SEE THE CHANGE

A CANADIAN RESEARCHER HELPS COMMUNITIES FORETELL WHAT CLIMATE CHANGE WILL LOOK LIKE.

BY ADAM REGN ARVIDSON, FASLA

ABOVE
When the sea level rises, these Vancouver area float homes might be safe, but not the town and farmland behind them.

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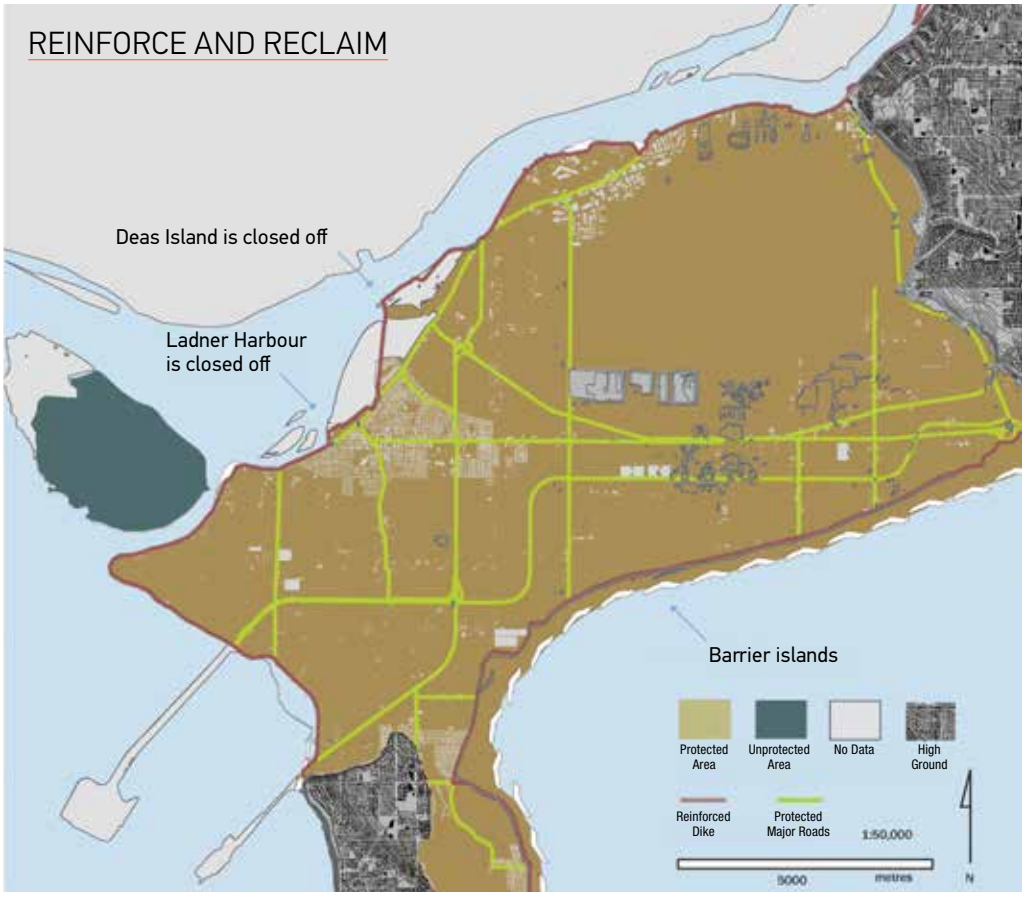
A few miles south of Vancouver, in Delta, British Columbia, a narrow residential street called River Road runs behind a sea dike. That linear earthen berm rises about 10 feet above street grade and stretches as far as the eye can see. On top is a mishmash of large homes, metal Quonset huts, garages, and the walkways that reach out to Fraser River float homes (two- and three-story houses on barge-like bases moored just offshore). On the other side of River Road are conventional homes that, when the tides are high or storms roll in, end up below sea level. The dike protects them, and most of Delta, now, but it's not tall enough to protect them in the future. In less than 100 years, climate change forecasters predict, the Fraser River (which is less a river here than an ocean bay) will regularly overtop it.

Standing here on River Road, though, on a hot, sunny August day, it's kind of hard to believe. People mow their lawns. Cars cruise the patchwork pavement, heading down to the blueberry farms to the west, perhaps, or out to the float homes. From the top of the dike the Fraser looks positively tame—and low—even lower than the road. And that is the real challenge of addressing global climate change: Most of the time, things look just fine. Of course the Delta dike is high enough, people tend to say. No, we don't need to spend extraordinary money to raise it. No, we don't need to drive less. Everything is okay.

