Chapter 9: Skeena River Water Conservation Project: Building Tools for Adaptation

James Casey (Final SRWCP Report to be Released in Spring 2012)

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In previous chapters we have discussed the utility of the LPJ-GUESS model for simulating potential future harvest and climate scenarios, in order to support resource planning and inform possible adaptation actions at a regional scale. Forest and resource managers, however, require additional tools to support decision making at the site and landscape levels in order to capture ecosystem dynamics as they occur in areas of operation, and ensure that management objectives around other values are being met.

The Skeena River Water Conservation Project (SRWCP), led by WWF in partnership with Coast Tsimshian Resources, is aimed at promoting integrated management of watershed values through the development of a climate-sensitive cumulative effects modeling framework. As described in the introductory chapter, the study area for the SRWCP, encompasses TFL#1 and the Copper, Lakelse, and Kitsumkalum watersheds. Given the high social, cultural, and economic value of fish, waterways, and forests in the Skeena region, this framework has been developed by Cortex Consultants as a decision-support tool to guide planners in strategically managing forests to decrease the vulnerability of water resources and stream health to both climate change and harvesting. The scenario-based approach that the framework uses is especially important for aiding resource managers to engage in adaptive management in the face of significant uncertainty about future climate conditions. Although not yet developed, the framework also has the capacity to incorporate other resource sector operations, such as mining and run-of-river hydro. Section 99.1 introduces the cumulative effects modelling framework developed for the SRWCP. Section 9.2 closes with a discussion of scenario-based planning as tool to support climate change adaptation in the study area.

9.1 Climate Sensitive Cumulative Effects Modelling Framework

The framework uses a process-based forest estate model (RemSoft) to evaluate the effects of development on values of importance within the project area. A simulation approach in SELES is used to spatially place cutblocks and roads during 5 year time steps. Both areal and network indicators are tracked, allowing for experts from different fields to assess potential impacts on a variety of values. Indicators produced by the current implementation of the analysis framework focus on values related to hydrology, aquatic habitat, and forestry. In addition, the model produces some generalized indicators that could be applied to assess other values, such as those related to wildlife. Three climate scenarios currently accepted as representing a range of potential climatic conditions in B.C., CGCM3 A2 run 4, HadCM3 B1 run 1, and HadGEM A1B run 1 (Murdock and Spittlehouse, 2010) are used to explore the range of potential shifts in bioclimatic conditions and their potential effects on growth and yield throughout much of the SRWCP project area (Cortex Consultants, 2011). At the time of publication, the SRWCP was not yet complete, however it is presented here as an example of one tool available to support adaptive planning for forest and resource managers. A detailed summary of the project prepared by Cortex Consultants is available in Appendix 9.1, and the final report will be released in April 2012.

For the purposes of this study, the SRWCP framework has incorporated indicators from the Fisheries Sensitive Watershed Monitoring Protocol (Chapter 3). This expert based and peer reviewed set of indicators is invaluable in providing guidance to understanding what initial criteria should be considered. Table 9.1 provides examples of some the hydrological indicators that can be calculated directly from the outputs of the SRWCP and were selected largely based on alignment with the indicators being developed as part of the FSW monitoring. Reporting for each of these indicators can be further stratified according to landscape context, which will then enable stakeholders with various concerns and values to understand potential impacts. This approach facilitates the existence of a complementary planning tool should the monitoring protocol be implemented in the Skeena region.

There are a number of output formats and options from the framework that allow consideration of different climate scenarios and forestry operations on watershed values. The framework depends on input and interpretation from experts, decision makers and stakeholders, in order to accurately capture the values and unique attributes of the area where it is being applied (in this case the Skeena). In November 2011 an expert workshop was held in Terrace to introduce the framework and review and select indicators for stream health. The workshop summary report is included as Appendix 9.2. Currently, this framework is useful for strategic analysis of the impacts of harvesting and climate change on water values in the study area. In the future, the framework has the capacity to be used for operational planning which would require additional data input from CTR and other operators in TFL-1. In addition, integrated management and the use of tools like the one being developed under the SRWCP will require sufficient legislation and education to support integrated resource management.

Table 9.1: Examples of hydrological indicators that can be calculated from SRWCP framework outputs.

