. Climate change poses new challenges to wildlife harvesting, management and conservation as it alters land and marine ecosystems. Moreover, as a result of less predictable weather patterns, access to land may change, indirectly impacting harvesting practices. Yet, it also raises some opportunities, as climate change may contribute to increase the abundance of some wildlife and plant species and improve access to parts of the land. Nevertheless, climate change is a complex phenomenon with many impacts on ecosystems and Cree activities.

FLORA

Cree traditional way of life rests on extensive use of forest products, such as medicinal plants, wild berries and trees. Climate change raises new challenges for traditional activities as it alters the quality, distribution and availability of plant and tree species. Many changes have been noticed in different Cree communities such as new pests and diseases affecting plants and trees, along with changing weather conditions involving new stressors for flora. Partly due to the declining quality and availability of certain plants, a decrease in berry picking has been observed, along with a loss of traditional healing practices. Some plants used traditionally in healing practices have been found to have preventive as well as curative effects for certain diseases and conditions. Moreover, the frequency and extent of forest fires is affecting the abundance of certain species. However, the warming of mean temperatures is creating new opportunities to grow food which could improve access to fresh herbs, fruits and vegetables.

FAUNA

Observations from Cree hunters and trappers along with Cree authorities have been instrumental in monitoring changes in wildlife and harvesting activities. Over the past decades, members of Cree communities have noticed changes in species distribution, abundance and quality[1]. The observations have also been supported by scientific research in the region[2]. These changes alter subsistence activities and pose threats to food security, individual and community well-being, along with the transmission of traditional knowledge. Yet at times, it remains difficult to isolate the impacts of climate change on wildlife from those that derive from large-scale natural resource exploitation. Overall, climate change exacerbates the impacts already associated to large-scale natural resource exploitation such as forestry, mining and hydro-electric development[3]. However, many communities and individuals have been responding to these changes in proactive manners, by shifting to other species or modifying harvesting schedules.

FOOD SECURITY

Food security "exists when all people, at all times, have access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life" (FAO). However, it has been recognized that "there is a food security crisis in Northern Canada" that is caused by recent changes in nutritional habits and limited access to nutritious food [4]. Many Cree public health authorities believe that climate change could worsen food security issues. Rapidly altering environmental conditions – i.e. period of ice melt, change in wildlife quality and availability – alter the circumstances of access to traditional food which still represent a significant part of Cree diet. Moreover, with the shift from a nomadic society to a more sedentary way of life, traditional bush food has been declining while the consumption of processed foods has risen sharply. This shift contributes to an erosion of foraging skills and impacts mental and spiritual health [5]. In this context, climate change appears as an additional challenge to ensuring healthy nutritional habits, and the transmission of traditional knowledge.

THE IMPACTS & OPPORTUNITIES

Impacts on Flora

- Plants and tree species' quality and distribution is affected by new stressors such as drought and late frost, impacting vegetation distribution, quality and availability.[6]
- Increase in the abundance of plant and tree species previously less present in subarctic territories competing with previously known species.
- Change in the coupling between plant phenology (life cycles) and wildlife reproductive cycles which impacts some wildlife species' nutrition, health and survival.

Impacts on Fauna

- Change in wildlife migratory patterns resulting to the decline in the availability of migratory species such as geese or migratory woodland caribou, in specific locations.
- Increase in the number of southern wildlife species such as white-tailed deer, moose, coyotes and wolves, leading to the introduction of new parasites and increased predation of large mammals.
- Wildlife health and body conditions are changing, as a result game has less fat, thinner fur and a different taste, which is associated to increased wildlife vulnerability to pests, parasites and diseases[7].

THE IMPACTS & OPPORTUNITIES

Impacts on food security:

- Difficulties in harvesting wildlife contribute to an overall decline in traditional food consumption which is replaced by highly processed foods associated with increased rates of diabetes and obesity[8,9].
- Altered conditions in snow and ice involving change in the calendar of harvesting cycle based on 6 seasons, impacts the time and place where hunting activities can occur along with the species that can be harvested.
- Change in wildlife body condition and health means hunting can take up more time and more animals are killed to obtain required amounts of game.
- Raising temperatures and new pathogens increase risk of exposure to zoonotic disease among hunters and trappers manipulating wildlife.

