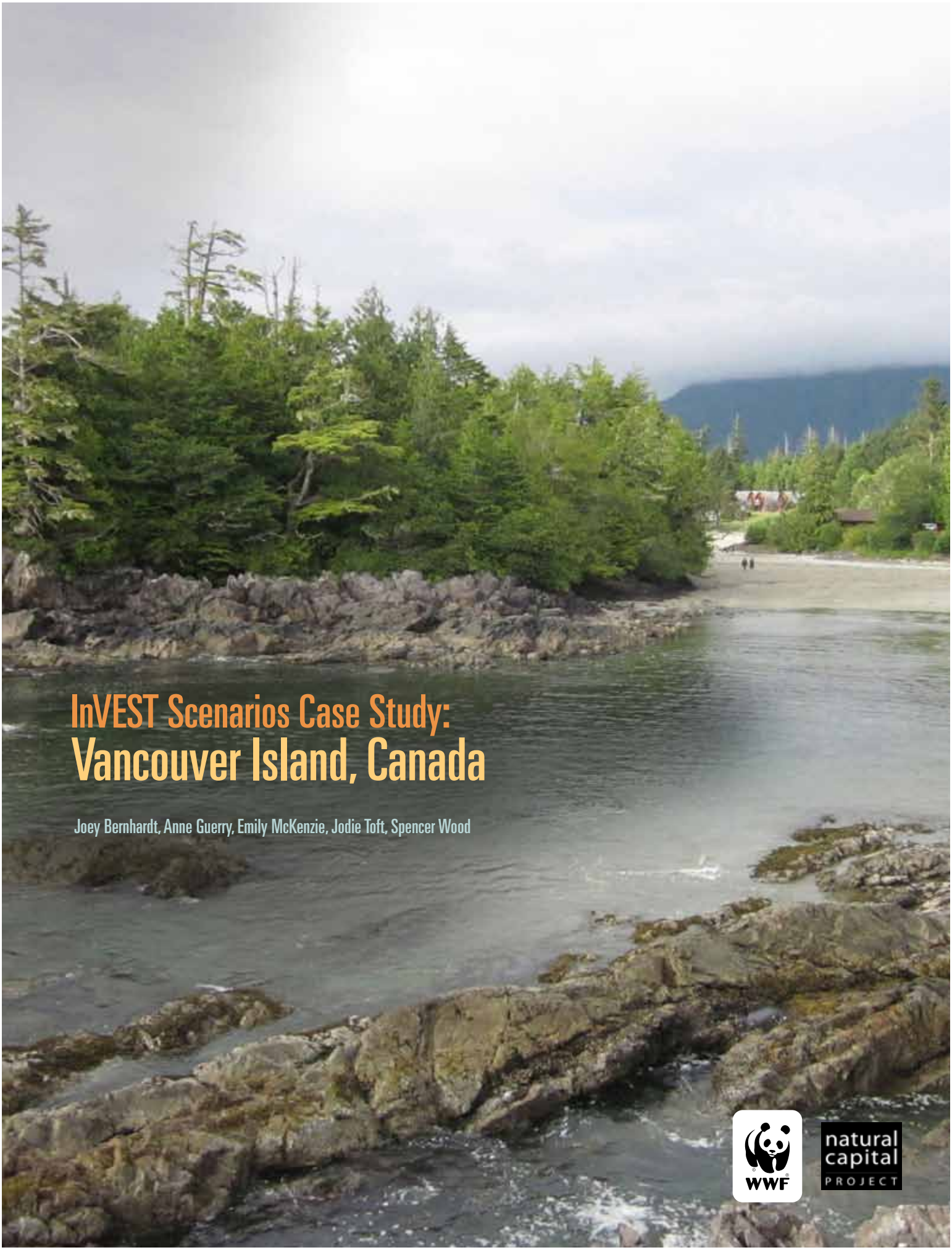

InVEST Scenarios Case Study:
Vancouver Island, Canada

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WWF

natural capital PROJECT

excerpted from

Developing Scenarios to Assess Ecosystem Service Tradeoffs

This case study highlights a real-world example of using InVEST scenarios to inform decisions about the use of marine areas. In this example, scenarios were developed, ecosystem service impacts were assessed, and the results were used to make sound policy decisions. The case study offers background on the policy context and goals, and then delves deeply into the experience with scenarios and draws out lessons.

