Integrating Climate Change Considerations into Plans and Policies in Durham Region

Report Prepared by the Ontario Climate Consortium Secretariat

SYNTHESIS REPORT

August 2018

ONTARIO CLIMATE CONSORTIUM

Supported by Toronto and Region Conservation Authority

www.climateconnections.ca

CONTRIBUTING AUTHORS

Kristina Dokoska, Ontario Climate Consortium
Ian McVey, Ontario Climate Consortium
Glenn Milner, Ontario Climate Consortium

Recommended Citation
Dokoska, K., McVey, I., Milner, G. 2018. Integrating Climate Consideration into Plans and Policies in Durham Region: Synthesis Report. Ontario Climate Consortium: Toronto, ON: pp. 20

ONTARIO CLIMATE CONSORTIUM

Supported by Toronto and Region Conservation Authority

www.climateconnections.ca

Table of Contents

Glossary of Terms

Analysis of Extremes: used to project future outcomes for specific climate variables and assesses the probability of extreme climate events. This often includes the use of Intensity-Duration-Frequency (IDF) curves.

Analysis of Low Confidence: when confidence in the climate information is limited, the impacts of future changes are evaluated by running climate scenarios to increase confidence in projections.

Climate Data Time Series: uses the information produced from climate models to determine the relationship between one or more climate variable over time (Charron, 2014).

Climate Normal: a representation of the climate average over a 30-year reference period.

Cumulative Distributive Function: is a representation of the probability associated with a specific climate variable. For example, the probability of increased precipitation in 2050.

Detailed Vulnerability Assessment: focuses on specific natural heritage features (e.g., urban forest) and identifies the specific climate modelling that will need to be completed for the assessment in order to effectively prioritize adaptation options.

Downscaling: is the process of developing finer resolution data through high resolution Global Circulation Model projections by either statistical or dynamic downscaling (Charron, 2014).

Dynamic Downscaling: is the process of downscaling based on Regional Climate Models.

Ensemble Approach: the process of incorporating a range of climate models rather than using a single climate model to predict future outcomes.

Evolution of Future Values: represents the evolution of future values for a specific climate variable in the region (Charron, 2014). It shows how these values have evolved over different time periods (Charron, 2014).

General Vulnerability Assessment: these assessments examine general impacts to the natural heritage and identify broad adaptation options to allow for increasing resiliency across the natural heritage system.

Global Climate Model (GCM): Project changes in climate over the entire Earth's surface (Charron, 2014).

Historical Trends: uses a single climate variable to demonstrate the long-term evolution and trends in past climate (Charron, 2014).

Intense-Duration-Frequency (IDF) Curve: a graph representing the probability that a given average rainfall intensity will occur (Charron, 2014).

Maps of Projected Future Values: a map representing the expected future values for a specific climate variable by comparing past climatic normals to future values (Charron, 2014).

Maps of Projected Regional Changes: is used to demonstrate projected changes in climate at a regional scale.

Regional Climate Model (RCM): a dynamically downscaled model that produces climate projections on a much finer scale.

Scatter Plots: project changes for two different climate variables (e.g. precipitation and temperature) using different climate models and scenarios for a specific region (Charron, 2014).

Spatial Analogues: compare expected future climate for a specific region to the historical climate of a different region.

SRES: Greenhouse gas emissions scenarios used in the Intergovernmental Panel on Climate Change's Special Report on Emissions Scenarios (2010).

Statistical Downscaling: is the process of generating finer spatial climate data from Global Climate Models and relies on the use of historical data to inform projections.

Synthesis Tables: use a single climate variable to demonstrate both past and future changes in climate.

INTRODUCTION

Global temperatures are rising due to human activities, namely the burning of fossil fuels and clearing of natural cover, which is resulting in a build-up of greenhouse gases in the atmosphere. These human influences have been associated with warmer temperatures, changes to the global water cycle, increases in global sea level rise, as well as changes to climate extremes (IPCC, 2014). At the regional level, these climate impacts will have significant effects on local communities. Through the *Durham Community Climate Adaptation Plan (2016)*, the SENES model shows that Durham Region will be subject to increased precipitation, more severe rainstorm events, average annual temperature increases, and reduced snowfall (Durham Region, 2016). This will lead to significant changes across the region including more localized flooding, threats to human health and safety, as well as overall changes to the ecosystem (Durham Region, 2016).

Protecting and enhancing natural heritage systems across Durham Region will play a critical role in the resilience of human communities and ecosystems to climate change. As a recent recipient of the Federation of Canadian Municipalities' (FCM) Sustainable Community Awards, the *Durham Community Climate Adaptation Plan (2016)* includes resilience measures that work to address impacts to the natural environment through the enhancement of natural capita and building climate change resilience in the natural environment.