That's where Stephen Sheppard, ASLA, and the University of British Columbia's Collaborative for Advanced Landscape Planning (CALP) come in. CALP is a think tank that Sheppard founded in 1998 to explore ways of showing communities the likely effects of climate change. It employs between five and 12 UBC students and recent graduates whose backgrounds vary depending on the projects under way. Teams typically include landscape architects, architects, and planners, along with other specialized researchers from forestry, geography, and even computer science. The overarching idea, Sheppard says, is to use 3-D visualization and digital modeling to "link global climate change science to local practice, local planning, and local communities."

Climate change visualization is popping up everywhere. *National Geographic* offered up some beautiful examples in an article on the topic



ABOVE AND RIGHT
CALP's work in Delta, British Columbia, helped the community visualize four options for addressing sea-level rise.

BELOW
In one scenario, barrier islands would allow for slightly lower dikes or seawalls around Boundary Bay.

in the October 2013 issue: the world coastlines with all the ice melted (bye-bye Florida), Manhattan in a Sandy-like event with sea-level rise factored in, and other artfully rendered horrors. But Sheppard's work tackles the issue at a much finer scale.

CALP typically gets funding from outside sources to do work in communities like Delta. In 2004, with money from Canadian, regional, and local governments, Sheppard went to the city and asked if he could help them talk to residents and elected officials about sea-level rise and the increasing salinity of agricultural land. He hosted community workshops that drew more than 100 people. Most people in town call this study the "four worlds." The CALP team drew four scenarios for the future of the low-lying town. One showed business as

Horizontal scale from the seawall to Tsawwassen and vertical scale of the Tsawwassen bluff have been compressed.

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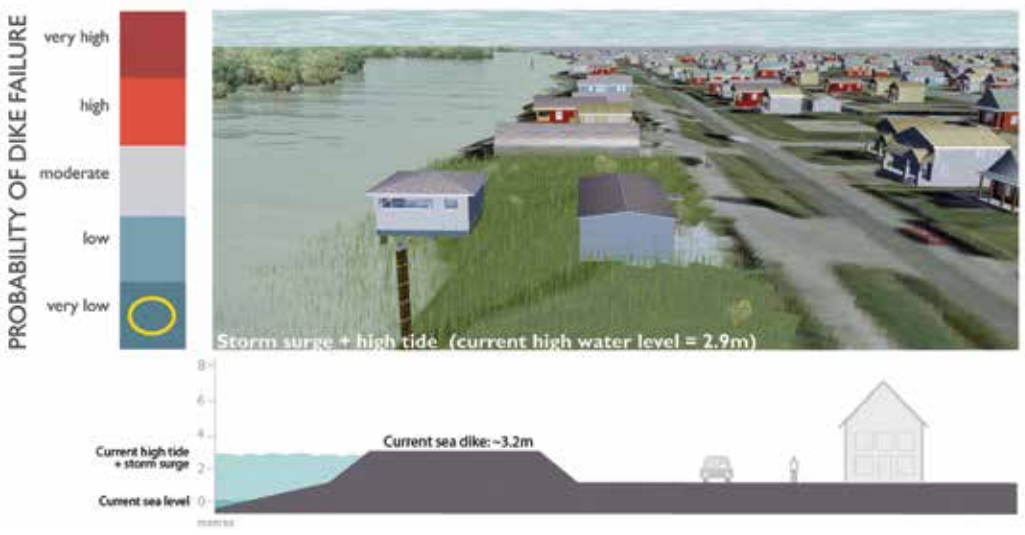

ABOVE AND BELOW
Current storm surge conditions for River Road in the Delta village of Ladner, above, compare with storm surge plus a projected 1.2-meter sea-level rise, below.

usual. A second focused on climate change adaptation (adaptation in this context means building to stave off climate change effects, as opposed to trying to reduce climate change, which is mitigation). A third included both adaptation strategies and a slow reduction in carbon use. The last, the most aggressive, focused on mitigation. All the renderings show the town in various stages of inundation. In worlds one and two, there isn't much left above water.

Sheppard remembers being a little scared to present the drawings. "We had no idea if [the people of] Delta were going to throw us out," he says with a laugh. And you can understand why. Seeing images of River Road flooded while standing on River Road is a little scary. Water is everywhere. A few gables peek above the flood on the inland side where the road was. A Quonset hut is knee-deep in the Fraser (which is now truly part of the ocean). Delta is gone. "We were showing them pictures of their homes being flooded," Sheppard says. "We were worried about liability, about property values. But because we were showing alternatives, it wasn't like the only future was doom and gloom." Angela Danyluk, Delta's senior environmental officer, also remembers the presentation. "That was our first real step into the conversation of sea-level rise and climate change. We're a low-lying community; we have dikes, so in the back of our heads we know we are vulnerable, but that was the first time we saw we could be affected by climate change in a way that could exceed our resources."