Opportunities

- Change in the patterns of migratory species may increase their availability to some communities and families.
- Some species such as the moose and the white-tailed deer are more abundant thus providing an increase in harvest.
- Communities have adopted different modes of transportation and timing of activities to access hunting and trapping lands, minimizing risks related to unpredictable weather and ice conditions.
- Communities are modifying the composition of wildlife species harvested and the timing of harvesting activities to adapt to changes in availability and distribution of wildlife.
- The increase in average mean temperatures provides opportunities for the production of new crops which could improve access to fresh food.

REFERENCES

1. Foro, A., Béziers, L., Robinson, E., & Torrie, J. E. (2013). Perceptions of the leaders and professionals of Eeyou Istchee in regard to climate change and its effects on human health: Report on the consultations, Cree Board of Health and Social Services of James Bay.

2. Hennigs, R. & Bleau, S.,2017. State of Climate Change and Adaptation Knowledge for the Eeyou Istchee James Bay Territory. Report presented to the James Bay Advisory Committee on the Environment, Montréal, Ouranos, 41 p. + appendices.

3. Lemelin, H., Matthews, D., Mattina, C., McIntyre, N., Johnston, M., Koster, R., & Peawanuck, W. F. N. a. (2010). Climate change, wellbeing and resilience in the Weenusk First Nation at Peawanuck: The Moccasin Telegraph goes global Rural and Remote Health, 10 (1333).

4. Council of Canadian Academies, 2014. Aboriginal Food Security in Northern Canada: An Assessment of the State of Knowledge, Ottawa, ON. The Expert Panel on the State of Knowledge of Food Security in Northern Canada, Council of Canadian Academies.

5. Tam, B. Y., Gough, W. A., Edwards, V., & Tsuji, L. J. S. (2013). The impact of climate change on the well-being and lifestyle of a First Nation community in the western James Bay region. The Canadian Geographer / Le Géographe canadien, 57(4), 441-456.

6. Cree Nation of Mistissini, Cree Nation Government, Ouranos, InsightShare. 2018. Climate Change Adaptation Action Plan. March 2018. 23 p.

7. Pétrin-Desrosiers, C. (2017). Climate change and health impacts in Eeyou Istchee. An internal report presented to the Public Health Department of the Cree Board of Health and Social Services of James Bay, 66 p.

8. Laberge Gaudin, V., Receveur, O., Walz, L., Girard, F., & Potvin, L. (2014). A mixed methods inquiry into the determinants of traditional food consumption among three Cree communities of Eeyou Istchee from an ecological perspective. International Journal of Circumpolar Health, 73, 10.

9. Proust, F., Johnson-Down, L., Berthiaume, L., Greffard, K., Julien, P., Robinson, E., Dewailly, É. (2016). Fatty acid composition of birds and game hunted by the Eastern James Bay Cree people of Québec. International Journal of Circumpolar Health, 75.

CLIMATE CHANGE

HEALTH AND SAFETY

BACKGROUND

Climate change raises new issues for the health and safety of Cree communities. Understood holistically, health comprises mental, physical, spiritual, emotional, and social dimensions, and is captured by the Cree concept of Miyupimaat isiiun, which translates as “being alive well” [1]. Health status measures for the Cree tend to be worse than for the Canadian population in general[2]. In addition to the well recognized impacts of colonialist policies such as residential schools, rapid social and environmental changes related to sedentary lifestyle, the quality of nutrition and sanitary conditions, are some of the causes of the health status of Cree communities. What is more, there is also a raising concern about the spreading up North of Southern infectious diseases affecting humans and animals, as a result of rising temperatures. Therefore, it is important to address any additional risks posed by climate change to the health of Cree individuals and communities. Access to the land poses security problems as the weather becomes less predictable and risk of sudden thaw changes ice and permafrost conditions. Travel on ice and snow is more dangerous as a result of extreme and unpredictable weather, also increasing the risk of floods and forest fires[3]. Therefore, improvement of emergency and preparedness actions in case of any incident related to travel or major natural hazard become a priority. While many challenges remain, many Cree communities have already modified their public safety programs.

