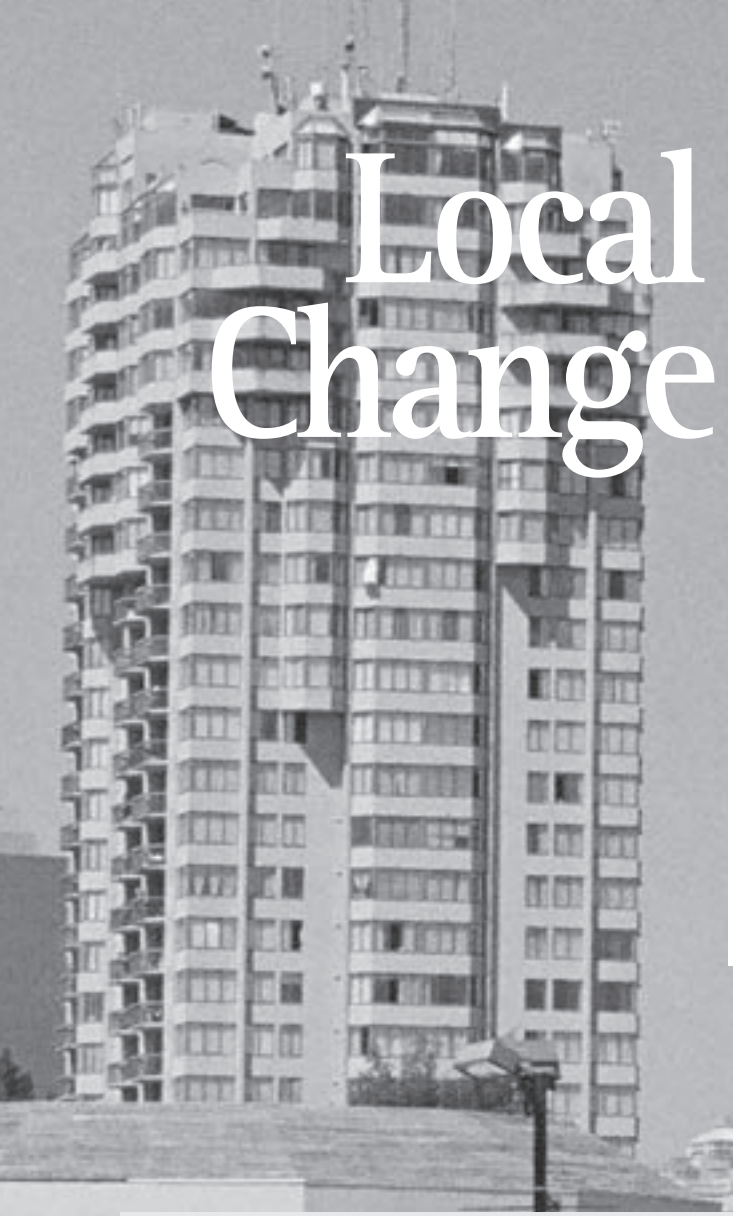


Local Climate Change Visioning:

A New Process for Community Planning and Outreach Using Visualization Tools

by Stephen RJ Sheppard

Summary

Researchers at the University of British Columbia have been working with climate scientists, planners and stakeholders in the Metro Vancouver area to develop a new process for outreach and planning that bridges the gap between global climate science and local action. The Local Climate Change Visioning process uses realistic 3D imagery and spatial modelling of alternative climate futures at the neighbourhood scale to address climate change causes, projected impacts, and possible adaptation/mitigation choices holistically. This article describes the visioning process and ongoing research to evaluate its effectiveness in building capacity and decision-support.

Résumé

Des chercheurs de l'Université de Colombie-Britannique ont collaboré avec des climatologues, des urbanistes et des intervenants de la région du Grand Vancouver pour élaborer un nouveau processus de diffusion et d'aménagement destiné à faire le pont entre la science climatologique globale et l'action locale. Le processus de visualisation locale des changements climatiques fait appel à une technique d'imagerie 3D réaliste et de modélisation spatiale de différents scénarios climatiques à venir à l'échelle du quartier afin de pouvoir cerner les causes des changements climatiques, les répercussions éventuelles et les choix possibles d'adaptation et d'atténuation. Cet article décrit le processus de visualisation et les recherches en cours pour évaluer son efficacité au plan de l'aide à la décision et du renforcement des capacités.