A follow-up study called the Regional Adaptation Collaborative Policy Report, funded by the Canadian government, made other specific locations in Delta recognizable and drove the message home. "It created realistic images," says Danyluk, "that triggered 'aha' moments among the staff here." The study also showed four scenarios based on either the worst case scenario or a future with very little mitigation. There was a "hold the line" option of simply raising all the dikes; a combination of dike raising and strategic dike rerouting; a "managed retreat" option that would protect village centers within the larger, mostly agricultural towns like Ladner and allow the sea in elsewhere; and a scheme to raise all the infrastructure, which would create an odd landscape of causeway roads and island hamlets. In 2012, UBC

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This current breach/inundation scenario probability is very low.

With no adaptive action, the Ladner dikes could overtop in the future, and the probability of infrastructure failure increases.

This future inundation scenario probability is higher than the current probability: the risk to Ladner **if no adaptive action is taken** is also higher.

LEFT
Another view of Ladner illustrates the extent of inundation under several sea-level scenarios.

landscape architecture students explored design scenarios in specific locations, including the Ladner town center and Westham Island, an agricultural island with even lower sea dikes off the tip of Delta.

In all the Delta studies—and this is a hallmark of Sheppard's work—the graphics don't hold back. Recognizable homes end up underwater. Vast swaths of productive farmland, parcel by parcel, get the shallow-sea-reeds-and-choppy-waves treatment. People can point to their homes on these maps—and see them submerged.

About two years ago, Sheppard got another tool to help people see climate change. The BC Hydro Theatre is basically a black box theater in the Centre for Interactive Research on Sustainability building where CALP has its offices. Two of the two-story walls are covered in projection paint, and six high-definition projectors hang from the ceiling and can be linked to any of the 30 iPads and Apple TVs in the room (or anyone's laptop). Using Google Earth, SketchUp (Sheppard believes in inexpensive and easily available software), and the projectors, CALP can turn the entire room into an interactive showplace.

Olaf Schroth, one of Sheppard's recent collaborators, invited me to see the way CALP uses this space to make climate change visualization even more immersive. Kimberley is a mountain community in southeastern

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British Columbia, a scenic, 10-hour drive from Vancouver. Kimberley is an old lead-mining town, but the mine has closed and the community is becoming more recreation focused. A community working group invited CALP to help them identify several specific threats brought on by climate change: water supply, flooding, wildfires, and the pine beetle infestation. CALP secured funding from the provincial government and other nonprofit partners to work in the city in 2008 and 2009. It mined existing data to create visual timelines for the community in Google Earth. Schroth showed me one evocative sequence that showed how planned low-density development will creep across the forested mountainsides and exacerbate erosion problems. The development data came from approved subdivision plans, but Schroth says the community was shocked to see the whole of what they had already approved.

In front of me, the two-story wall shows the town of Kimberley and its surrounding mountains as if I were in a low-flying airplane. Schroth can change my point of view with a keystroke by whirling the map around to get me looking in a different direction. It's like a cross between Google Earth and a planetarium. The diligent Kimberley fire chief had previously produced a wildfire-spread model taking into account increased fuel in the forests and warmer, drier temperatures. But it was a text-heavy report, and probably was read and understood by few townspeople. Using this data, Schroth and CALP plotted a hypothetical wildfire's advance from different origin points. Schroth

BELOW
In the new BC Hydro Theatre, Sheppard and his team can illustrate their climate change work interactively at a large scale.

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LEFT
The town of Kimberley is also facing climate change challenges, such as tree loss to pine beetles.

runs the fire model timeline for me. A red blob expands across the landscape. In seconds (four hours, real time) the blob is on top of the city. In a few more seconds, it cuts off the town's last escape route. It's a stunning and scary visualization.

Then Schroth lights up all that new low-density housing on top of the red fire blob. Yikes! It's right where the fire will go. Then he plots pine beetle susceptibility, draping colors over the mountains, and shifts the view so I seem to be standing in the town center. Oh my! That gorgeous forested mountain view is all orange. And now the flooding, which will, of course, be exacerbated by the pine beetle and new development tree removal: The whole town is flash-flood prone. "This allows people to see the combination of things," Sheppard says. "I don't think anyone put that picture all together before."

As a result of these visualizations, Kimberley is looking at allowing the wood-pellet fuel industry (which is well established in British Columbia) to remove excess dead wood in the forests and pelletize it. The town is also considering new development rules to address fire, flood, and pine beetle risk. But what if—and this is all what if, isn't it?— Kimberley, faced with this doom and gloom, could instead create a booming green energy industry, coupled with more dense resort-like development in town, and new parks that help address flash flooding problems? That is the critical second act in Sheppard's work.