Objective

The purpose of this study is to assess whether and how climate change considerations have been incorporated across natural environment-related policies and plans within Durham Region and provide guidance for updating these plans and policies to align with directions being established by leading climate research organizations and early mover municipalities. This report was developed to establish a consistent set of practices to integrate future climate projections into natural environment-related policies and plans, and thereby support the implementation of climate adaptation initiatives across the region.

Overview of Methodology

To carry out this work, the project team undertook a desktop review and inventory of the extent and range of climate change information used in existing high-level plans and policies as well as technical documents in place at responsible agencies within Durham Region. The policies and plans were limited to natural heritage-related planning documents as well as high-level policies and plans such as Official Plans. In order to limit the scope of the plans and policies reviewed, individual agencies were consulted to determine which documents, up to a maximum of three per organization, they would like included in the study. A complete list of documents reviewed under this study can be found within the full report.

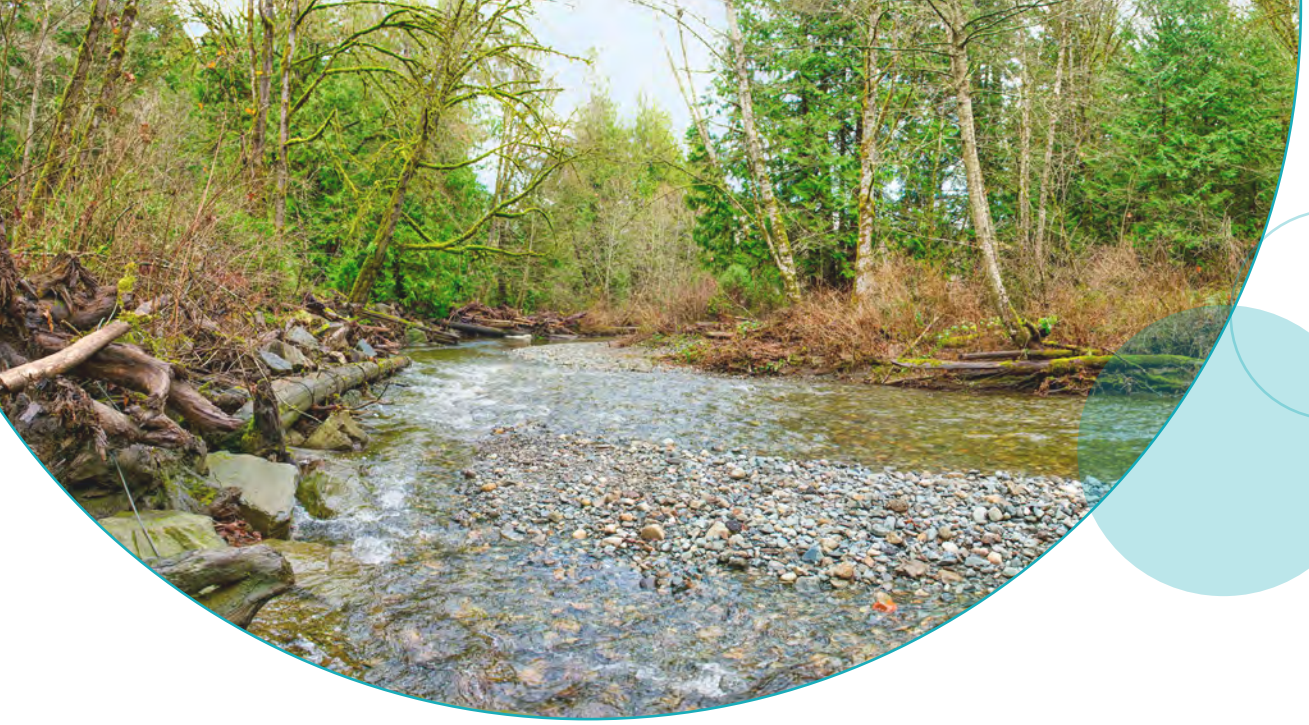
For each plan/policy, the following were identified:

- Documents lacking climate change considerations,
- Documents that include climate change considerations but require updates to be made, and
- The climate change information/data/approach used, if applicable.

Once the inventory of existing policies and plans was complete, the project team conducted an inter-jurisdictional scan of best practices related to the integration of climate change considerations in natural heritage system planning. Through this process, a set of criteria for integrating climate considerations in policies and plans were defined. A proposed set of jurisdictions were identified and presented to the NECCWG prior to the start of this study. The jurisdictions selected for the review included Quebec, British Columbia, Peel Region and the United Kingdom. These jurisdictions were selected based on available climate information from associated climate data centres. The climate data centres have been identified as the leading climate service providers in Canada and abroad. The work conducted by OURANOS (Quebec), the Pacific Climate Impact Consortium (BC), UK Climate Impacts Programme (UK), and OCC form the basis for the recommended best practices identified in this study.