Background

Along the west coast of Vancouver Island in Canada, multiple, often competing interest groups came together to envision the future of their coast and how myriad human uses could coexist without undermining each other or the marine ecosystem on which they depend. The West Coast Aquatic Management Board (WCA) is helping to achieve this by creating a marine spatial plan for the region. Marine spatial planning involves using scientific and geospatial information to address conflicts and organize human activities in the ocean, while maintaining ecosystem health, function and services.

WCA is a public-private partnership with participation from four levels of government (federal, provincial, local, and First Nations) and diverse stakeholders. Ultimately, WCA's vision is to manage resources for the benefit of current and future generations of people and nonhuman species and communities. Some key considerations for WCA and their stakeholders include balancing important industrial and commercial activities (such as shipping, mining, logging, aquaculture, and fisheries), increased development of tourism and recreation, renewable energy generation, access to healthy and local seafood, and a strong cultural desire for sustaining the remote, wild feeling of the place. Aesthetic, spiritual and cultural values—benefits that are not readily quantified—are universally important across the diverse communities.

What policy questions did the analysis set out to address?

WCA worked with the Natural Capital Project (NatCap) to apply InVEST as part of a four-year marine spatial planning process. The goal of the analysis was to (1) assess the suitability of regions for different activities; (2) assess how alternative spatial plans might affect a range of ecosystem services; and (3) identify the marine-use conflicts likely to arise from alternative spatial plans, and how such conflicts could be avoided or minimized.

What scenarios were selected?

Together, WCA and NatCap created a large number of spatially explicit scenarios, each representing alternative configurations and intensities of activities on the coast and in the ocean at a range of spatial scales (from that of single First Nations' territories to whole sounds and neighboring coastlines). Since marine

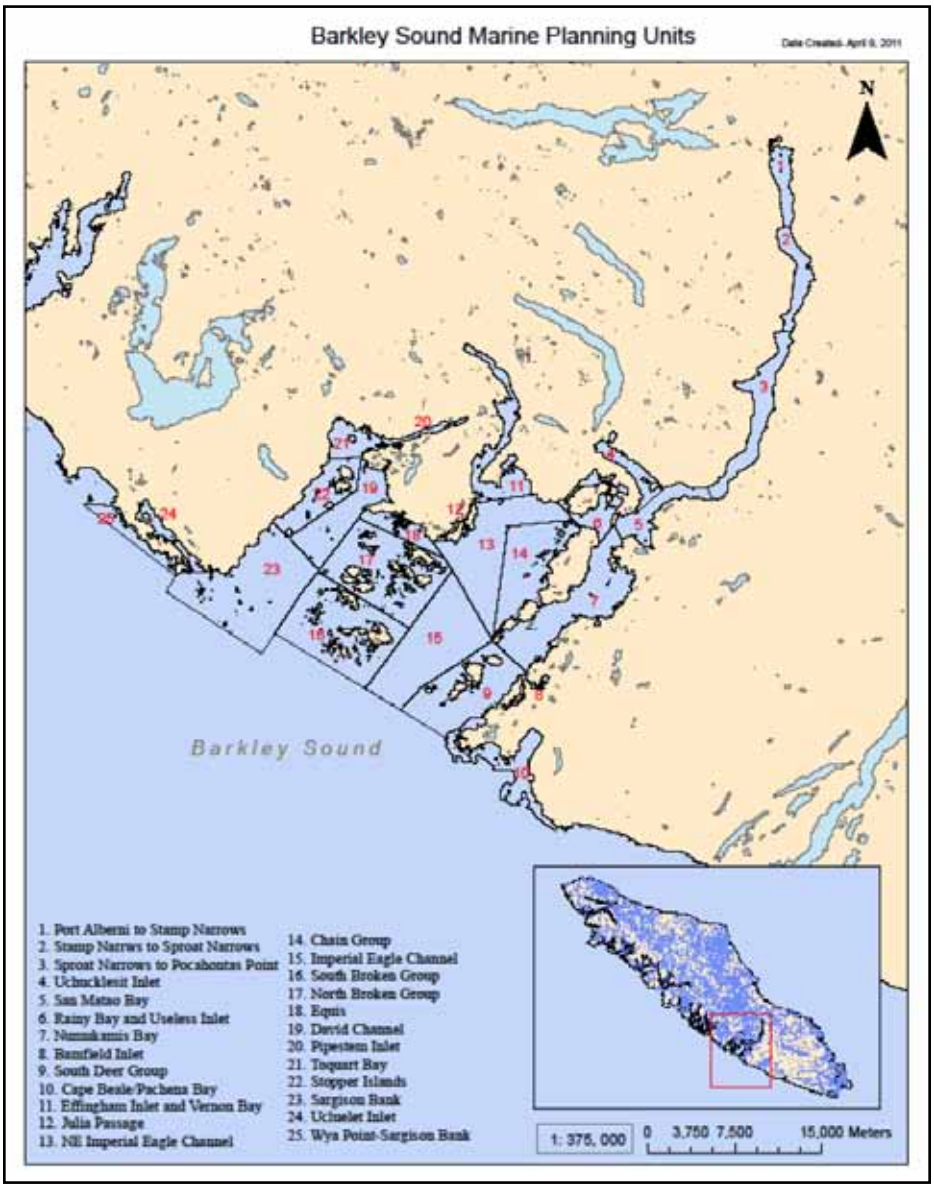
spatial planning involves a diversity of decisions made by different industries and government agencies at a range of spatial scales, the team needed to be flexible with the scale of analysis. In particular, the team developed scenarios at two distinct spatial scales, local and regional, each with a different mix of stakeholders and uses:

