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LEARNING FROM OTHERS:  
RECOMMENDATIONS FOR BEST  
PRACTICES IN ADAPTATION  
OF THE BUILT ENVIRONMENT  
TO CHANGING CLIMATE AND  
ENVIRONMENT IN NUNATSIAVUT  
EXECUTIVE SUMMARY AND  
KEY FINDINGS

## Nain Research Centre 13-002

Goldhar, C<sup>1</sup>, Bell, T<sup>2</sup>, and Sheldon, T<sup>1</sup>, editors (2013): *Learning from others: Recommendations for best practices in adaptation of the built environment to changing climate and environment in Nunatsiavut*, Nunatsiavut Government, Nain, NL, 303 p.

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## EXECUTIVE SUMMARY

Rapid population growth and resulting community expansion along the Nunatsiavut coast coupled with recent climatic and environmental changes demand sustainable approaches to community planning and development. Community leaders from the five coastal communities of Nunatsiavut have responded to the opportunity presented by these challenges and are forging a vibrant, inter-governmental, inter-departmental, multi-disciplinary team under the umbrella of the SakKijânginnatuk Nunalik (Sustainable Communities) initiative.

The overall goal of the initiative is to inform best practices and provide guidance for community sustainability in coastal subarctic environments under changing climatic and environmental conditions. The initiative addresses issues that are central to community wellbeing and sustainability in the context of a changing climate and has prioritized the following areas:

- Infrastructure, housing and community development
- Valued places and spaces
- Energy security
- Food security
- Transportation and emergency services
- Safe communities

Directed by the Joint Management Committee of the Nunatsiavut Government, the SakKijânginnatuk Nunalik initiative is strongly aligned with the Nunatsiavut Government's Strategic Plan, specifically issues of Housing, Capacity Building, and Economic and Resource Development, as well as the Government of Newfoundland and Labrador's Northern Strategy and Climate Change Action Plan. As an essential first step towards addressing these community development objectives, four literature reviews were conducted. The primary aim of these reviews was to understand the risks posed by a changing climate and review best practices in sustainable, climate change adapted, housing design and community planning in the Canadian North.

Part 1 of this report helps set the context by presenting climate change projections for Nunatsiavut, conducted at scales appropriate for the built environment, that will enable regional and local scale climate change adaptation planning. While four studies were initially reviewed, two met the study criteria and were thus selected for analysis. The first study reviewed was conducted by Ouranos as part of the Nunavik-Nunatsiavut ArcticNet IRIS report, published in 2012. Climate scenarios were developed by physically downscaling output from General Circulation Models (GCMs) using the Canadian Regional Climate Model. The projected changes were computed using the 1971-2000 "current climate" normal and a 2041-2070 "future climate" period, and assumed the Special Report on Emissions (SRES) A2 scenario for future greenhouse gas emissions. The second study, conducted by Dr. Joel Finnis of Memorial University

(in preparation) provides an overview of projected climate changes centered around 2050 for Labrador. Similar to the Ouranos study, Finnis employed Regional Climate Models nested within GCMs to compare current conditions with projected mid 21st century conditions using the same SRES A2 scenario for future greenhouse gas emissions.

Where climate variables generated by the two studies overlap, there is broad agreement in projections. Projections from both studies identify average winter temperature increases for Nunatsiavut of 3-4°C by 2050. These winter air temperature changes will drive changes in thawing degree-days (projected to increase by 25-50%), frost season duration (reductions up to 19 days per year), continuous snow cover (reduction of three weeks per year) and summer season (identified to increase duration by three-weeks per year). Projected trends in precipitation suggest an increase of up to 10-15%, with a larger fraction falling as rainfall, a resulting reduction in mean annual snowpack of up to 15%, and an increase in intensity of extreme rainfall events, particularly in spring and summer. While the trends provided by these studies are useful tools in regional-scale adaptation planning, finer resolution projections would be even more valuable for the development of community-scale climate change adaptation plans and strategies.

The main objective of Part 2 is to identify and review climate sensitive environmental constraints on the subarctic built environment, including approaches to mapping and assessing current and projected landscape hazards. As no hazard mapping initiatives have been undertaken in Nunatsiavut, an assessment of approaches to landscape hazard mapping used in regions with similar environmental and climatic characteristics should guide the selection of future assessment tools for Nunatsiavut. Findings from Part 3 identify permafrost degradation, flooding, shoreline or coastal hazards, landslides, snow avalanches, snow overloads, wildfires and strong winds as hazards relevant to Nunatsiavut communities. These natural events can impact roads, buildings, airstrips, port facilities, drainage infrastructure and other elements of the built environment, in addition to soft infrastructure such as semi-permanent snowmobile and ATV trails. The review emphasizes the need for hazard mapping at a relevant scale for community-level decision-making, the communication of project findings through means that are accessible to all end-users and ensure policy relevance, the need for building codes and standards that are uniquely suited to northern cold-climate environments, and the need for more comprehensive funding for hazard mapping initiatives that supports post-mapping implementation and action such as adaptation policy development and monitoring.

Part 3 presents a review of best practices in the design of sustainable, energy efficient, climate adapted and climate change resilient housing for northern regions. The section is divided into six chapters that focus on culturally appropriate housing designs and participatory design processes, super energy efficient housing designs, retrofit strategies aimed at improving the energy performance of existing housing, technologies and housing designs that accommodate renewable energy sources such as solar,

wind and ground source heating, as well as housing projects, designs and technologies that were developed in light of recent changing climatic conditions such as strong winds, coastal erosion and flooding. Examples were drawn from projects in the Canadian north (including the territories and the northern part of the provinces), Alaska, Greenland and the Scandinavian countries.