In sum, there are five components to this study:

1. Document the status of integration of climate change in policies and plans for each of the selected agencies;
2. Provide a framework to evaluate the policies and plans;
3. Analyze the policies and plans based on the identified framework;
4. Conduct an inter-jurisdictional scan of best practices; and
5. Provide a set of recommendations based on the findings



This study leverages existing frameworks that have been developed by academics and climate scientists to inform how climate considerations should be incorporated within various policies and plans as well as the levels of climate change information that should be integrated within natural heritage planning documents. The frameworks were adapted to reflect the specific needs of Durham Region and the scope of this study. The climate information provided within this report is based on the most recent climate literature.

The policies and plans reviewed under this study have been categorized into three main tiers. These tiers, are based in part by the OURANOS *Guidebook on Climate Change Scenarios (2014)* and documents provided by responsible agencies in Durham Region. The guidebook has helped to inform the type of climate change information that should be integrated within each tier as well as the level of detail. The policies and plans were categorized based on the type of document provided (i.e., general land use plans, master plans, and technical natural heritage plans) as well as the expected level of detail in relation to climate information. The tiered framework also includes the types of climate information that should be included within each of the three tiers such as future changes in means for specific climate variables, as well as common formats for presenting the climate information in policies and plans. A summary of the tiered framework is outlined in ***Table 1. Further explanation of the common information formats can be found within the Glossary.***

PART ONE: Tiered Framework

The policies and plans reviewed under this study have been grouped into three main tiers. These tiers are based in part, on the type of planning document (i.e., general land use plans, master plans, and technical natural heritage plans) as well as the level of detail in climate change information associated with each document. The overall goal of the tiered system is to provide a basis for the types of climate information and considerations that should be integrated at different stages of the planning process. The tiered framework also includes the types of climate information that should be included for each plan such as future changes in means for specific climate variables, as well as common formats for presenting the climate information in the policies and plans. A summary of the tiered framework is outlined in *Table 1. Further explanation of the common information formats can be found within the Glossary.*

TABLE 1: Tiered Framework Approach

TIER	Relevant Documents	Purpose and Overall Goal	Types of climate information commonly provided	Examples of common information formats
TIER 1: Basic	• Official Plans • Strategic Plans • Other general municipal documents (i.e., asset management plans, Clarington's green development framework, recreational master plans)	• Provide broad vision statements and goals • Encompass broad land use planning activities and not solely focused on natural heritage • Aim is to increase awareness and provide high-level governance	Historical trends and future changes in mean for certain climate variables. The information generally covers large spatial and temporal scales and for simple climate variables.	• Synthesis tables • Climate normals • Historical trends (station data, homogenized climate records) • Global changes • Maps of projected regional changes
TIER 2: Intermediate	• Climate Change Strategies • Adaptation Plans	• Identify how climate change impacts both humans and the natural environment • Provide general guidance for natural heritage planning • Evaluate the risks to the natural heritage system through general vulnerability assessments	Future climate changes or future absolute values of more complex climate variables over finer spatial scales.	• All formats from the basic category • Spatial analogues • Scatter plots • Map of projected future values • Evolution of future values • Cumulative distribution function
TIER 3: Detailed	• Watershed Plans • Natural Heritage Plans • Stormwater Mgmt. Plans • Ajax Urban Forest Mgmt. Plan • TRCA East Duffins Headwater Mgmt. Plan • TRCA Watershed Characterization Report	• Provide technical, sector-specific policies that focus on specific ecological features • Evaluate and prioritize adaptation options following a detailed vulnerability assessment • Provide guidance for local governance	Future changes in means, absolute values and extremes over finer spatial scales.	• All formats from the basic and intermediate categories • Specific format • Temporal series • Analysis of extremes • Analysis of low-confidence climate indices and events using synthetic scenarios and climate models

Charron, I. (2014). A Guidebook on Climate Scenarios: Using Climate Information to Guide Adaptation Research and Decisions. Ouranos, 86 p.