HEALTH

Lifestyle

Climate change can affect the physical and mental health of Cree communities due to its impact on lifestyle. A lifestyle based on harvesting plants and animals has long been a central aspect in Cree health and well-being. Yet, unpredictable weather conditions reduce access to the land and physical activities related to the harvesting of wildlife and traditional medicinal plants. The decline in physical, social and spiritual activities surrounding the harvesting of plants and wildlife has been contributing to the decline in general health status, and the surge in chronic diseases such as diabetes and obesity. Changes in lifestyle and perceptions about negative changes in the environment affect Cree relationship with the land and identity causing impacts on mental health[4]. Negative consequences of climate change related to lifestyle affects the three spheres of health: physical (i.e. injuries, heat stroke, chronic disease), mental (i.e. stress, depression, anxiety) and community health (i.e. loss of community cohesion, disrupted sense of belonging)[5]. Climate change forces us to address health as holistic, including all aspects of individual and community well-being.

HEALTH

Infrastructures

The rise in mean temperatures and extreme weather events poses new threats for basic infrastructures ensuring water sanitation and quality housing. In some areas, variation in major precipitation may result in lower water levels, increased sediment load in water and poorer drinking water quality. Flooding of sewage treatment and waste sites can result in spreading untreated contaminants[6]. Climate change provides the opportunity to improve water treatment facilities and sewage systems to make sure they are designed for extreme events. Housing quality is central in health and well-being, but may also suffer the consequences of climate change in subarctic climate. As such, providing good quality and climate adapted housing remains a challenge in many communities, whereas poorly insulated houses, and the presence of moulds and basement flooding have been widely reported[7]. Some aboriginal communities in Canada are considering opportunities to adopt new housing designs better adapted to a changing climate[8]. Roads, bridges and power lines are also highly exposed to extreme events, and their disruption could have major impacts on health and well-being, especially for vulnerable people in times of emergency.

SAFETY

Access to the land

Cree people have developed a unique relationship with the land that depends on extensive use of natural resources through harvesting activities. Mobility is increasingly being disturbed by unpredictable weather events that raise major safety issues. The transportation risks associated with off-road vehicles and seasonal ice conditions are examples of main dangers for civil security. These risks have called out for new methods to monitor ice and snow conditions. Already, communities are modifying ways of accessing the land by adopting alternative means of transportation, travel routes and technologies. As such, the need to go around unsafe spots during periods of thaw may increase the time and distance to reach a destination and augment transportation costs. Moreover, the increased reliance on plane and helicopter to avoid unsafe ice conditions has resulted in higher costs, which prevents families from pursuing harvesting activities. Softer snow in periods of thaw also makes traveling longer and more costly. Although their occurrence remains relatively low, other hazards affect land access such as forest fires and floods which may cut off road access and trap people on their hunting lands or in the communities[9].

SAFETY

Emergency Preparedness

Climate change forces communities to revise protocols and means of preparing for and responding to emergency situations. To respond to the risks posed by climate change, such as forest fire, more can be done in terms of public education and raising awareness among specific audiences. According to the Cree Trappers' Association, new security and safety awareness programs are required to prevent accidents on ice during spring[10]. Many initiatives have been developed, such as radio announcements to warn people about unsafe ice conditions, and ice monitoring by the Fire Department (Mistissini) or marking safe ice paths by the Police and Safety Department (Whapmagoostui). Emergency response plans can also be reviewed to better outline the roles and responsibilities of first responders to have a more coordinated emergency response in case of accident. It is also important to improve safety equipment, and to install early warning systems for extreme events and hazards. Moreover, in case of extreme weather events, it has been suggested to improve community trade to increase access to traditional food and maintain food security, while reducing dependence on highly processed imported foods[11].

THE IMPACTS & OPPORTUNITIES

Health Impacts

- Reduced engagement in traditional harvesting activities is an important cause of physical health problems and general health status decline associated to increase chronic diseases such as diabetes.
- Changes in lifestyle and perceptions about negative changes in the environment affect Cree relationship with the land and identity causing impacts on mental health and spiritual well-being.
- Variations in major precipitation may result in lower water levels and increased sediment load in water which may affect the quality of drinking water in certain circumstances.
- Low quality housing characterized by inadequate insulation and the presence of moulds is more vulnerable to the impacts of climate change which may increase the risk of basement flooding.

Health Opportunities

- Climate change forces Cree communities to address health as holistic, including all aspects of individual and community well-being, and develop new means of teaching and engaging with traditional harvesting activities and traditional medicine.
- Climate change provides new opportunities to improve water treatment facilities and promote new housing designs better adapted to regional climatic conditions.