- **Local-scale zoning maps**: WCA and NatCap worked in close collaboration with each of nine First Nations in Barkley and Clayoquot sounds to develop a number of local-scale scenarios. The spatial scale of these scenarios matched the extent of each Nation's traditional territory (tens of km^2) (Figure 1, p. 3). These scenarios reflected the visions and values of each First Nation and consisted of zones for a range of human uses and activities. For example, zones were identified to accommodate important income-generating activities (e.g., finfish farms) as well as zones for cultural and spiritual activities (e.g., "culturally managed areas"). Each scenario represented an alternative arrangement of these zones in space (e.g., moving finfish farms from one inlet to another) or varying intensities or spatial extent of each activity (more or fewer finfish farms). The team created two or three alternative scenarios for each Nation's traditional territory.
- **Regional-scale scenarios:** These scenarios stitch together each of the small-scale traditional territory zoning maps to create regional-scale maps for the Barkley and Clayoquot sounds. After putting the local-scale maps together into one, the team overlaid them with other ocean uses (e.g., shipping lanes). The local-scale zoning maps primarily reflected the interests of the First Nations, whereas these larger-scale scenarios reflected the interests of a much broader range of stakeholders (industries such as commercial fisheries and aquaculture, shipping operators, etc.). It was most appropriate to reflect the interests of other stakeholders (such as Fisheries and Oceans Canada and tourism operators) in these larger-scale scenarios because these players use the ocean at regional scales (10–100 km^2). The regional-scale scenarios thus represent the intersection of the interests of large-scale ocean users (primarily commercial users and federal government) and the small-scale users in First Nations. The scenarios are being used to identify compatibilities and conflicts among multiple ocean uses.

How were scenarios developed?