PART TWO:
Evaluation Criteria Framework

In order to assess the quality of the plans provided by municipalities and conservation authorities in Durham Region, this study uses the framework developed by Dr. Dave Guyadeen, Assistant Professor, Dalhousie University as the basis for evaluating Durham Region's plans (Guyadeen, Thistlethwaite, & Henstra, n.d.). The framework was developed through his analysis of existing climate change strategies and was adapted to reflect the scope of this study and ensure that the plan quality framework used in this report was specifically tailored to Durham Region and its plans and policies. To ensure a consistent approach for reviewing the integration of climate considerations within the policies and plans, this framework combines the plan quality indicators with the tiered framework approach. As the level of detail in climate information increases, the plan quality indicators also become more specific, and the climate change considerations become more focused on natural heritage features rather than broader land use planning activities. Outlined below are the main indicators used to assess plan quality under each of the three tiers. Although Tiers 2 and 3 include the same indicators, the number of measures within each of the indicators increase as the level of detailed climate information becomes more complex. A complete list of indicators and measures are found within the full report. the common information formats can be found within the Glossary.

FIGURE 1: Plan Quality Framework

TIER 1
- *Organization and Presentation*
- *Goals*
- *Monitoring and Evaluation*
- *Sectional Climate Change Information*
- *Inter-Organization Coordination*

TIER 2
- *Organization and Presentation*
- *Goals*
- *Monitoring and Evaluation*
- *Sectional Climate Change Information*
- *Inter-Organization Coordination*
- *Participation*

TIER 3
- *Organization and Presentation*
- *Goals*
- *Monitoring and Evaluation*
- *Sectional Climate Change Information*
- *Inter-Organization Coordination*
- *Participation*

(Guyadeen, Thistlethwaite, & Henstra, n.d.)

Overall Findings from the Inter-Jurisdictional Scan and Durham Region

The inter-jurisdictional scan of best practices found that a lack of standardized methodology exists internationally to integrate climate change considerations within policies and plans. With no 'official' methodology, many municipalities are hesitant to incorporate climate change considerations in their policies and plans, creating a potential barrier to action towards climate change adaptation. However, despite the lack of a standardized approach, there are enough progressive natural heritage policies and plans that exist to develop an approach ***(see Table 2)***. This also provides an opportunity for vulnerability assessments to be a key part of natural heritage planning. As well, it is important to acknowledge and leverage what portions of existing policies and plans can be re-framed as climate change considerations.

TABLE 2: Examples of Best Practice from other Municipalities

TIER 1	Type of Climate Information Commonly Provided	Common Information Formats	Plan Quality Content
TIER 1	Historical trends and future mean changes over large spatial and temporal scales and for simple climate variables	• Synthesis tables • Climate normals • Historical trends (station data, homogenized climate records) • Global changes • Maps of projected regional changes	• Fact Base • Organization and Presentation • Goals • Monitoring and Evaluation • Sectional Climate Change Information • Inter-Organization Coordination
District of Squamish Official Community Plan (2017)	References the Adapting to *Climate Change in Squamish (2016)* which includes historical trends for the whole Squamish area	• Historical trends • Climate normals	• Includes detailed policies related specifically to the natural heritage • For example, "Integrate green infrastructure (both natural and engineered) to manage rainwater resources, protect water and air quality, maintain ecosystem functions, provide flood control, and address climate impacts within local watersheds" (Squamish, 2017, p. 116)

>> continued >>

TABLE 2: Examples of Best Practice from other Municipalities *(continued)*

TIER 2	Type of Climate Information Commonly Provided	Common Information Formats	Plan Quality Content
TIER 2	Future climate changes or future absolute values of more complex climate variables over finer spatial scales	• All formats from the basic category • Spatial analogues • Scatter plots • Map of projected future values • Evolution of future values • Comulative distributive function	• Fact Base • Organization and Presentation • Goals • Monitoring and Evaluation • Sectional Climate Change Information • Inter-Organization Coordination • Participation
Vancouver Climate Change Adaptation Strategy (2012)	Includes projected changes in climate for Vancouver (for both 2050's and 2080's)	• Historical trends • Projections of future values for 9 different climate variables • Projected future changes in extremes	• Includes specific adaptation indicators related to natural heritage • Objective 5.2: Increase the long-term health and vigour of urban forests, green spaces and trees - Specific adaptation indicators include: tree canopy coverage, average increase/decrease in green space and trees, and proximity of residents on average to natural areas (Vancouver, 2012, p. 54)

TIER 3	Type of Climate Information Commonly Provided	Common Information Formats	Plan Quality Content
TIER 3	Future changes in means, absolute values and extremes over finer spatial scales	• All formats from the basic and intermediate categories • Specific format • Temporal series • Analysis of extremes • Analysis of low-confidence	• Fact Base • Organization and Presentation • Goals • Monitoring and Evaluation • Sectional Climate Change Information • Inter-Organization Coordination • Participation
Peel Region Natural Heritage Vulnerability Assessment (2017)	The document includes future climate projections for specific natural heritage features	• Historical trends and climate normal • Future projected values • Analysis of extremes for specific climate variables (e.g. precipitation)	• Examines 10 different natural heritage features and the impacts of climate change to those specific features. For example, climate sensitive vegetation • Includes the analysis results for each natural feature, the climate change impacts that are expected, as well as recommendations.