"Part of our challenge is to make this stuff exciting and fun and positive," he says. "Think what these communities could be. Think of all the extra things you could get. Adaptation studies typically include damage reports and then engineering solutions, and they often stop there."

Sheppard feels the next step is to ask: What are the five other things this community really wants to do? Does it need a better harbor, more parks, a new energy system? On the surface, it might not seem like much fun to see a landscape ravaged by fire on a two-story screen, but it is. It is fundamentally stimulating—far better than reading a fire chief's report, or anything by the Intergovernmental Panel on Climate Change (IPCC). Standing on a dry road and glancing down at an image showing the water a dozen feet higher—seeing houses right there in the real world up to their eaves in ocean—is quite poignant. I can picture the typical human reaction: incredulity, a nudge of the neighbor and some comment like "Hey, Bob, looks like you gotta move to the attic," then a breath, then a serious discussion about the next steps.

"That's your job," says Sheppard, addressing the landscape architecture profession in general. "You have to help people figure out the climate change impacts on their neighborhood. You do the doom and gloom bit—the damage report, the impacts—but that's just one piece. The next piece is: What are the solutions? Then we're back on more familiar territory." He lists things landscape architects do: green infrastructure, stormwater management, parks, urban agriculture, native restoration, master planning—all of which also address climate change. Can a park be a carbon sink? Can it buffer storm surge? Can it generate energy? And instead of just talking about it, Sheppard suggests showing some alternative futures, graphically.

Sometimes this can be surprisingly simple. In Richmond, a fast-growing, low-lying town between Vancouver and Delta, CALP modeled a variety of scenarios of the city's energy use.

OLAF SCHROTH

There's Richmond's current energy plan, and an option with solar on all new roofs, and one that adds geothermal/biomass district energy. Each option is accompanied by a big sliding scale of carbon emissions, both per capita and as a total, as well as a rendering of the planned town center with these ideas implemented. People sometimes freak out about words like "solar panels on every roof" and "biomass district energy." But CALP's drawings show very little visual impact: The panels are hardly visible on the high roofs, and the district energy plant occupies an unassuming place in the corner of the green space.

PEOPLE GET PICTURES. DOOM-AND-GLOOM PICTURES, YES, BUT THEY ALSO NEED HOPEFUL ONES.

It's the all-of-the-above option that would reduce per capita energy use in central Richmond by 72 percent and would drop total energy use in the neighborhood to a level below what it is now—even with forecasted population growth. It is an effective visualization of mitigation. In Delta, the dike is studded with redevelopment notices, and though Danyluk laments not having a specific climate policy in hand, she says that the staff has been able to alter many of these proposed projects based on a deeper understanding of climate change effects. One new float-home development will have all of its on-dike services (garages, ramp landings, and the like) built so they can be easily raised later to put a higher dike underneath them.

CALP shares its expertise with practitioners in two publications, a *Guidance Manual* for local climate change visioning and *An Illustrated Guide to Community Energy,* which CALP is currently transforming into an interactive, online platform. Sheppard also has a recent book called, appropriately, *Visualizing Climate Change: A Guide to Visual Communication of Climate Change and Developing Local Solutions,* which, aside from being packed with useful strategies, is also a fun read (Routledge, 2012). In it, Sheppard suggests landscape architects and planners look at alternative futures for their communities, rather than planning toward a single outcome. They should also use visuals systematically, instead of automatically. Designers tend to render what helps them sell their design. Instead, use truthful renderings as a design tool and then show communities that truth. And get familiar with climate science. Pick up an IPCC document—they usually have chapters on how to mitigate and adapt. Climate change science is not rocket science (at least not anymore), and the more design professionals can talk about it, the more they can actually help communities (and perhaps win even more work).

"Take it on. This is our brief," Sheppard says. "This is one of the things we do. Landscape architects should ask the question: Have you done an adaptation plan, a risk assessment, a vulnerability mapping exercise?" He says that communities tend to respond one issue at a time: They might hire a designer because they have storm damage on the beach, but Sheppard says that designer should ask about the broader issues. Why was there storm damage? How can the beach mitigate or help a community adapt to climate change?

Thousands of words have been written and spoken about climate change. But people get pictures. Doom-and-gloom pictures, yes, but they also need hopeful pictures. The climate is changing and our communities will, too. If we can visualize that change, we can manage it. The seas won't rise tomorrow. "In all fairness, there is time," Sheppard says. "Not time to do nothing, but time to plan." ●

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RESOURCES

The *Local Climate Change Visioning and Landscape Visualizations Guidance Manual* is available at *calp.forestry.ubc.ca/viz-guidance-manual.*

An Illustrated Guide to Community Energy is available at *web.forestry.ubc.ca/calp/CALP_CommunityEnergyGuide_highRes.pdf.*