Workshop on the Cumulative Impacts on Salmon

February 17, 2012
Northwest Community College

Purpose:

The purpose of the work planning session is to provide strategic direction to the Bulkley Valley Research Centre's "*An integrated assessment of the cumulative impacts of climate change and industrial development on salmon in Western British Columbia*" project. Based on the strategic direction a work plan will be drafted to direct the project's activities.

Attendees:

Don Morgan (Principle Investigator)
Ivan Thompson (Moore Foundation)

Aaron Trowbridge (MARR)
Alison Beal (Bulkley Valley Research Centre)
Barry Watson (MFLNRO)
Blair Ells (MFLNRO)
Dave Daust (consulting ecologist)
Greg Tamblyn (Ministry of Environment)
David deWit (Office of the Wet'Suwet'en)
Greg Knox (Skeena Wild)
Irene Ronalds (Bulkley Valley Research Centre)
Jim Pojar (SkeenaWild Trustee)
Katrina Connors (Pacific Salmon Foundation)
Matt Sakals (MFLNRO)
Michelle Tung (Pacific Salmon Foundation)
Mike Sawyer (consultant)
Richard Overstall (consulting lawyer)
Jane Lloyd-Smith (MFLNRO)
Rick Budhwa (Bulkley Valley Research Centre)
Walter Joseph (Office of the Wet'suwet'en)

Moore Foundation (Ivan Thompson)

- Their main focus is currently the Amazon/Andes region, but approximately 5% of their funding goes to the northwest region
- Mandate is not to stop development
- No energy or climate change program or approach

- They have been the largest private funder of salmon science in North America for a while
- They consider themselves a junior partner and collaborator playing a supporting role, but not a major driver
- They are not investing in pure salmon science right now, but rather in what we should be doing (the issue is not knowing, it's not knowing how to do it)
- They have the resources to hire the best people to tell them the right things to do
- Funding for this project is from their Pacific Salmon Program which is one initiative within their environment and conservation program
- They support areas that are most intact
- They may only be here for temporarily so it is in our best interests to make sure we make a difference

Project Objectives

- To conduct an assessment of the cumulative effects of ecological and industrial scenarios on aquatic, and their dependent terrestrial, ecosystems in the Cassiar-Iskut-Stikine Land and Resource Management Plan area and in the upper Morice Watershed.Proposed activities:
    - Organizing existing knowledge of the current and historic dynamics in the two study areas;
    - Adapt or create models of social, economic and ecological metrics;
    - Cataloging potential future ecological and human dynamics, including climate change; and
    - Developing and analyzing scenarios of possible futures.

- Identify and develop methods for government/non-government collaboration on decision making and long term environmental monitoring. Proposed activities:
    - Identify and develop alternative institutional mechanisms for government/non-government collaboration on cumulative effects assessments and decision making;
    - Develop tools for evaluating risk and trade-offs from cumulative effects; and
    - Project extension.

Project Overview and Linkages (Don Morgan)

- It would be great to see this project funded by interests other than the Moore Foundation (see project proposal Appendix 1)
- People and government need to change the way they think for this to work
- Need to move from a project-centered approach to a value-centered one
- How do we manage different scenarios of Cumulative Effects (CE)

See Appendix 2 for the Power Point Presentation "*An Integrated Assessment of the Cumulative Impacts of Climate Change and Industrial Development on Salmon in Western British Columbia".*

Discussion:

Participant

- MARR interested in proponent dynamic so that duplication of efforts does not occur
- perform a gap analysis
- need to collate information

Participant

- Bustard report identifies gaps in fish management in Morice and is a good place to start
- Access to this report is currently unknown
- Tamblyn has synthesized some of the information in his thesis work but uses a systems approach

Participant

- Need to have a retrospective look at upper Stikine and Hwy 37 corridor which had two major incursions about 40 years ago (what it was like)
- Dave Bustard and Dave Hatler were working in this region back then, and would be great resources now

Participant

- Real historical perspective is necessary to tell the story appropriately

Participant

- Need to make inventory of what information actually exists
- Each organization should coordinate on how and what information they are collecting, so it's as efficient as this can be
- Link websites and projects to other groups, like Pacific Salmon Foundation

Participant

- There is a need for someone to pull all of the background information together, but this can be overwhelming and unstructured, and not useful
- Background information must be linked back to a consistent conceptual model so it can relate to decision making.

Participant

- Must measure the level of uncertainty around the metrics, which is related to the level of risk that society is willing to take. There is so much uncertainty, we can't let you go in and do that right now. We have to determine whether to invest in order to reduce uncertainty.

Participant

- How good is our anthropogenic disturbance information for our project region?