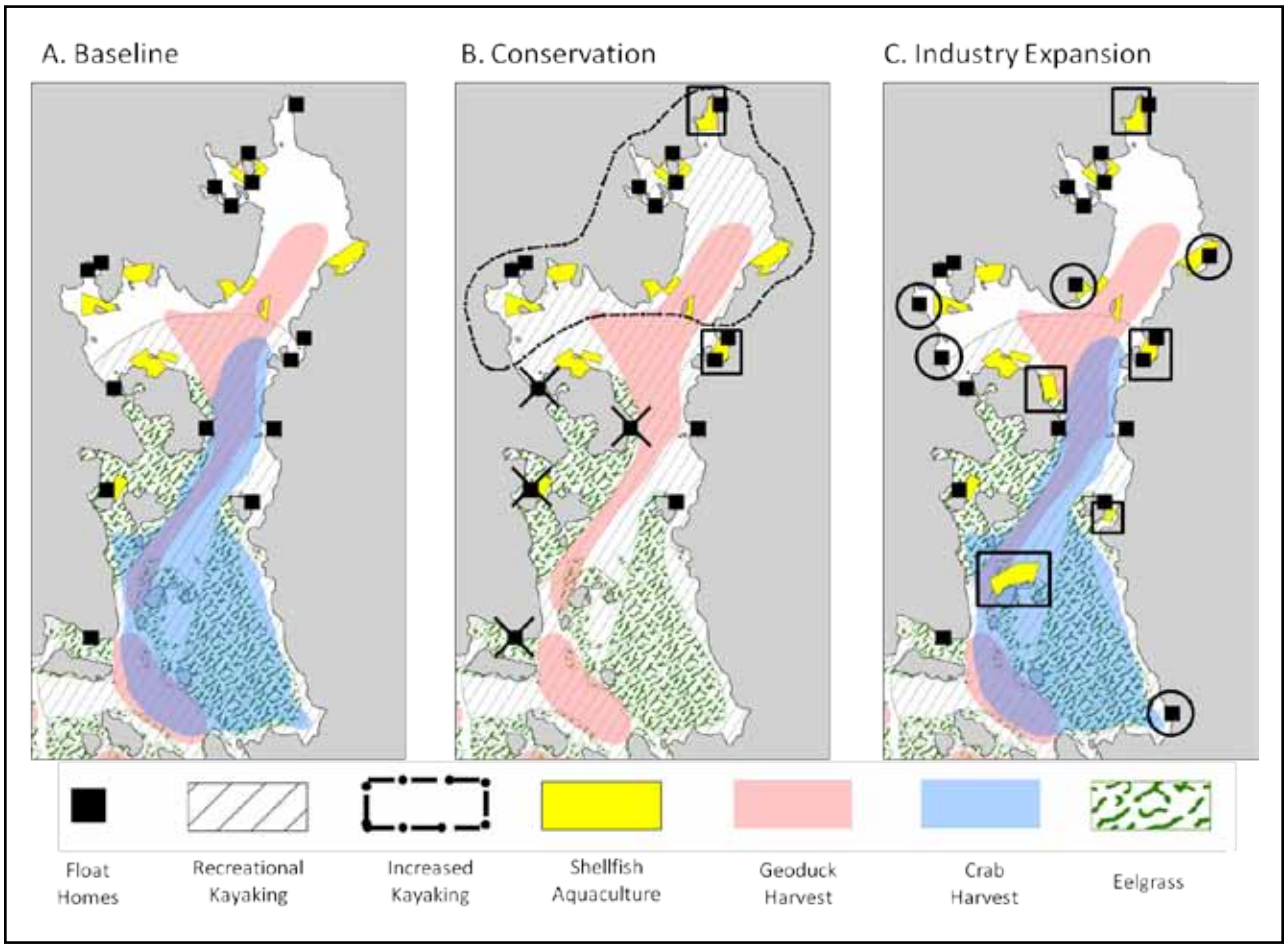
Together, WCA and NatCap developed these scenarios with extensive stakeholder engagement. The first step was to gather information on existing marine uses and activities. This information was scarce and widely dispersed. WCA gathered fragmented local knowledge through a year-long period of extensive stakeholder interviews. Next, NatCap and WCA used the information garnered from those interviews, plus a series of scenario-focused community meetings, to identify desired and likely changes in human uses and management. For example, some of the First Nations expressed an interest in expanding economic opportunities by developing the tourism industry within their traditional territory. Some of the tourism plans included developing new facilities such as resorts, campgrounds, and boat ramps.