The climate change challenge for community planners

Global warming is fundamentally changing the context within which communities have traditionally planned, requiring communities to adapt proactively to an increasing range of impacts, risks and unfamiliar circumstances.[1] At the same time, new policies are beginning to set ambitious targets for greenhouse gas (GHG) reduction, e.g., BC's target of 33% reduction from 2007 levels by 2020.[2] Planners have to deal with both of these challenges, while grappling with trends such as population increase in rapidly growing areas, continuing preferences for single family dwellings, and economic instability in resource-dependent communities. However, there are few roadmaps and no proven planning processes yet in place enabling Canadian communities to holistically and practically address multiple climate change issues and uncertainties at the local level. How will these challenges and targets be met? What do low-carbon, resilient communities look like? How would they work, and how will the necessary radical changes be made without antagonizing local stakeholders and the public? The problems can seem overwhelming to any planner or elected official.

Planners need a simple flexible framework and modified planning procedures for integrating the best available science and knowledge into policy and decision-making while simultaneously building awareness, capacity, and the constituency for change in the wider community. Carrying out these tasks is made more difficult because scientific information on climate change often seems abstract and overly complex, and we cannot know which of the very different global scenarios modelled by the Intergovernmental Panel on Climate Change (IPCC) will transpire. But what if compelling visual media could be used to translate the scientific information and make alternative futures explicit at the local level, through a participatory planning process that educates the community and better informs tough decisions on climate change options?

The Collaborative for Advanced Landscape Planning (CALP), a research group within UBC's Design Centre for Sustainability, has been working with climate scientists, planners and stakeholders in the Metro Vancouver area to develop a new process that bridges the gap between global climate science and local action; this visioning process uses realistic landscape imagery and spatial modelling of alternative climate futures at the neighbourhood scale (Figure 1). This article describes the Local Climate Change Visioning process and ongoing research to evaluate its effectiveness.

A new climate change planning process

The research team has developed a prototype process that many communities could use for envisioning and assessing local futures with climate change. The intent of the Local Climate Change Visioning process is to make climate change choices more explicit in order to build awareness and capacity for behaviour change, policy development, and decision-making. One of its innovations lies in the integrated treatment of climate change causes, impacts, adaptation and mitigation in distinct scenarios. It uses the power of 3D landscape visualization supported by Geographic Information Systems (GIS) and climate/environmental modelling,

FIGURE 1

a) Existing conditions in a high-carbon urban landscape

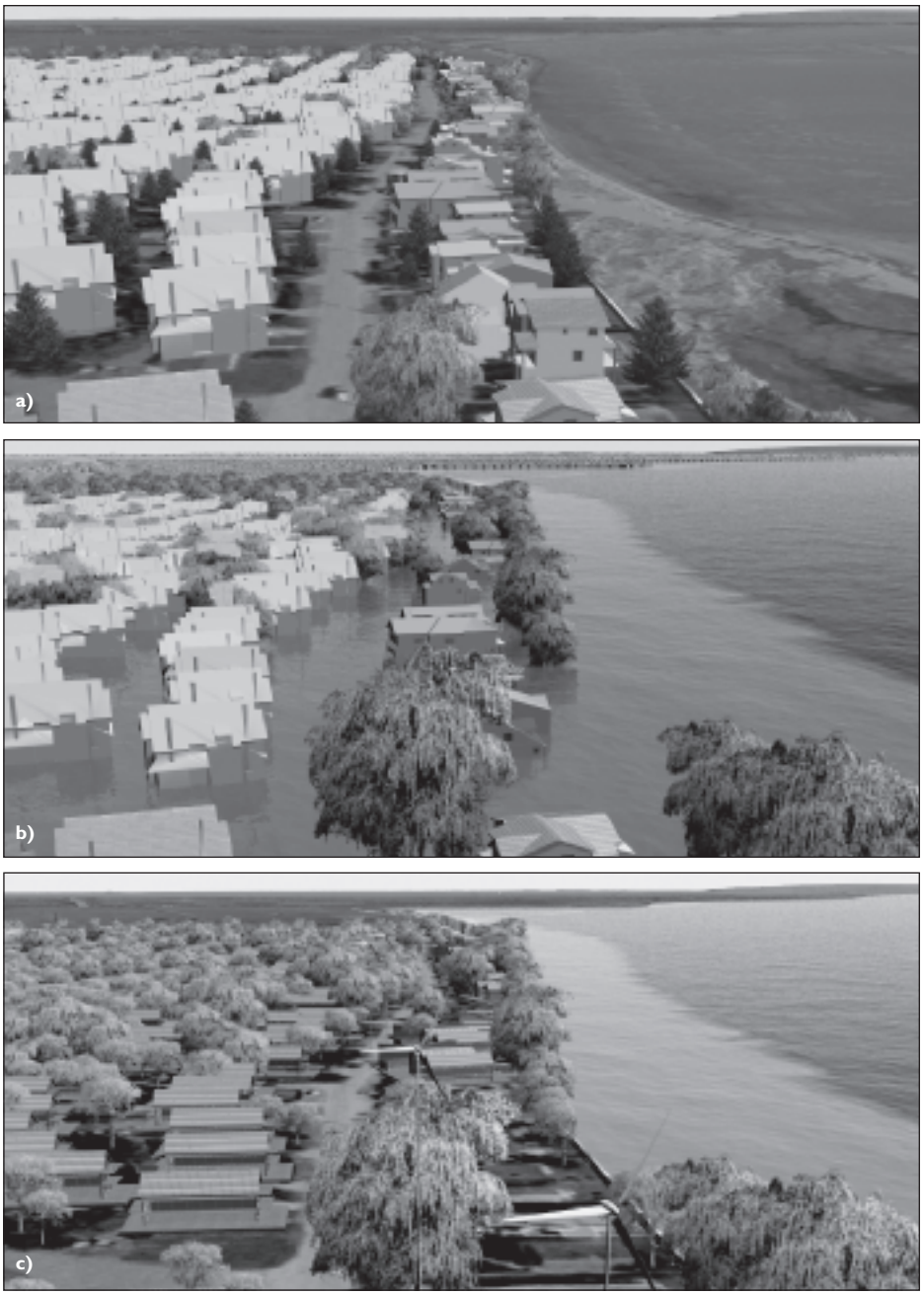
b) Conceptual visualization of a low-carbon future with intensive mitigation (eg. transit corridors, walkable neighbourhoods, live-work buildings, energy efficient design, energy-generating buildings, etc.) and adaptation (increased summer shade, local food production, etc.)