Examples of hydrological indicators that can be calculated from stratified attribute table.	Units	Examples of use
Equivalent clearcut area	ha	Valdal and Quinn 2010; B.C. Ministry of Forests 2001; Gustavson and Brown 2002; Forsite et al. 2007
Road density	km/km^2	Valdal and Quinn 2010; B.C. Ministry of Forests 2001; Forsite et al. 2007
Road density on steep slopes (>=50%)	km/km^2	Gustavson and Brown 2002
Road density on steep coupled slopes	km/km^2	Forsite et al. 2007
Roads within 100m of stream	km/km^2	Valdal and Quinn 2010; B.C. Ministry of Forests 2001; Forsite et al. 2007
Stream crossing density	$\#/km^2$	Valdal and Quinn 2010; IWAP; Gustavson and Brown 2002
Stream crossing density on steep slopes (>=50%)	km/km^2	Forsite et al. 2007
Logged fish bearing streams	km/km^2	Valdal and Quinn 2010
Logged S1-S6 streams (all)	km/km^2	Valdal and Quinn 2010
Logged S1-S6 streams (recent)	km/km^2	Valdal and Quinn 2010
Disturbed streams	km/km^2	Valdal and Quinn 2010; Gustavson and Brown 2002
Disturbed S4-S6 streams	% of total length	Gustavson and Brown 2002; B.C. Ministry of Forests 2001
Stream adjacent to sleep slope	km	Forsite et al 2007
Area in alpine and alpine forest	km^2	Forsite et al 2007

9.2 Scenario-based assessment of climate change and management decisions

Humans have a tendency to plan for the future based largely on their knowledge and experience of the past. This is no different when it comes to resource management. Traditionally, although planning may include assumptions that future socio-economic or political conditions will change, ecological and climate conditions were, until recently, considered to be relatively constant and predictable. However, we are quickly learning that this is far from true. As a result of both climate change and the cumulative impacts of human activities, ecological conditions do, and will continue to, change. So, if climate change means we can no longer rely on trends from the past to predict the future, what approach is available for those tasked with long-term planning?

Scenario-based planning is one approach gaining prominence as an aid to making decisions amidst uncertainty. Scenarios are described as "stories or 'snapshots' of what might be" (Wollenberg, 2000). Scenarios are cognitive aids that allow local decision makers to understand the possible impacts of large scale drivers that they might not have direct control over. Unlike predictive approaches such as hazard assessments, the scenario approach involves creative visioning for different possible futures (Wollenberg, 2000). In particular, the axis approach to scenario building is a common method for structuring the development of scenarios meant to encapsulate the whole range of possible futures based on best available information (Groves, 2007).

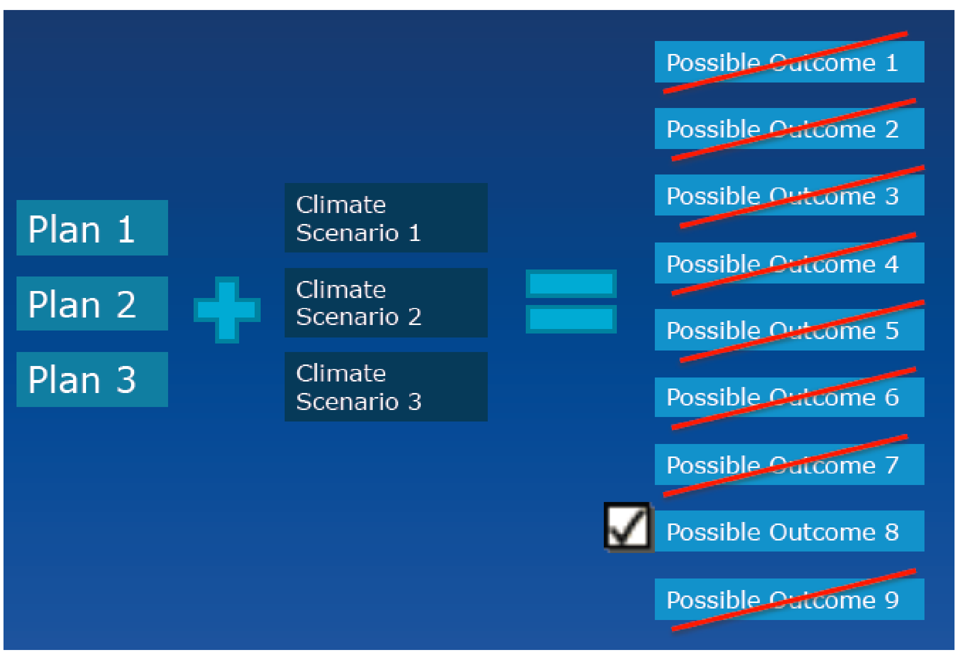

Figure 9. 1. Scenario-based planning helps decision makers understand a range of possible futures in order to identify the best possible path to achieve positive outcomes.