FIGURE 1 Planning Units designated by West Coast Aquatic



The local-scale zoning maps created in collaboration with the First Nations correspond roughly with each of the Planning Units. The regional-scale scenarios correspond to the scale of Barkley Sound (shown here) and Clayoquot Sound. *Figure from West Coast Aquatic (2011).*

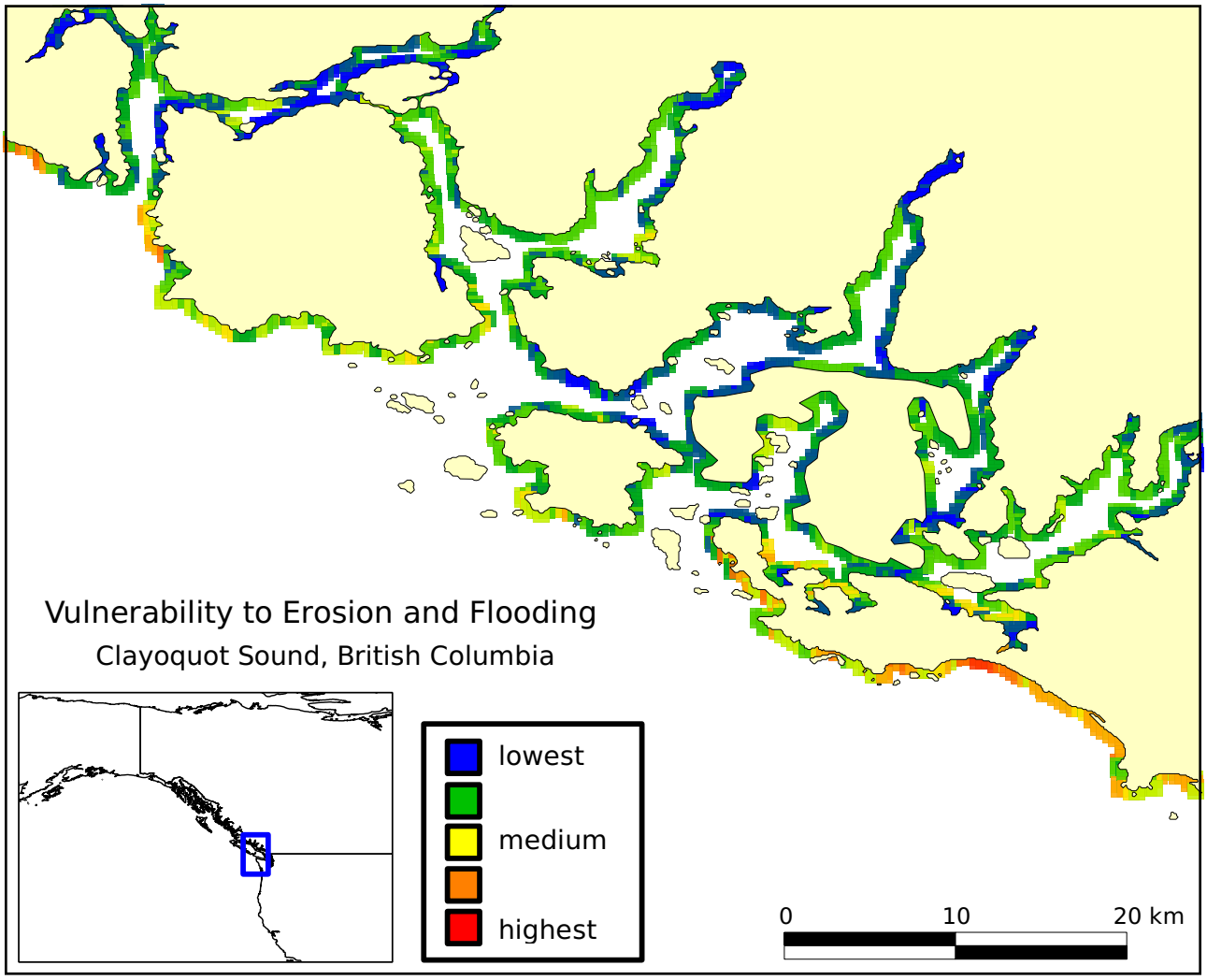
FIGURE 2 Three alternative management scenarios for Lemmens Inlet, British Columbia