Credit: David Flanders, CALP/DCS, UBC.

not only to communicate climate change implications to professionals and non-experts, but also to force the integration of diverse streams of information from multiple sources and disciplines. The goal is to bring these scenarios home to people and their municipal governments, through spatializing, localizing, and visualizing information on climate change, within larger educational and planning processes. Together with maps and plausible storylines, computer visualizations are produced at a scale that matters to decision makers and the community: their neighbourhoods and backyards. Through the images, people can see, for example, the effects on their community of unmitigated climate change (e.g., sea-level rise, drought, increased fire risk) in their lifetime, or of "complete" resilient low-carbon communities with renewable energy, local food production, and sustainable technologies (Figure 2). The process generates pictures of alternative climate scenarios over time, showing different levels of climate change impacts, adaptive responses, and mitigation measures in combination; this holistic approach is important in allowing synergies and conflicts between adaptation and mitigation to be considered, e.g., raising dykes against sea-level rise may require more fossil fuel usage to pump out surface water and maintain the dyke system.

How does all this work? The process builds upon early Canadian and international precedents addressing more limited aspects of climate change[3,4,5] and other modelling-based planning processes using visualization.[6,7] It draws on the best available data, science, and best practices, as well as local knowledge and multidisciplinary expertise, through workshops with scientists, practitioners and community stakeholders. Products include visioning material for each community or neighbourhood, illustrating different adaptation and mitigation strategies that can be assessed against carbon reduction

FIGURE 2: 3D VISUALIZATIONS OF ALTERNATIVE CONDITIONS IN A BC COASTAL FLOODPLAIN COMMUNITY AT RISK OF FLOODING



a) Existing conditions in 2000

b) Projection of same neighbourhood in 2100 with a +4°C global warming scenario, storm surge, and no effective adaptation measures

c) Projection of same area in 2100 with a +2°C global warming scenario, storm surge, raised sea-wall, flood-proofed buildings, and on-site energy generation (intensive mitigation)

Credit: David Flanders, CALP/DCS, UBC; sea level data provided by Natural Resources Canada.

