Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

Dr. Robert Newell
Royal Roads University

Dr. Ian Picketts
Quest University Canada

Sustainable community development requires integrated approaches to planning that recognize how local policy and land use can affect interconnected aspects of human wellbeing and the environment. Systems modelling exercises can support integrated planning because they can elucidate relationships and outcomes of social and physical infrastructure decisions. However, modelling community systems presents the significant challenge of deciding what to include in the model, since including all aspects of a community and its local environment is unfeasible. This challenge can be addressed through participatory approaches to model development. Through engaging local government and diverse stakeholders, models can be designed to capture a comprehensive range of key interests, concerns and values, thereby increasing their relevance to the community and usefulness in local planning efforts.

This study explores such a participatory approach. The research involved assembling a focus group representing diverse sectors/interests in Squamish, BC, to discuss local issues and possible futures for the community. Focus group data were analyzed using NVivo, resulting in a series of considerations that informed the development a systems model. In turn, the model can be used to support integrated planning by serving as tool for guiding investigations into possible outcomes associated with developing the community in different ways.
Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

SPACES, PLACES AND POSSIBILITIES

1. Modelling community development scenarios

2. Visualizing community development scenarios
Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

SYSTEMS MODELS AND INTEGRATED PLANNING
Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

SYSTEMS MODELS, INTEGRATED PLANNING AND SUSTAINABILITY

Ecological

Economic

Social
Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

PLACES + SPACES

Effects (Direct)
- Land-use
  - Green space
  - Dead space
  - Agricultural land (urban and rural)
  - Density
  - Walkability/cyclability
  - Accessibility
  - Commercial space
  - Mixed-use space (multi-functionality)
  - Agricultural fertilizer usage
- Transportation
  - Mode split
  - (walking/cycling/transit/driving)
  - Transit use
  - Average VKT
  - Vehicle mix
  - # of bike racks, bus bike racks
- Demographics
  - Population change
  - # of dwellings by type
  - # of people/household
  - Age characteristics
  - Diversity (age, gender, culture)
- Economics
  - # of direct jobs
  - # of indirect jobs
  - change in inequality
  - # of people below poverty line
  - Municipal tax revenues
  - Municipal operating costs

Impacts (Indirect)
- Ecological impacts
  - Change in forest cover
  - Change in air pollution (GHG emissions NOx, SOx, ozone, carbon monoxide, particulate)
  - Change in water quality (contaminants, environmental – fertilizers and eutrophication)
  - Change in water quantity (equitable and sufficient water supply)
  - Change in biodiversity
  - Change in waste production
- Health impacts
  - Change in cancer rates
  - Change in heart disease
  - Change in mental illness
  - Change in obesity rates
  - Change in asthma rates
  - Change in osteoporosis
  - Change in diabetes
- Connectivity
  - Change in # of coffee shops
  - Change in people within walking
  - Position and # of community centres
  - Change in # of libraries
- Accessibility
  - Change in # of doctors/capita
  - # of people within walking distance of
green space
  - Change in # of people within walking
distance of grocery store,
  - Change in # of people with access to
agricultural land
  - local food markets, community gardens
- Infrastructure
  - Change in energy mix
  - Change in energy cost
  - Change in average age of buildings
  - Change in average age of municipal infrastructure by type

How does one decide what to include in and what exclude from a systems model?

Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

SPACES, PLACES AND POSSIBILITIES

1. Designing systems model and defining scenarios
2. Modelling community development scenarios
3. Visualizing community development scenarios
PARTICIPATORY MODEL DESIGN

“The ideal is that participatory planning helps ensure that the ‘plan’ is grounded in the pluralistic socio-economic and bio-physical context of the community.”

Ling et al. (2009)
Stakeholder-driven Modelling for Integrated Community Planning

A participatory approach for creating community systems models and development scenarios

METHODS

Preliminary meeting with planning department

• What are rough ideas for community development scenarios?
• What neighbourhoods could be affected by these scenarios?
Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

METHODS

Preliminary meeting with planning department

• What are rough ideas for community development scenarios?
• What neighbourhoods could be affected by these scenarios?

• Low density residential neighbourhoods
• Medium density row housing and low-rise condo neighbourhoods
• Medium density high-rise neighbourhoods
• High density vibrant community nodes
Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

METHODS

Focus group with community stakeholders (e.g., non-profit, local government, chamber of commerce, development, academia, transit, etc.)

• Do the presented scenarios represent possible futures situations in Squamish that are worth exploring? What could be added or changed?

• What other development directions or focuses would you like to explore for Squamish? What would be a desirable ‘potential future’ for the community of and neighbourhoods in Squamish?

• What are key questions that emerge when exploring a particular scenario?