Three alternative management scenarios for Lemmens Inlet, B.C., identified by West Coast Aquatic. (A) Baseline (no changes to current uses or zones). (B) Conservation (zoning rules restrict float homes and aquaculture in areas near eelgrass beds). Four float homes are removed from areas where they overlap with eelgrass (shown under black X's). Two new oyster deepwater tenures are located outside of sensitive habitat zones (shown in black squares). Kayaking routes expand into previously unused areas (shown in dashed line). Geoduck harvest is prohibited throughout the inlet. (C) Industry Expansion (five new float home leases are added, shown in black circles; five new oyster tenures are added, shown in black squares; and wild geoduck harvest is allowed). *Figure 4 in Guerry et al. (2012) International Journal of Biodiversity Science, Ecosystem Services & Management.*

The next step was to use InVEST Tier 0 models to build a better understanding of the most appropriate areas for particular marine uses (e.g., development of a new resort, new shellfish aquaculture tenures). For example, the InVEST Tier 0 Coastal Vulnerability model was used to understand the relative vulnerability of the shoreline to erosion and flooding, in order to determine the least vulnerable locations for resort development to occur (Figure 3, p. 5). Using this information, the team collaborated with the First Nations to develop scenarios that explored alternative spatial configurations of marine uses. Since the First Nations helped develop the scenarios, the scenarios reflected their specific desires for the future and local knowledge of what would be feasible within their traditional territory.

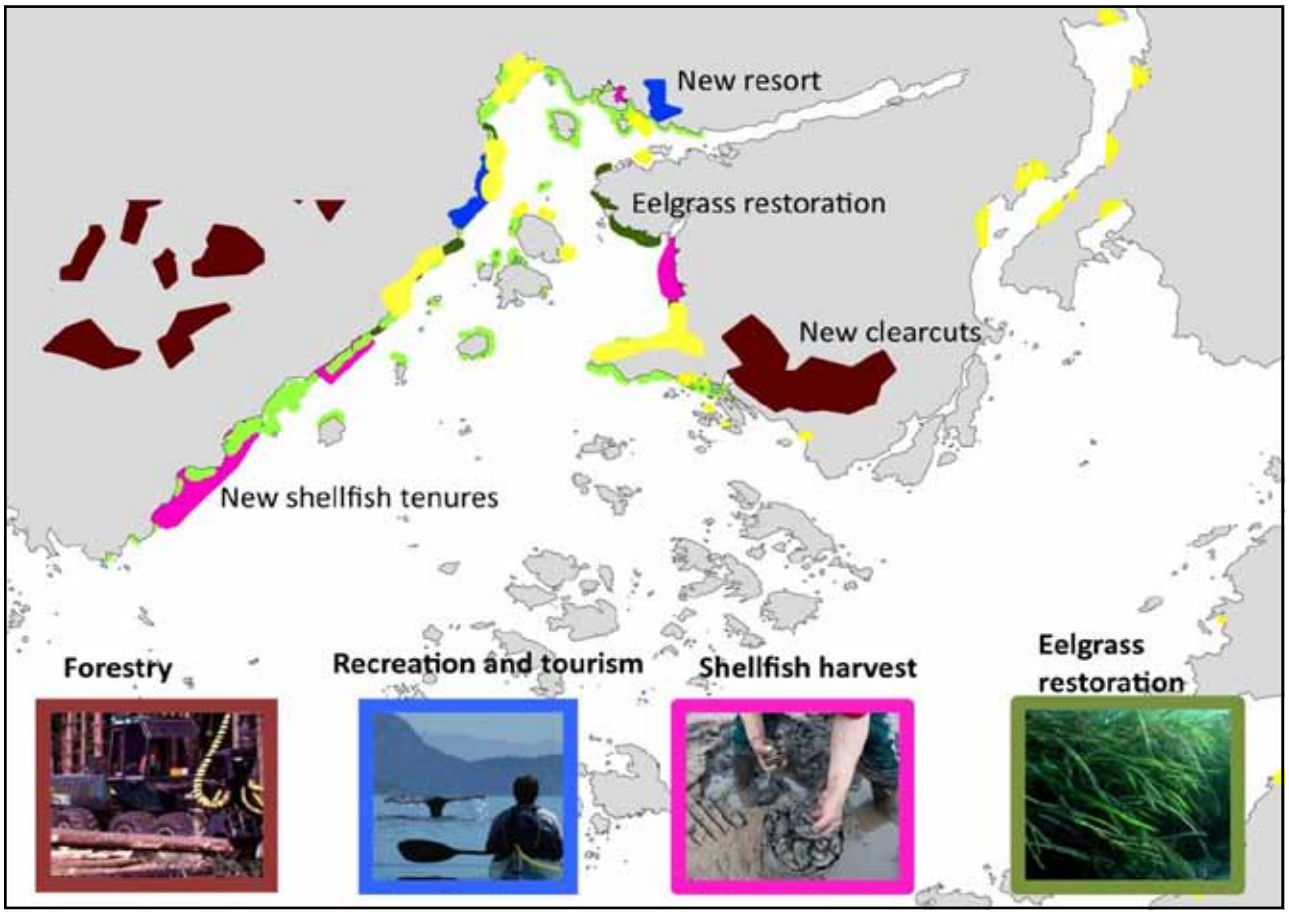
FIGURE 3 Output from InVEST Tier 0 Coastal Vulnerability model