The Skeena River Water Conservation Project produced a unique tool. It has translated climate information into operational level information, relevant for forestry planning and for the development of scenarios that can be used to assess the potential consequences of forestry decisions on freshwater ecosystems. Through this process, the research team has become very aware of the limitations of current climate information, and the significant effort required to make current approaches to forestry management responsive and resilient to the impacts of climate change.

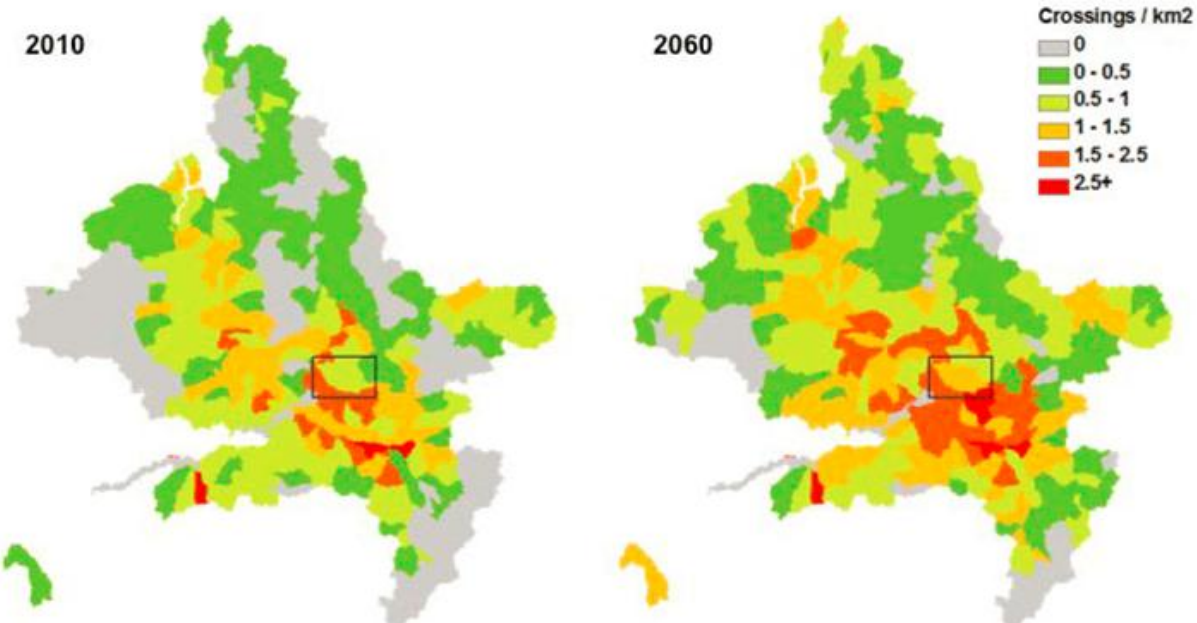

Figure 9. 2: Stream crossing density shown for 2010 and projected stream crossing density in 2060. Such outputs help identify high-risk areas and inform management efforts to decrease vulnerability. Adaptation options could include reviewing road construction standards in high-density zones, or implementing monitoring programs.

The final report of the SRWCP, to be released in the summer of 2012, will include the results from 4 different scenarios. As in the CCAP project, the Cortex modeling team used emissions scenarios A1 B, A2, and B1 (See Chapter 5.1 for a description of the IPCC Emissions scenarios). The impact of these different climate futures was captured using the Climate WNA program developed by Wang et al (2010) to translate a total of eight key variables into information that can reconstruct the expected shifts of biogeoclimatic zones. The next step was to translate the projected climate impacts into impacts for the forest sector, including, for example, the impact of BEC zone shifts on species composition and timber supply (See Figures 9.3, 9.4, 9.5). The hypothetical shifts in tree species resulted in changing costs and opportunities for Coast Tsimshian Resources, and other operators on the land-base. Although refinement of the data still needs to occur, this is an important first step that represents the potential for including scenario planning in forest management.

Using indicators established through the FSW monitoring protocol (Chapter 8) and through the expert workshop on hydrological indicators (Appendix 9.2), scenarios developed using the Cortex framework also illustrate the implications of human activities on other values such as watershed health and fish habitat (See Figure 9.2). The community interviews clearly indicate that these are important values and that action to protect them would be looked upon favorably by all three communities. The results can be used on a strategic level by both Coast Tsimshian Resources and the community, to understand the types of conditions that they may need to plan for, or respond to, in the future. It is hoped that when the final report is released, results will encourage further dialogue and negotiation about the future direction of forest and resource management and the sustainability of freshwater ecosystems for the benefit of the region.