• What are the major planning and development challenges Squamish faces?
Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

METHODS

Analysis of focus group data

- Data consisted of written feedback, notes and transcriptions
- Data were coded using NVivo (v. 11) with 31 codes
  - Access to amenities, Access to education, Access to green space, Aesthetics and viewshed, Air quality, Community attitudes, Community health, Commercial space, Connectivity, Current development patterns, Density extremes, Downtown development, Economically viable nodes, Food and farm systems, Greenhouse gases, Housing availability, Housing affordability, Local employment, Land-use efficiency, Mix of housing types, Mixed-use development, Missing middle development, Population growth, Preserving green space, Residential neighbourhoods, Regional commuters, Shared lots and infill, Social diversity, Steep slope development, Transit corridors, Walkability
- Coded data were organized into a series of ‘considerations’
- Considerations informed the design of systems model and refinement of scenarios
Stakeholder-driven Modelling for Integrated Community Planning

A participatory approach for creating community systems models and development scenarios

RESULTS

<table>
<thead>
<tr>
<th>Consideration</th>
<th>Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Squamish is growing</td>
<td>Population growth, Current development patterns</td>
</tr>
<tr>
<td>Development has been planned and approved</td>
<td>Residential neighbourhoods, Downtown development, Current development patterns</td>
</tr>
<tr>
<td>Local employment spaces are important</td>
<td>Regional commuters, Local employment, Commercial space, Mixed-use development</td>
</tr>
<tr>
<td>Explore a range of densities</td>
<td>Missing middle development, Aesthetics and visuals, Density extremes, Housing availability, Land-use efficiency, Shared lots and infill</td>
</tr>
<tr>
<td>What is the ‘optimal density’</td>
<td>Walkability, Economically viable nodes, Transit networks, Corridor-based development, Mixed-use development, Community attitudes</td>
</tr>
<tr>
<td>Create an accessible community</td>
<td>Access to green space, Access to education, Access to amenities, Connectivity, Transit corridors, Walkability, Mixed-use development, Community health, Air quality, Greenhouse gases</td>
</tr>
<tr>
<td>Develop communities with diverse housing types</td>
<td>Mixed-use development, Mix of housing types, Missing middle development, Social diversity, Shared lots and infill</td>
</tr>
<tr>
<td>Housing affordability is a problem</td>
<td>Mix of housing types, Housing affordability</td>
</tr>
<tr>
<td>Developing all land as residential is not necessarily desirable</td>
<td>Access to green space, Preserving green space, Food and farm systems, Steep slope development</td>
</tr>
</tbody>
</table>
Stakeholder-driven Modelling for Integrated Community Planning

A participatory approach for creating community systems models and development scenarios
<table>
<thead>
<tr>
<th>Community outcome</th>
<th>Potential measurement methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Access to amenities</td>
<td>• Distance to green space, schools, health, restaurants, grocery stores</td>
</tr>
<tr>
<td>Access to schools</td>
<td>• Distances from residences to schools</td>
</tr>
<tr>
<td></td>
<td>• School space per number of children</td>
</tr>
<tr>
<td>Access to green spaces</td>
<td>• Distances from residences to parks and trails</td>
</tr>
<tr>
<td></td>
<td>• Park area per person within a neighbourhood</td>
</tr>
<tr>
<td>Preserving green space and habitat</td>
<td>• Residential, commercial/industrial and agricultural land encroaching on green space</td>
</tr>
<tr>
<td></td>
<td>• Residential density near critical habitat and sensitive ecosystems</td>
</tr>
<tr>
<td>Transit accessibility</td>
<td>• Density around transit stops and routes</td>
</tr>
<tr>
<td></td>
<td>• Distances from residences to transit stops (both existing and potential)</td>
</tr>
<tr>
<td></td>
<td>• Estimated public transportation ridership</td>
</tr>
<tr>
<td>Commute reduction</td>
<td>• Estimated change in number of vehicle kilometers travelled</td>
</tr>
<tr>
<td>Air quality</td>
<td>• PM$_{2.5}$ emissions based on vehicle kilometers travelled</td>
</tr>
<tr>
<td>Greenhouse gas emissions</td>
<td>• CO$_2$ equivalents emissions based on vehicle kilometers travelled</td>
</tr>
<tr>
<td>Health</td>
<td>• Air quality variable</td>
</tr>
<tr>
<td></td>
<td>• Estimated numbers of people walking based on distances from residences to employment</td>
</tr>
<tr>
<td>Food and farm systems</td>
<td>• Amount of land reserved for agriculture</td>
</tr>
<tr>
<td></td>
<td>• Distance from residences to food services</td>
</tr>
<tr>
<td></td>
<td>• Distance from high-density residences to community gardens</td>
</tr>
<tr>
<td>Local businesses</td>
<td>• Amount of space reserved for commercial/industrial</td>
</tr>
<tr>
<td></td>
<td>• Number of nearby residents to support local businesses</td>
</tr>
<tr>
<td>Local employment</td>
<td>• Amount of space reserved for commercial/industrial purposes</td>
</tr>
<tr>
<td></td>
<td>• Number of potential jobs using estimates on business sizes</td>
</tr>
<tr>
<td></td>
<td>• Percent of population commuting outside of Squamish</td>
</tr>
<tr>
<td>Social diversity</td>
<td>• Inferred through the level of diversity in housing types within a neighbourhood</td>
</tr>
<tr>
<td>Housing affordability</td>
<td>• Inferred through using average prices for different housing types and mixes of housing types</td>
</tr>
</tbody>
</table>
Stakeholder-driven Modelling for Integrated Community Planning
A participatory approach for creating community systems models and development scenarios

REFINED SCENARIOS

- Low-density residential neighbourhoods
- Mixed housing types
- High-density neighbourhood nodes
- Increased non-residential lands (i.e., commercial and agricultural)
REFLECTIONS AND CONCLUSIONS

• The participatory approach to systems model and scenario development provided a reasonable scope of work, while ensuring the modelling is relevant and useful to the community.

• The preliminary meeting was useful for focusing the stakeholder discussion; however, it is possible that it also constrained this discussion.

• The comprehensiveness of a systems model developed through a participatory approach depends on the diversity of participants.