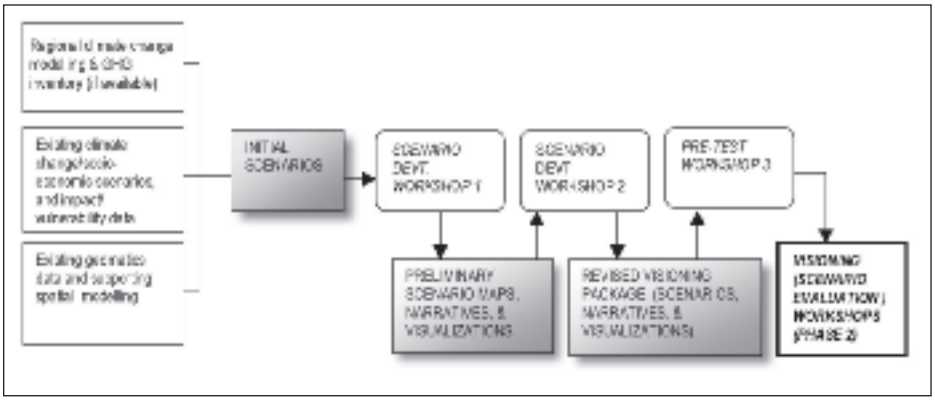
targets, and other key sustainability/ feasibility criteria. Preferred scenarios are refined through community design charrettes or other public processes. Community education and input are vital throughout.

In Phase 1 of this visioning process (Figure 3), basic tasks include:

- Downscaling of global climate projections with regional climate change modelling if available or interpretation by climate scientists, e.g., from Environment Canada or other scientific groups.
- Developing an initial set of plausible alternative climate change scenarios which address key community impacts/vulnerabilities, adaptation and mitigation, out at least to 2050 and preferably 2100. These integrate relevant studies such as any inventories of greenhouse gases (or interim assumptions on carbon sources), and are reviewed by a local working group of experts and community representatives.
- Mapping impacts and appropriate locations for mitigation and adaptation measures, using spatial analysis with GIS and remote sensing data, and interpretation of available urban planning or resource management models. Hybrid modelling is used to link together, directly or indirectly, various models addressing, for example, climate impacts, land uses, hydrology, sea level, adaptation costs, transportation, energy use, etc.; these models can be used to project, refine, and/or evaluate the scenarios. Simple GIS analysis can also be used – since appropriate models or specialized data are often not yet available – to address the key issues identified locally.
- Visualization media can range from simple 2D photorealistic tools like Photoshop to an array of 3D programs such as ArcSCENE, Google Earth, Sketch-up, Visual Nature Studio (Figure 2) and interactive tools such as Community Viz. These can make use of any available high-resolution 3D datasets, eg. LiDAR data,[8] but the preparation of imagery should follow a standard process to ensure defensibility.[9] Input should be sought from the local working group on issues such as representative locations for focus areas and viewpoints, themes to be visualized, and important local conditions.
- Generating visioning packages for working group review of scenarios illustrating possible future neighbourhood conditions, including visualizations, narratives or profiles using key indicators, GIS mapping, and photographs of best practice precedents.

Phase 2 of the process consists of presenting the climate change scenarios for evaluation by the intended audiences, through visioning (scenario evaluation) workshops. Participants may include upper management professionals, community representatives, elected

FIGURE 3: SUMMARY FLOWCHART FOR A TYPICAL PHASE 1 STUDY PROCESS (SCENARIO DEVELOPMENT)



officials, other stakeholder groups, or the general public. Outcomes on information gained, awareness built, and local preferences for action can be documented for consideration by Council or staff, using questionnaires or recorded discussions; more specific scenarios and design solutions can be explored through further workshops, charrettes, focus groups, and other processes.

Findings from the BC Local Climate Change Visioning Project to Date

Since 2005, the research team has been developing and assessing a climate change visioning process as described above, working with two communities that represent different climate change challenges: the coastal community of Delta facing sea-level rise, and the urban fringe on the Northshore mountains, affected by reduced snowpack (Figure 4) and increasing natural hazards. These municipal case studies have been conducted in close coordination with Metro Vancouver and various provincial and federal agencies. In both communities, visioning packages were prepared which illustrate four alternative scenarios or "worlds" based on assumed local and global conditions modelled in part using UBC's Georgia Basin QUEST model:[10]