Participant

- Structure information and link it to specific problems
- Should not be opening projects in an area for which we do not have any information

Participant

- OK on social and economic side, but not much beyond

Participant

- Socioeconomic aspects not really well represented
- People like Kevin Kriese require this information in order to be better informed to make decisions

Participant

- Socioeconomic piece very important, because paradigm needs improvement
- Failure of our decision-making has to do with time. If we dealt with time more appropriately, we would have better results
- To what degree are we willing to trade off short term for long term gain

Participant

- Issues of scale and time

Participant

- This project will provide a tool for pushing for a paradigm shift, so it would be good to consider a sister project for this that focuses on the socio-economic aspects

Participant

- Is the socio-economic going to be a technical assessment or does that information get fed through the local political system? For example, the Office of the Wet'suwet'en may not want a bunch of sociologists and economists studying their system, vs another, perhaps more ecological, traditional way

Participant

- Alternative strategies on how to do this work must be explored. For example, integrating independent science. See Don's PowerPoint presentation (Appendix 2). Highlights BWMT and general shared decision making entities

Participant

- Disturbance inventory – social and economic is weak. Need to know more about economic and social trade-offs.

INTEGRATING INDEPENDENT SCIENCE

1 Alternative institutional mechanism for collaboration

- Some mechanism whereby proponents and interest groups can develop and direct actions on a governing body. Gov't is responsible for the decisions, who is the guardian of the information. How do we make sure that the info is unfettered. A Trust, with reps from gov industry, first nations interest groups.