THE IMPACTS & OPPORTUNITIES

Safety Impacts

- Off-road transportation and access to harvesting grounds raise risks related to seasonal ice conditions which are among the main dangers for civil security.
- The need to modify traveling routes and technologies to avoid unsafe ice or snow conditions increases the time and distance to reach a destination and augments the costs of transportation.
- Forest fires and floods increase the risk of injury and death and may cut off access to roads and trap people on their hunting lands or in their community.
- Extreme events such as floods and storms may damage roads and airport runways, disrupting transport of people and merchandise.
- Lack of adequate and systematic emergency response plans, safety equipment and warning systems may limit the capacity of authorities to prevent or respond to emergency situations related to climate change.

Safety Opportunities

- Improve public education and awareness campaigns among specific audiences while involving the public in improving safety equipment, and responding adequately to early warning systems.
- Review emergency response plans to better outline the roles and responsibilities of first responders and to have a more coordinated emergency response in case of accident.
- Ensure better community trade to improve access to traditional food and maintain food security, while reducing dependence on highly processed imported foods.

REFERENCES

1. Council of Canadian Academies. 2014. Aboriginal food security in Northern Canada: an assessment of the state of knowledge. Council of Canadian Academies: Expert Panel on the State of Knowledge of Food Security in Northern Canada.

2. Torrie, J., Bobet, E., Kishchuk, N., Webster, A. 2005. Cree Board of Health & Social Services of James Bay. The Evolution of Health Status and Health Determinants in the Cree Region (Eeyou Istchee).

3. Comité consultatif de l'environnement Kativik. 2016. Climate Change Adaptation and Clean Energy – Nunavik Workshop, October 26-28, 2016.

4. Berry, P., Clarke, K., Fleury, M. D., & Parker, S. (2014). Human Health. In F. J. Warren & D. S. Lemmen (Eds.), Canada in a changing climate: Sector perspectives on impacts and adaptation (pp. 191-232). Ottawa, ON: Government of Canada.

5. Hennigs, R. & Bleau, S.,2017. State of Climate Change and Adaptation Knowledge for the Eeyou Istchee James Bay Territory. Report presented to the James Bay Advisory Committee on the Environment, Montréal, Ouranos, 41 p. + appendices. p. 6

6. Assembly of First Nations, Environmental Stewardship Unit, 2008. Climate change and water : Impacts and Adaptations for First Nations Communities, March 2008. Funded by Natural Resources Canada: Climate Change Impacts and Adaptation Program (CCIAP).

7. Torrie, J., Bobet, E., Kishchuk, N., Webster, A. 2005. Cree Board of Health & Social Services of James Bay. The Evolution of Health Status and Health Determinants in the Cree Region (Eeyou Istchee).

8. Nain Research Centre Kaujusapvinga, 2018. retrived from https://www.nainresearchcentre.com

9. Hennigs, R. & Bleau, S.,2017, p. 8

10. Royer, M.-J. S., Herrmann, T. M., Sonnentag, O., Fortier, D., Delusca, K., & Cuciurean, R. (2013). Linking Cree hunters' and scientific observations of changing inland ice and meteorological conditions in the subarctic eastern James Bay region, Canada. Climatic Change, 119(3), 719-732.

11. Cree Trappers Association. (2011). Climate change in Eeyou Istchee – Identification of impacts and adaptation measures for the Cree hunters, trappers and communities. Canada.

CLIMATE CHANGE

BUSINESS AND EMPLOYMENT

BACKGROUND

Many economic sectors are directly impacted by climate change, and their capacity to adapt will greatly influence their long-term viability. Adaptation to climate change in Eeyou Istchee also provides new business and employment opportunities. Climate change may present opportunities to invest in initiatives that will improve the resilience of the Cree economy and create jobs. Warmer temperatures potentially mean new potentials for tourism, provided that infrastructures and technologies respond adequately to changes. In sectors such as forestry and mining as for most industrial activities, operations may be disrupted by extreme weather events[1]. The increased risk of sudden and heavy rainfall raise major challenges for waste and water management. Cree nation stakeholders are called upon to play an active role in the monitoring of weather conditions and land planning. There is an opportunity to increase scientific training among Cree youth and support the development of new businesses that will create jobs to ensure proper monitoring, safety and adaptation of all economic sectors.