In addition to climate change scenarios, modellers also included options to assess potential impact of the three different harvesting schedules examined in the CCAP study – including a 50 % reduction in the AAC, a 50 % increase in the AAC, and a scenario representing no change to the AAC. Given the uncertainty about the future of the tenure, these scenarios were not chosen based on actual potential futures, but are used only to illustrate how different harvest levels may interact with climate change and ecosystems at an operational scale. As discussed in Chapter 6, this is an important complement to the outputs from the LPJ-GUESS model that consider these changes on a larger scale and without the addition of hydrological indicators.

Together these set of options allowed the research team to model potential impacts of the interaction of forest management decisions and climate change on environmental resources identified as important values by community members. The combination of these options provides a starting point to map out possible pathways, and to identify risks associated with different paths. With adequate investment in adaptive management, there is high likelihood that adaptation measures undertaken now will protect the valued resources of the area long into the future. Scenario planning is one tool that community members and resource managers can use to visualize the costs and benefits of adaptation measures and choose actions appropriate to the region. Given the amount of data and work already achieved with respect to modeling the region, this is an excellent opportunity for stakeholders, and especially Coast Tsimshian Resources, to invest in the further development of this framework.

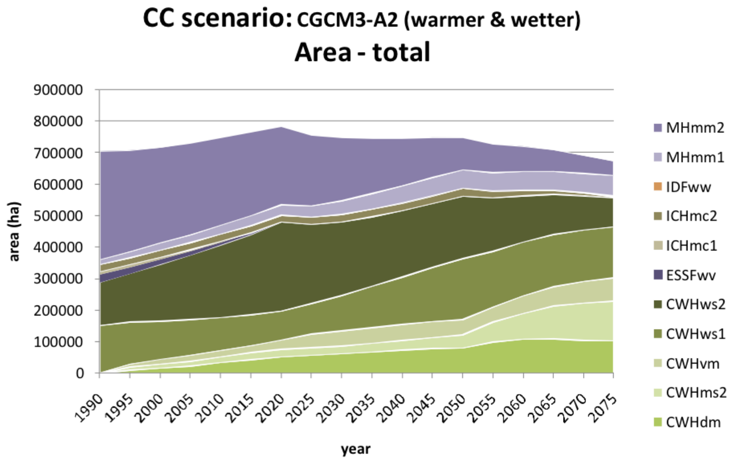

Figure 9. 3 Projections of species composition for the SRWCP study area under the A2 climate scenario.

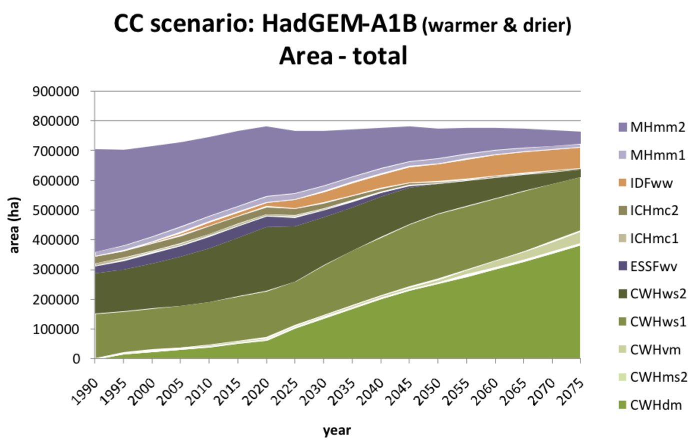

Figure 9. 4: Projections of species composition in the SRWCP study area under the A1B scenario.

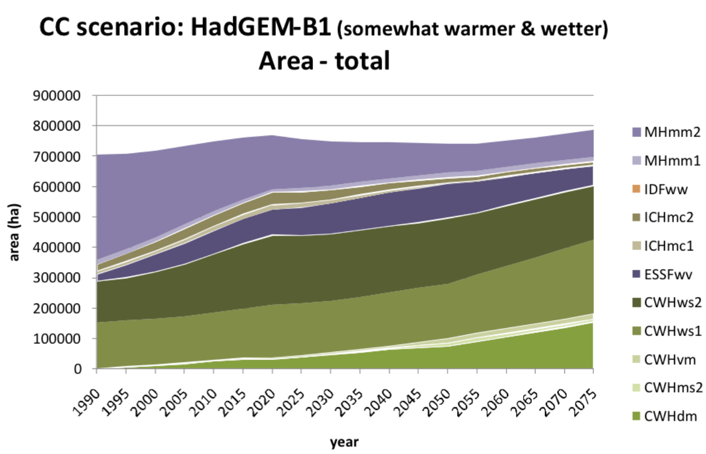

Figure 9. 5: Projections of species composition in the SRWCP study area under the B1 scenario.