The overall findings of the policies and plans reviewed for agencies in Durham Region revealed that many of the documents predate the work of the *Durham Community Climate Adaptation Plan (2016)*. As a result, many of the complementary technical studies used to inform natural heritage planning (i.e., urban forest management plans, natural heritage strategies, etc.) were not always available. Despite this, many agencies in Durham Region have begun to incorporate climate change within their policies and plans. A few examples of current initiatives are listed below.

TIER 1 City of Oshawa Official Plan

TIER 2 Kawartha Region Conservation Authority Climate Change Strategy

TIER 3 Town of Ajax Urban Forest Management Plan

In the coming years, municipalities and conservation authorities in Durham Region should work collaboratively to integrate information on future climate into natural environment related policies and plans in a consistent manner. This report provides a framework for updating the policies and plans in Durham Region to reflect the application of forward-looking climate information in natural environment policies and planning documents.

Future Local Climate Modelling Recommendations

General Climate Modelling Practices

In recent years, confidence around future climate modelling projections have significantly increased. Since the IPCC released their first assessment report in 1995, the number of General Circulation Models (GCM), which simulate climate projections over the entire Earth System has grown to over 40 different models (Auld et al., 2016; Charron, 2014). In addition, Regional Climate Models (RCM) have become increasingly important in producing climate projections at a much finer scale (usually 10-50 km) (Charron, 2014). In order to capture a full range of plausible future outcomes, an ensemble approach that integrates both GCM's and RCM's should be applied. An ensemble approach which incorporates a range of models, will be able to account for any biases that may arise from individual models and provides a complete representation of climate projections (Auld et al., 2016).

Since GCMs simulate climate projections over the entire Earth system, the process of downscaling is necessary to evaluate specific climate trends within a region (Charron, 2014). Downscaling is the process of producing finer resolution data through high resolution GCM projections. The use of RCMs is one example of a downscaling method. Although downscaling does have its limitations, it is expected that the process of downscaling will reduce uncertainties that arise as a result of using GCMs (Wilby et al., 2004).

Prior to the IPCC's fifth assessment report (AR5), GHG emissions scenarios used in climate models were assessed using the concentration emissions scenarios presented in the IPCC's Special Report on Emissions Scenarios (known as SRES) (Charron, 2014; IPCC, 2000). Common SRES scenarios included A1F1, A2, A1B, B1, and A17. These scenarios have since been replaced with radiative-forcing scenarios (RCP) to better account for the driving forces influencing GHG Emissions (Charron, 2014). RCPs are representative of the latest literature on GHG emissions (Charron, 2014). Four RCP scenarios have been developed including RCP8.5 (business-as-usual), RCP6.0 (stabilized), RCP4.5 (stabilized), and RCP2.6 (best case scenario).

A general good practice in climate modelling is to use a 30-year reference period when modelling climate variables. For example, a 30-year reference period would be applied when examining the yearly minimum, maximum and average temperature trends for a specific region. This 30-year reference period allows for a more accurate portrayal of the trends for specific climate variable by averaging the variation in climate over decades and even on a seasonal and yearly basis (Charron, 2014).

Lastly, all climate model projections produce some form of uncertainty. There is no single climate model that can predict with absolute certainty the expected changes in future climate. What can be said for certain is that as the level of climate information becomes more detailed and area-specific, the level of uncertainty in the information provided also increases. One consideration that needs to be taken into account is the time period that the climate models are projecting to (Charron, 2014). A longer time scale (i.e. 2050's or 2080's) will generally include greater uncertainty than models using shorter timescales (i.e., 2020) (Charron, 2014). In order to overcome these concerns, uncertainty will need to be addressed and communicated during the climate modelling process (IPCC, 2010). Since there is no exact scenario which will predict projected future outcomes with certainty, it is important that users analyze the data that is produced from the climate projections and prioritize projections that have potentially high consequences (IPCC, 2010).

Concluding Recommendations

1 Understand and measure impacts through Vulnerability Assessments.

Vulnerability Assessments are necessary for Tier 2 and Tier 3 plans in order to have a good understanding of the known or potential impacts of climate change and identify any vulnerabilities that may exist within the natural heritage system (Gleeson et al., 2011). Tier 2 policies and plans are aimed at providing general guidance for natural heritage planning, and as such, evaluate the risks to the natural heritage system on a broader scale. In this sense, general vulnerability assessments are used to capture the general impacts to the natural heritage system and identify broad adaptation measures. Since Tier 3 policies and plans are focused around evaluating, identifying and prioritizing adaptation options and measures, detailed vulnerability assessments are necessary for identifying vulnerabilities to the system and specific natural heritage features. Detailed vulnerability assessments require responsible agencies to identify the climate models which will be used to model the impacts for key natural heritage features such as the urban forest.