TOURISM

In Eeyou Istchee, outdoor activities, sports fishing and hunting along with cultural tourism are an important economic sector which is largely dependent on weather conditions. Warmer temperatures in Eeyou Istchee mean that the tourism season could be extended with more opportunities for summer recreational activities earlier in the spring and later in the fall[2]. Summer tourism revenues may increase in the coming years, however winter recreational activities are more vulnerable to unpredictable weather patterns and extreme events. Changes in wildlife and plant distribution could have positive or negative impacts on tourism based on fishing or hunting. Tourism infrastructures such as hunting and fishing outfitters, camps and coastal properties are vulnerable to the damages of extreme weather which could increase safety risks. In general, impacts of climate change on tourism will be differentiated according to activities and areas. For the tourist economy to respond adequately to climate change, it will require new resources to improve activity planning and infrastructure maintenance and development.

FORESTRY

Warmer temperatures associated with climate change may involve longer and faster forest growth and higher productivity. Yet warm and dry conditions also increase the risk of fire and pest outbreaks[3]. It is predicted that the occurrence and intensity of wildfire will be higher in the coming years, which could cause a loss of timber production and pose new risks for forestry operations and the safety of forestry workers. More resources may be necessary to monitor and extinguish forest fires, especially to ensure sustainable forestry activities. Safety rules in the forest industry may require to be revised in light of projected changes. Moreover forest roads and culverts in some areas may be vulnerable to being washed out due to high spring melt and heavy rainfall. Much uncertainty remains regarding the overall impact of climate change on forest activity, as it may influence positively or negatively wood harvest and the quality of forest products. Forestry activities on Cree territory will have to integrate projected climate condition and their impact on forest ecosystems, and ensure that as they transform, forestry activities respect Cree customary forest uses. Moreover, carbon sequestration could become a dominant forest management objective, as new techniques will be adopted to monitor carbon stocks and maximize carbon sequestration throughout boreal forest and peatland life cycles[4].

MINING

Mining is an important economic activity in Eeyou Istchee and James Bay, and recent discoveries confirm the presence of rich reserves of precious metals and minerals, such as gold and diamond. There is currently a boom in mining exploration in the area and it is expected that the number of available jobs in this sector will increase[5]. Climate change is widely acknowledged as a concern among mining practitioners since mining operations, or labour transportation, are heavily dependent on weather conditions[6]. Mining infrastructures and transportation networks are particularly vulnerable to climate change, as changing hydrology and extreme events concern most stakeholders. It is mainly in the exploitation phase that mining activities are vulnerable. Operations could potentially be disrupted by extreme events which could further cause maintenance or operation costs to rise significantly[7]. The restoration phase appears particularly vulnerable to changing climatic conditions, as the planning of restoration sites does not integrate future climate scenarios in general [8]. The need to improve the resilience and sustainability of mining operations becomes manifest with climate change. Cree expertise should be able respond to these new challenges.

RENEWABLE ENERGY

Eeyou Istchee and James Bay territory are endowed with very important renewable energy resources such as hydropower and forest biomass. The share of renewable energy in global consumption is susceptible to increase manifold in the coming decades to mitigate climate change impacts and reach global CO_2 emission reduction. Although higher precipitation could increase hydropower production, dams are vulnerable to environmental change. Changing precipitation regime and higher hydraulic variability will require adaptive reservoir management. Forest biomass is considered one of the most promising sources of renewable energy for the future and could provide 30% of all energy consumption globally[9]. As energy consumption keeps increasing, the development of new facilities to produce forest biomass energy could be promoted. High volumes of available forest biomass in Eeyou Istchee could also encourage innovative activities such as biofuel production.

INFRASTRUCTURE

All built infrastructures could become vulnerable to the impacts of climate change. The rise in mean temperatures and extreme weather events poses new threats for basic infrastructures ensuring water sanitation and waste management facilities. In some areas, variation in major precipitation may result in lower water levels, increased sediment load in water and poorer drinking water quality. Flooding of sewage treatment, waste sites and landfills can result in spreading untreated contaminants[10]. Climate change provides opportunities to improve water treatment facilities and sewage systems, and also to implement better practices in waste management. New jobs could be created in the development of infrastructures, waste management and recycling facilities.