These maps of coastal vulnerability are being used by marine spatial planners to inform locations of new development, as well as develop mitigative strategies for existing infrastructure and human activities occurring in regions of high vulnerability. *Unpublished figure from J. Bernhardt.*

To facilitate the collaborative scenario development process, the team used NatCap's online mapping tool—InSEAM—to enable multiple people to draw on maps in real-time. NatCap used these initial zoning maps to identify questions of particular concern, such as conflicts among stakeholders. NatCap then applied InVEST models to assess the impacts of specific changes in the spatial configuration of marine uses. For example, InVEST helped assess the impacts of a proposed new mine stockpile on the quality of views that people might experience from a proposed new resort. InVEST also served to identify unanticipated negative consequences of activities on other ecosystem services, such as exploring the consequences of finfish farming on coastal protection through indirect effects on eelgrass. These impacts had important consequences for stakeholders, but would not have been anticipated without the InVEST analysis.

FIGURE 4 A sample scenario map developed with the Toquaht First Nation for Toquart Bay



Each potential new human use is represented in a spatially explicit way. *Unpublished figure from J. Bernhardt.*

This process was repeated many times—developing spatial scenarios, running InVEST models to assess the impacts on ecosystem services, and revising the scenarios to reduce conflicts and negative impacts. When each First Nation has selected one or two preferred scenarios, WCA and NatCap will put all of the local maps into a few larger sound-scale maps and layer in other existing and potential future ocean uses (e.g., shipping lanes and commercial fishing grounds) to create a few alternative sound-scale scenarios.

How were scenarios translated into maps?

The original scenarios were in map form from the outset, so it was not necessary to translate them into maps (see Figure 4).

How did the scenarios shape the final results for policy makers?

The next phase of this project will involve presenting the first iteration of the regional-scale scenarios to WCA's board of directors, an entity with wide representation from stakeholder and sector groups. They will review whether the scenarios are likely to create conflicts with the activities of commercial sectors

and federal and provincial governments. WCA will then facilitate discussions among and within the sectors and the First Nations to try to resolve these conflicts where possible, and come to a common understanding of the marine spatial plan that best balances different interests.

Ultimately, the iterative process of developing many scenarios—gradually focusing on those marine zoning maps that protect or enhance ecosystem services—is guiding marine spatial planning. Not only is the work on track to inform the final coastal plan for the region, but it is also informing a number of decisions at smaller scales. For example, maps of coastal vulnerability to erosion and flooding from storm surge are helping to direct coastal development permits to low-risk areas. Similar maps of the value of captured wave energy are being overlaid with existing ocean uses (e.g., fishing and recreational activities) to highlight optimal sites of high wave energy value and low conflict with other ocean uses. Examinations of tradeoffs among aquaculture (finfish, shellfish), wild salmon fisheries, recreation (kayaking, whale watching, diving), coastal development (on the coast, as well as float homes), and habitat and water quality are under way.