Therefore, in order for responsible agencies to be able to understand the complete impacts to the natural heritage system and what demographics will be disproportionately affected, responsible agencies in Durham Region will need to address how they will approach integrating vulnerability assessments prior to the completion of Tier 2 and Tier 3 plans in order to inform the types of adaptation options that will be necessary.

2 Develop natural heritage planning documents.

In order to understand how climate change impacts the natural heritage system, technical studies for key environmental features such as urban forest management Plans will need to be developed. These technical studies allow responsible agencies to monitor the impacts related to climate change and develop appropriate adaptation measures. With the limited number of natural heritage system focused documents provided by responsible agencies in Durham Region, there should be greater focus as to how responsible agencies will manage the impacts of climate change to specific natural heritage features. As previously mentioned, many municipalities including the Town of Ajax have developed these strategies to understand the impacts to the natural heritage system. With other municipalities in the Greater Toronto Area already undertaking this work, it is recommended that responsible agencies within Durham Region work to develop these documents and update any existing natural heritage planning documents.

3 Prepare a background report that includes climate change as one component.

Understanding the impacts of climate change on specific natural heritage features is necessary in order to effectively develop adaptation measures and build resiliency in the natural heritage system. While climate change is an important component, there are other factors such as habitat loss and fragmentation which directly impact the health of the natural heritage system. As a result, it is important that responsible agencies in Durham Region prepare background documents that discuss both the impacts of climate change to the specific natural heritage features with the appropriate climate information, as well as the impacts of other factors such as habitat loss to the natural heritage system.

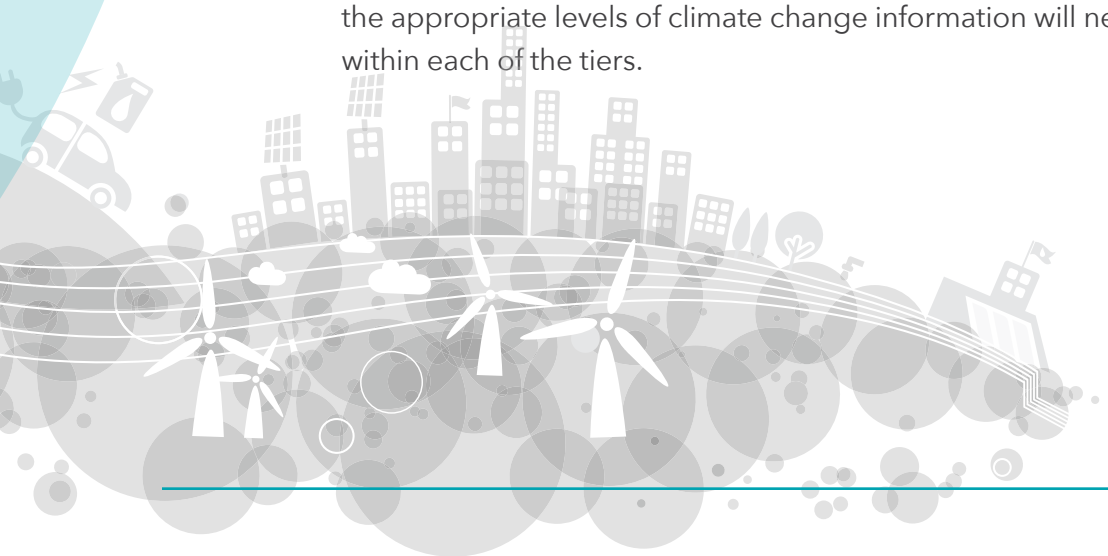
It is recommended that the Regional Municipality of Durham undertake an exercise to update the current SENES model as well as an alternative method in conducting climate projections which can then be used to update policies and plans. The report would allow responsible agencies to select the most relevant climate projections and incorporate those projections within the specific document. Metro Vancouver has developed a *Climate Projections for Metro Vancouver (2016)* report which includes projections for different climate variables. As well, the District of Squamish (2016) has also developed a background report that includes climate information and is used to inform their *Official Community Plan (2017)*. By having a background report that is readily available and referenced in documents within the different tiers would provide consistency amongst the different responsible agencies.