THE IMPACTS & OPPORTUNITIES

Tourism

- With climate change, summer tourism revenues may increase but winter recreational activities are more vulnerable to unpredictable weather patterns and extreme events.
- To respond adequately to climate change, the tourist industry will require new resources to improve infrastructure maintenance and development.

Forestry

- Much uncertainty remains regarding the overall impact of climate change on forest activity, as it may influence positively or negatively wood harvest and the quality of forest products.
- More resources may be necessary to monitor and extinguish forest fires, to ensure sustainable forestry activities.
- Forestry activities will have to integrate projected climate conditions and their impact on forest ecosystems.
- Carbon sequestration could become a dominant forest management objective, as new techniques will be adopted to monitor carbon stocks and maximize carbon sequestration in boreal forest ecosystems.

THE IMPACTS & OPPORTUNITIES

Mining

- The exploitation phase of mining activities is vulnerable to the impacts of climate change as operations could be disrupted by extreme events and maintenance or operation costs could rise significantly.
- The restoration phase in mining is vulnerable to changing climatic conditions, as the planning of restoration sites does not integrate future climate scenarios.

Renewable Energy

- Higher precipitation could increase hydropower production, but changing precipitation regimes and higher hydraulic variability will require adaptive reservoir management.
- As energy consumption keeps rising globally and regionally, the development of new facilities to produce forest biomass energy could be promoted.
- High volumes of available forest biomass in Eeyou Istchee could also encourage innovative activities such as biofuel production.

Infrastructure

- Climate change provides opportunities to improve water treatment facilities and sewage systems, and to implement better practices in waste management.
- New jobs could be created in the development of infrastructures, waste management and recycling facilities

REFERENCES

1. Duerden, F., Pearce, T., Ford, J., & Pittman, J. (2014). Case Studies Of Adaptation To Climate Change In The Yukon Mining Sector: From Planning And Operation To Remediation And Restoration. Ottawa, Ontario: Report submitted to Climate Change Impacts and Adaptation Division, Natural Resources Canada.

2. Lemmen, D. S., Johnston, M., Ste-Marie, C., & Pearce, T. (2014). Natural Resources. In F. J. Warren & D. S. Lemmen (Eds.), Canada in a Changing Climate: Sector Perspectives on Impacts and Adaptation. Ottawa, ON: Government of Canada.

3. Comité d'experts sur l'aménagement écosystémique des forêts et les changements climatiques CEAEFCC (2017). L'aménagement écosystémique des forêts dans le contexte des changements climatiques - Rapport du comité d'experts, Québec, p.29

4. Garneau, M., & van Bellen, S. (2016). Synthèse de la valeur et la répartition du stock de carbone terrestre au Québec: Rapport présenté au Ministère du Développement durable, Environnement et Lutte contre les changes climatiques du Québec.

5. Larbi, Y. (2017). Cree awareness and the mining boom in Eeyou Istchee [Press release]. Retrieved from https://www.mern.gouv.qc.ca/english/mines/quebec-mines/2017-05/mineral-exploration.asp

6. Ford, J. D., Pearce, T., Prno, J., Duerden, F., Berrang Ford, L., Smith, T. R., & Beaumier, M. (2011). Canary in a coal mine: perceptions of climate change risks and response options among Canadian mine operations. Climatic Change, 109(3), 399-415.

7. Bussière, B., Demers, I., Charron, P., & Bossé, B. (2017). Analyse de risques et de vulnérabilités liés aux changements climatiques pour le secteur minier québécois. Unité de recherche et de service en technologie minérale, UQAT. Rapport préparé pour le Ministère de l'Énergie et des Ressources naturelles, 106 p. + app.

8. Hennigs, R. & Bleau, S.,2017. State of Climate Change and Adaptation Knowledge for the Eeyou Istchee James Bay Territory. Report presented to the James Bay Advisory Committee on the Environment, Montréal, Ouranos, 41 p. + appendices.

9. Hydro-Québec. 2014. L'énergie de la Biomasse. Retrieved from http://www.hydroquebec.com/developpement-durable/centre-documentation/energie-biomasse.html

10. Assembly of First Nations, Environmental Stewardship Unit, Climate change and water: Impacts and Adaptations for First Nations Communities, March 2008. Funded by Natural Resources Canada: Climate Change Impacts and Adaptation Program (CCIAP).

Notes