Ecosystem service modeling results for scenarios have informed early iterations of the marine spatial plan and will inform the creation of the final plan in 2012. Understanding the ecosystem service tradeoffs of different scenarios is helping to identify where marine uses should occur, articulate connections between human activities that are often considered in isolation, align diverse stakeholders around common goals, use science to resolve conflicts among different interests, and make implicit decisions explicit.

Strengths

- Small scale zoning scenarios—developed by local communities to explore where marine uses and activities should occur—provided realistic and meaningful scenarios that could inform marine spatial planning.
- Working directly with First Nations and sector groups helped establish legitimacy and credibility in the region.
- Working with WCA helped the scenario development team to benefit from WCA's years of relationship-building with local communities.
- First Nations could be frontrunners for marine spatial planning because they have jurisdiction over their lands and waters, and they can go from planning to implementation relatively quickly (without approval from federal and provincial governments).
- InSEAM was a valuable tool for gathering information from diverse sources and for facilitating community involvement in scenario generation.
- InVEST Tier 0 models helped to develop the scenarios by building a better understanding of the most appropriate areas for particular marine uses.

Challenges and areas for future improvement

- Marine environments are complicated when developing scenarios. There is no single equivalent of a land-use/land-cover map for the marine realm. Authority and property rights are often unclear. No single marine planner knows where

everything happens on the seascape. And no one agency has jurisdiction over any given place on the seascape. Thus, the development and implementation of a marine spatial plan—and the scenario development entailed—requires coordination among many stakeholder groups and government agencies.

- Taking a community-based, bottom-up approach to planning and scenario development took extensive time and resources. Frequent iterations and extensive community stakeholder engagement in scenario development and assessment took more than two years.
- Mapping scenarios (particularly at local scales) from individuals' and communities' perspectives can be challenging because planning becomes personal. An individual's livelihood as well as that of his or her family and neighbors is at stake. This is very different from developing scenarios with a government official who may be more removed from the issues at hand.
- Working with First Nations groups can involve sensitive information and requires careful and respectful communication.

SNAPSHOT | Vancouver Island, Canada

POLICY CONTEXT

Policy level

Integrated federal, provincial, First Nations and local government decision making on management of Barkley and Clayoquot sounds

Policy questions

- where are different activities most suitable?
- how would alternative marine spatial plans affect ecosystem services?
- what conflicts among uses could arise? how do we avoid/minimize them?

Ecosystem services included

Food from fisheries and aquaculture, recreation, renewable energy, coastal protection, provisioning of aesthetic views, and carbon storage and sequestration. InVEST habitat risk and water quality models were also used.

SCENARIO PRODUCT AND PROCESS

Scenario format

Marine zoning maps at various scales and locations
Maps depict marine uses, developments and activities

Number of scenarios

At least 22 (2x9 at the local level, and 2x2 at the sound level)

Time frame for scenarios

Not explicit—looking at potential zoning configurations for marine spatial plan at unspecified future date

Spatial extent of scenarios

Varies from 10 km^2 to 100 km^2

Spatial extent of policy recommendations

10 km^2 (local scale) to 100 km^2 (regional scale)

Stakeholder participation in scenarios

High

Consideration of exogenous drivers

Medium

Consideration of endogenous drivers

Medium

Capacity and time required

High

Case Study References

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THIS CASE STUDY WAS DEVELOPED THROUGH THE NATURAL CAPITAL PROJECT, WHICH IS A PARTNERSHIP AMONG

Developing Scenarios to Assess Ecosystem Service Tradeoffs: Guidance and Case Studies for InVEST Users is a resource for practitioners who want to assess the provision of ecosystem services under alternative future scenarios. The guide draws on case experiences where InVEST was used to compare ecosystem service tradeoffs under different scenarios. It can help InVEST users choose appropriate types of scenarios and methods, engage stakeholders, and create scenario maps. The guide highlights key issues and questions for reflection, along with tools, case studies, references and resources for those who want to learn more.

InVEST is a suite of ecosystem service models, developed by the Natural Capital Project, for mapping, quantifying and valuing ecosystem services under different scenarios. InVEST helps decision makers incorporate ecosystem services into policy and planning at different scales in terrestrial, freshwater and marine environments.

Further materials are available on the scenarios page at naturalcapitalproject.org