4 Consider re-framing existing natural heritage policies and plans around climate change.

As was evident through this study, a significant opportunity exists for agencies in Durham Region to prioritize and re-frame natural heritage policies and plans around climate change, where relevant. As agencies in Durham Region update existing policies and plans, and develop new technical studies, considering how policies can be re-framed around climate change to understand the impacts to the natural heritage system will be essential.

5 Incorporate advances in climate science and information to inform natural heritage planning.

Current climate literature and best practices have identified the types of climate change information that should be incorporated within different types of planning documents. In order to begin developing a consistent approach across the Region, the appropriate levels of climate change information will need to be incorporated within each of the tiers.



Checklist for Integrating Climate Change Considerations into Plans and Policies in Durham Region

The following section is a summary of the list of actions for which responsible agencies should undertake when updating or developing plans and/or policies under each tier. The checklists are intended to provide high-level guidance to responsible agencies in identifying priority action areas to address the level of climate change information for plans and policies under each tier. A complete list of indicators and measures can be found in the full report.

TABLE 3: Tier 1 Criteria

CRITERIA	Has it been integrated within the plan? (Y/N)
Does the plan include the appropriate levels of climate change information identified for Tier 1 (e.g. historical trends and future mean changes over larger spatial and temporal scales)?	
Does the plan include the identified climate change information formats that should be used to present the climate information (e.g. synthesis tables, map of projected values, climate normals, etc.)?	
Does the plan include the appropriate level of fact base within the plan (e.g. general climate change awareness and climate change impacts)?	
Is climate change referenced throughout the plan and is climate change information utilized throughout the plan?	
Does the plan include both broad and specific goals related to climate change and/or climate adaptation?	
Does the plan include information in relation to monitoring adaptation actions?	
Does the plan include climate change information for the key natural heritage or environment components identified in the plan?	
Does the plan make reference to other local climate change initiatives or connections to federal, provincial, or regional plans?	

TABLE 4: Tier 2 Criteria

CRITERIA	Has it been integrated within the plan? (Y/N)
Does the plan include the appropriate levels of climate information identified for Tier 2? (e.g. future climate change or future absolute values over finer spatial scales)	
Does the plan include the identified climate change information formats used to present the climate information? (e.g. spatial analogues, scatter plots, etc.)	
Does the plan include the appropriate level of fact base? (e.g. is climate change framed as a global and local issue, are general and specific climate change impacts identified?)	
Has the plan completed a general vulnerability assessment to identify general impacts to the system and broad adaptation measures?	
Does the plan reference climate change as well as climate information consistently throughout the plan?	
Does the plan include both broad and specific goals related to climate change and/or adaptation?	
Does the plan include information related to monitoring adaptation actions including key performance indicators?	
Does the plan include climate change information throughout all key natural heritage components?	
Does the plan make reference to other climate change initiatives or connections to federal, provincial, or regional plans?	

TABLE 5: Tier 3 Criteria

CRITERIA	Has it been integrated within the plan? (Y/N)
Does the plan include the appropriate levels of climate information identified for Tier 3? (e.g. future changes in means, absolute values, extremes)	
Does the plan include the identified climate change information formats used to present the climate information? (e.g. climate data series, analysis of extremes, etc.)	
Does the plan include the appropriate level of fact base? (e.g. is climate change framed as both a global and local issue, specific climate impacts identified)	
Has the plan completed a detailed vulnerability assessment to identify and prioritize climate adaptation measures?	
Does the plan reference climate change as well as climate information consistently throughout the plan?	
Does the plan include both broad and specific goals related to climate change and/or adaptation?	
Does the plan include information related to monitoring the success of adaptation measures including key performance indicators?	
Does the plan include climate change information throughout all key natural heritage components?	
Does the plan make reference to other climate change initiatives or connections to federal, provincial, or regional plans?	

List of Resources and Best Practice Documents

Resources and Tools

Ontario Climate Change Data Portal:
http://www.ontarioccdp.ca/index_a1b.html

Ontario Climate Data Portal:
http://lamps.math.yorku.ca/OntarioClimate/

Climate Change Hazard Information Portal (CCHIP):
https://www.risksciences.com/project/climate-change-hazards-information-portal-cchip/

Climate Atlas of Canada:
https://climateatlas.ca

OURANOS 'A Guidebook on Climate Scenarios' (2014):
https://www.ouranos.ca/publication-scientifique/GuideCharron2014_EN.pdf

A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems:
http://www.climateontario.ca/doc/Tools/A%20Practitioners%20Guide%20to%20ClimateChange%20Adaptation%20in%20Ontario%27s%20Ecosystems%20Ver%201%202011.pdf