Findings from Chapter 1 emphasize the importance of participatory design processes to ensure the cultural and environmental suitability of housing to meet the specific needs of a community. Chapter 2 identifies improvements in the design and construction of building envelopes as the most cost effective means of achieving super energy efficiency in new homes. Despite significant progress in the field in recent years, barriers limiting the successful application of energy efficiency approaches and technologies within remote, isolated communities remain to be addressed. The need for an enhanced skills base within northern communities and knowledge of sustainable housing technologies and approaches was identified as one area in need of particular attention. A significant need for further development within the areas of super energy efficiency retrofits, alternative energy use and climate change adapted building technologies and designs was identified in Chapters 3, 4 and 5. Findings presented in Chapter 4 highlight the limited number of examples in the literature of alternative energy use in northern communities and the many barriers restricting further development. These barriers include: severe climatic conditions, high construction and installation costs, high transportation costs, and the need for a larger pool of skilled workers in northern communities. High energy prices, in particular, were identified as a significant barrier to alternative energy development and factor heavily within cost/benefit analysis. The review of climate change adapted building designs and technologies (Chapter 5) found very few examples of proactive measures to address changing climatic conditions. The majority of innovative approaches identified in the literature were developed in Alaska in response to rapidly changing conditions that are already occurring.

Within Part 4, a review of current and best planning practices for northern regions is presented. The section is divided into 6 chapters and addresses regional planning (Overview of Planning Practices in Northern Regions), municipal planning and sustainability planning (Integrated Community Sustainability Plans), climate change planning (Climate Change Adaptation Planning) and summarizes the regulatory planning framework used in Nunatsiavut (Nunatsiavut Regulatory Framework). The broad conclusion offered by Part 4 identifies good planning and the creation of a good plan (at both the regional and community scale) as a means of resolving many land use issues, improving certainty, and generally improving day-to-day decision-making capacity in the areas of land use and development. The incorporation of climate change planning into community and regional planning is in a very explorative phase of development and new approaches are continuously tested and improved. Throughout Part 4, the review emphasizes the need to develop unique plans that are tailored to the specific circumstances of a community or region (reflecting local history, culture, tradition, landscape and changing climatic conditions).

Moving forward, we aim to use the best practices identified in these literature reviews to inform the development of policies and programs that foster resilient and sustainable Inuit communities that are well adapted to changing climatic realities. Continued support for the Sustainable Communities Initiative will ensure that Nunatsiavut communities have the information and tools needed to adapt to the already occurring and unavoidable impacts of environmental and social changes.

## SUMMARY OF KEY FINDINGS AND RECOMMENDATIONS

The following section provides a summary of key findings and recommendations offered within all sections of this report.

### Part 1. Climate Scenarios for the Built Environment in Nunatsiavut: Review of Available Data and Relevance for Adaptation Planning

- Climate projections assessed for Nunatsiavut for 2050 indicate warmer winter air temperatures of 3-4°C, a 25-50% increase in thawing-degree days, a shorter frost season by 19 days per year, a shorter period of continuous snow cover by three weeks and a longer summer season by three weeks.
- Precipitation projections identify an increase in mean annual precipitation of up to 10-15% with a larger fraction as rainfall, leading to a thinner mean annual snow pack (up to 15% reduction) and an increase in intensity of extreme rainfall events, especially in spring and summer
- Future downscaling studies should develop climate projections at an appropriate resolution for community-scale planning.

### Part 2. A review of Landscape Hazard Mapping in the Canadian Arctic and Subarctic: Best Practices and Recommendations for Future Mapping in Nunatsiavut

- The spatial scale of landscape hazard analysis must be relevant for policy implementation and use within the community. Community-scale data are thus preferred to regional data because they ensure the integration of social and physical community components.
- Hazard maps must be accessible to all end-users. Project documentation must include a full description of methods and the level of uncertainty associated with project findings.
- Adaptation actions resulting from the implementation of hazard mitigation programs should be monitored and evaluated by the community.
- Building standards should be developed for infrastructure construction and maintenance in northern environments. A significant vulnerability of the built environment in northern communities is attributable to the use of inappropriate standards.
- Increased funding is needed specifically for adaptation planning and monitoring following the identification and assessment of landscape hazards.

### Part 3. Best Practices in Sustainable Northern Housing

- In addressing housing issues in Nunatsiavut, careful consideration should be given to community needs, the cultural context of the community, the local climate and environment, materials transportation, and the attributes of the local labour market.
- Development of innovative housing designs should incorporate participatory design processes that ensure stakeholder involvement.
- Greater emphasis should be placed on the testing and development of alternative energy technologies for application in the north, the development of strategies to improve the energy performance of new and existing buildings in northern communities, and the design of climate change adapted housing and technologies.

### Part 4. Best Practices Review: Sustainable Community Planning in Northern Communities

- A good planning process is just as important, if not more important, than a good plan. A good planning process is rooted in a solid understanding of the community's needs, vision, values and interests, the engagement of a diversity of community members, the maintenance of good relationships, good technical input, and adherence to reasonable timelines.
- Successful implementation of plans relies on effective communication of new policies, regulations and standards, on-going local/regional training and capacity-building efforts, and long-term funding to maintain and update plans.
- Climate change adaptation research and initiatives should be integrated or 'mainstreamed' into community planning efforts. This integration will create synergies across planning processes, increase communication and sharing of information between interests, reduce administrative burden, and improve decision-making on this issue.
- Given the multi-jurisdictional and cross-disciplinary nature of community sustainability planning and climate change adaptation planning, strong regional or territorial government coordination and direction is critical. The direction could be prescriptive in the form of policies and regulations, or enabling in terms of guidelines, toolkits, and information sharing networks.