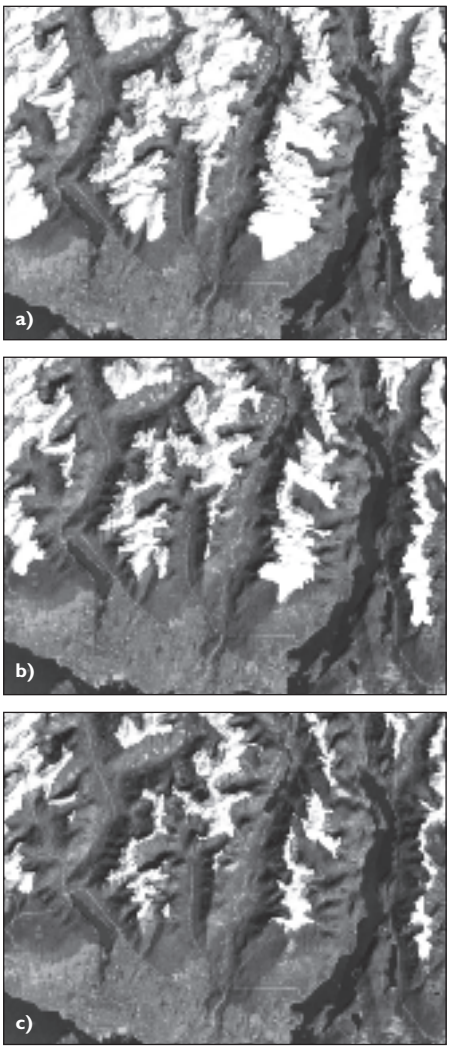
- a baseline "Do Nothing" world where no effective action on climate change is taken, and carbon emissions continue to rise;
- an "Adapt to Risk" world where proactive measures are taken to reduce community vulnerability but no effective actions are taken to reduce greenhouse gases;
- an "Efficient development" world, with a combination of adaptation and modest mitigation measures; and
- a "Deep Sustainability" world showing what a low-carbon community could look like that matches BC's GHG reduction targets and adapts to unavoidable climate change impacts.

The research evaluation in Phase 2 of the case studies was conducted with approximately 120 community members in Delta and North Vancouver, and with a sample of Lower Mainland planners and engineers. Preliminary results show that:

- the issue of climate change became more real and urgent to participants: for example, before the presentation, a majority of practitioners felt that serious climate change effects were 20 years away in the Lower Mainland, while after the presentation the majority felt the effects were serious now;
- the local visioning process increased awareness on the nature of local climate change impacts and the range of response options available to the community – leaving people with a sense of the constructive actions that can be taken;
- the process altered community participants' attitudes: willingness to support climate change policies (both mitigation and adaptation) was substantially increased; and
- people found the visualizations and visioning process credible and helpful.

The visioning project has been well received by the public, politicians, planners, engineers, and international scientists. The resulting visual products have been sought after by local to national media, providing an expanded opportunity for public education and awareness-building.

FIGURE 4: AERIAL VIEW OF VANCOUVER'S NORTHSHORE SNOWPACK ON APRIL 1ST, BASED ON MEAN SNOWLINE ELEVATION OF DOWNSCALED +4°C GLOBAL WARMING SCENARIO (A2):



a) Year 2000 (existing conditions)
b) 2050s (projected)
c) 2080s (projected)
Credit: David Flanders, CALP/DCS, UBC; snowpack data provided by Environment Canada.

Recommendations

All Canadian communities face an urgent need to choose between possible climate change strategies with far-reaching consequences, while keeping their public involved and supportive. The Local Climate Change Visioning project has established a systematic prototype that

has been tested, and which could be used to operationalize climate change planning into conventional procedures. It suggests that it is possible to carry out an inclusive, multi-criteria process based on visualizing holistic future conditions, backed by scientific spatial modelling, and leading to increased community capacity and more structured decision-making. The process would appear to work with simpler GIS and visualization tools suitable for smaller, less well-resourced communities, or with more sophisticated tools and models. However, further testing of such processes in decision-making and capacity-building is needed across a range of climate change issues affecting Canadian communities. To this end, we are planning a comparative national study working with colleagues in Toronto, Calgary, and an Arctic community in Nunavut, and other case studies in BC.

Further research is needed in developing/using integrated spatial modelling tools, spatial GHG inventories, and energy use and carbon calculations at the neighbourhood and community level. We need to know much more about projecting the effectiveness, costs, and public acceptability of different GHG reduction strategies.[11,12] We also need to learn how to assess synergies and conflicts between adaptation and mitigation at the local level. However, the challenge of moving urgently towards more resilient communities with greatly reduced carbon footprints means we cannot wait for all the research results to come in; we need to start spreading useful approaches and solutions to climate change NOW. CALP researchers are hoping to work with other extension agents in the BC government, regional agencies, industry, and NGOs to transfer knowledge (in both directions) and test new planning/visioning techniques with communities that are trying to meet the climate change challenge.

For more information visit the CALP web site (www.calp.forestry.ubc.ca). ■

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