Guide for Assessment of Hydrologic Effects of Climate Change in Ontario:
https://www.researchgate.net/profile/Linda_Mortsch/publication/309565142_Guide_for_assessment_of_hydrologic_effects_of_climate_change_in_Ontario/links/58adeba892851cf7ae85b0db/Guide-for-assessment-of-hydrologic-effects-of-climate-change-in-Ontario.pdf

Best Practice Documents

Adapting to Climate Change in Squamish: Background Report (2016):
https://squamish.ca/assets/OCP-Review/Public-Hearing/Backgrounders-and-Policy-Guides/Adapting-to-Climate-Change-in-Squamish-Nov-2016.pdf

Climate Projections for Metro Vancouver (2016):
http://www.metrovancouver.org/services/air quality/AirQualityPublications/ClimateProjectionsForMetroVancouver.pdf

City of Vancouver Climate Change Adaptation Strategy (2012):
http://vancouver.ca/files/cov/Vancouver-Climate-Change-Adaptation Strategy-2012-11-07.pdf

District of Squamish Draft Official Community Plan (2017):
https://squamish.ca/yourgovernment/projects-and-initiatives/ocp/

Climate Change Adaptation Plan for the Montreal Urban Agglomeration 2015-2020:
http://ville.montreal.qc.ca/pls/portal/docs/PAGE/ENVIRO_FR/MEDIA/DOCUMENTS/2017_PACCAM_2015-2020_report.PDF

Natural Systems Vulnerability to Climate Change in Peel Region (2017)
https://climateconnections.ca/app/uploads/2012/03/Final-Natural-Systems-VA.pdf

Resort Municipality of Whistler Official Community Plan:
https://www.whistler.ca/sites/default/files/2018/Feb/related/21269/ocp-bylaw-schedule-a-complete-3rd-reading-final-11-20-2012-revisedcopy.pdf

District of West Vancouver Shoreline Protection Plan (2012):
https://westvancouver.ca/sites/default/files/shoreline-protection-plan.2012-2015.pdf

References

Auld, H., Switzman, H., Comer, N., Eng, S., Hazen, S., and Milner, G. (2016). Climate Trends and Future Projections in the Region of Peel. Ontario Climate Consortium: Toronto, ON: pp.103

Charron, I. (2014). A Guidebook on Climate Scenarios: Using Climate Information to Guide Adaptation Research and Decisions. Ouranos, 86 p.

Consortium on Regional Climatology and Adaptation to Climate Change (OURANOS). (2018). Ouranos. Retrieved from https://www.ouranos.ca/en/ouranos/

City of Vancouver. (2012). Climate Change Adaptation Strategy. n.p. Web.

District of Squamish. (2016). Adapting to Climate Change in Squamish: Background Report. n.p. Web.

District of Squamish. (2017). Official Community Plan. n.p. Web.

District of West Vancouver. (2012). Shoreline Protection Plan 2012-2015. n.p. Web.

Gleeson, J., Gray, P., Douglas, A., Lemieux, C.J., and Nielsen, G. (2011). A Practitioner's Guide to Climate Change Adaptation in Ontario's Ecosystems. Ontario Centre for Climate Impacts and Adaptation Resources: Sudbury, Ontario: pp. 74

Guyadeen, D., Thistlethwaite, J., & Henstra, D. (n.d.). Evaluating the Quality of Municipal Climate Change Plans in Canada. n.p.

References (continued)

Intergovernmental Panel on Climate Change. (2000). Special Report on Emission Scenarios. n.p. Web.

Intergovernmental Panel on Climate Change. (2010). Guidance Note for Lead Authors of the IPCC Fifth Assessment Report on Consistent Treatment of Uncertainties. n.p. Web.

Intergovernmental Panel on Climate Change. (2014). Climate Change 2014 Synthesis Report Summary for Policymakers. n.p. Web.

Metro Vancouver. (2016). Climate Projections for Metro Vancouver. n.p. Web.

Region of Durham. (2016). Community Climate Adaptation Plan. n.p. Web.

Resort Municipality of Whistler. (2011). Official Community Plan. n.p. Web.

Tu, C., Milner, G., Lawrie, D., Shrestha, N., Hazen, S. 2017. Natural Systems Vulnerability to Climate Change in Peel Region. Technical Report. Toronto, Ontario: Toronto and Region Conservation Authority and Ontario Climate Consortium Secretariat.

Wilby, R.L, S.P. Charles, E. Zorita,B. Timbal, P. Whetton, L.O. Mearns. (2004). Guidelines for Use of Climate Scenarios Developed from Statistical Downscaling Methods. Intergovernmental Panel Climate Change (IPCC). Retrieved from: http://www.ipcc data.org/guidelines/dgm_no2_v1_09_2004.pdf