2 Evaluating risk and trade-offs from cumulative effects

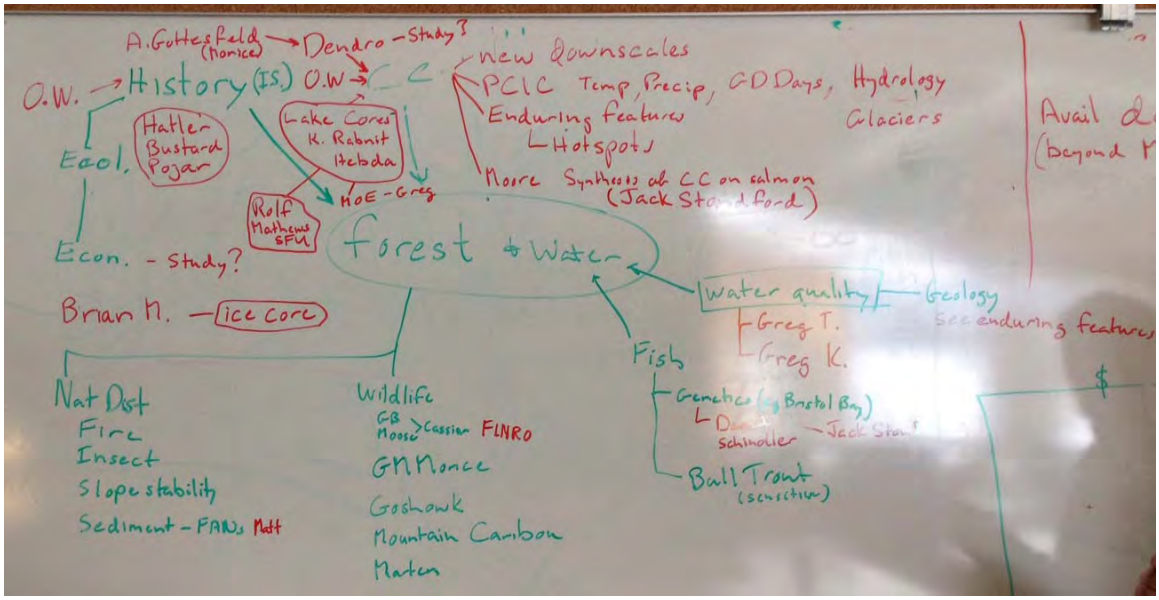
3 Project extension outreach

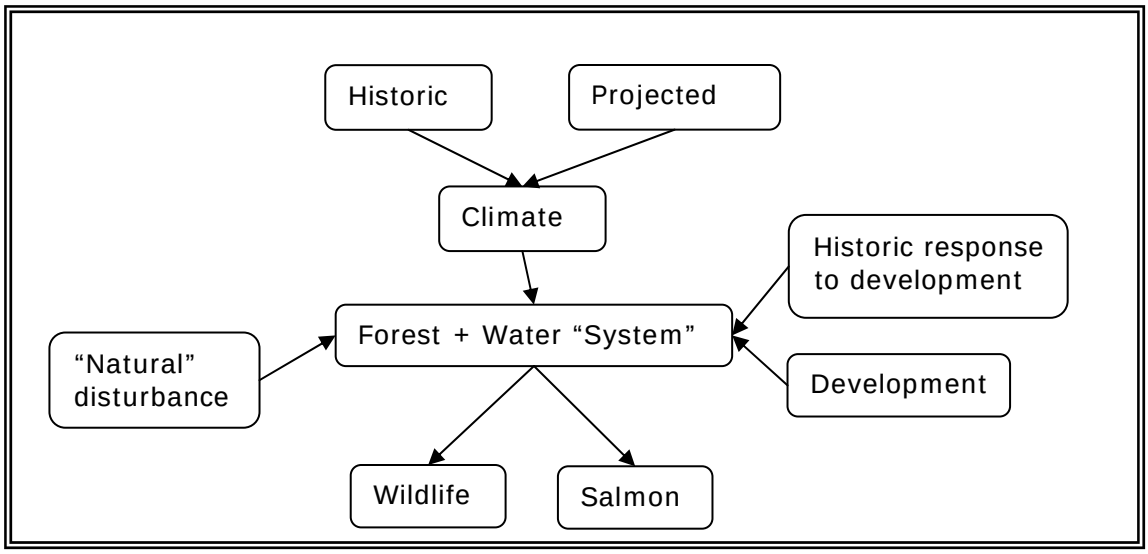
- Upper Morice Monitoring Protocol
- Operational Plan for Water Quality, Fisheries Resources
- Morice Water Management Area (from LRMP)
- BC Govt and OW
- Greg Tamblyn, Dave Dewitt,

- Baseline water quality, biological resource inventory
- Water quality objectives and management targets
- Set limits upfront
- Long-term monitoring plan (Jan 2009)
- 40 monitoring stations
- 2008 $100,000 for monitoring that year
- Building capacity with OW
- No ongoing funding at present.
- OW saw participation as a way of working collaboratively and a means to shared decision-making
- Majority of salmon stocks spawn in that area. how to designate as an official plan
- Not legal arrangement yes, but continuing to build that relationship
- West Coast Environment Law may be able to provide guidance

POTENTIAL PROJECTS / TASKS

Developing an understanding of the forests and water systems (Figure below) to support cumulative effects assessment will require several projects (listed below figure). Note that some projects will be limited to the Morice TSA or to the Upper Morice Zone and others will extend into the Iskut-Stikine.





Potential Projects related to climate change

Downscaled climate projections

- Obtain list of needed variables from terrestrial ecologists and hydrologists (e.g., temp, precip, growing degree days, glacier melt, rain/snow ratios)
- Contact PCIC to see what's available

Historic climate from dendrochronology

- Contact Alan Gottesfeld to see if he has information for the Morice

Historic climate from lake cores

- Contact Kenny Rabnit
- Get Richard Hebda or Rolf Mathews (SFU) to interpret

Historic climate from ice cores

- Contact Brian M. to see if he has ice core data relevant to the region

Enduring features

- Identify underlying topographic features, soils and geology that are responsible for ecological diversity; identify potential biodiversity hotspots (e.g., serpentine geology; floodplains)

Impacts of climate change on hydrology/salmon

- Find out what information Jack Standford can provide on hydrological impacts of climate change.
- Get copy of *Climate Change Impacts on Salmon* by Jack Standford

Potential projects related to traditional knowledge

Historic climate from Traditional Knowledge

- Aim to gather knowledge about historic climate

Summary of traditional knowledge of development impacts

- Aim to gather knowledge about impacts of historic development from elders

Potential projects related to development

Retrospective study of impacts in Iskut-Stikine

- Contact Dave Hatler and Dave Bustard to determine if they have data needed to characterize impacts of developing rail and Highway 37; develop project

- Contact Dave Hatler to see if he has data/observations to document the switch from caribou to moose (may be due to climate and/or development)

Potential projects related to disturbance

Landscape disturbance models

- Develop Landscape ecology models based on existing Nadina and/or Morice models, considering current and projected disturbance regimes (e.g., fire, insects, disease, harvesting)

Hydro-geomorphic models

- Develop models of sediment input (erosion and slides) that account for watershed type, current and projected climate and development.
- Consider using process based on Watershed Assessment Procedure (ask Mike Z. about his past work)
- Would be nice to have explicit model of hydrology to account for changes in winter rain to snow ratios, snowpack, melting glaciers, etc. (ask Matt for advice)

Potential projects related to wildlife

- important species include grizzly, moose, goshawk, caribou and marten

Collaborate with FLNRO to obtain grizzly bear and moose assessment models

Identify other existing models and plan work to extend models

Potential projects related to salmon and water

Characterize diversity among salmon runs

- contact Daniel Schindler and Jack Standford to assess progress on characterizing genetic and physiological diversity among salmon runs (e.g., similar to Bristol Bay)
- compare to watershed/stream characteristics
- estimate impacts of fishing pressure and climate change on different runs

Develop bull trout assessment model

Develop salmon assessment model

Projects related to Upper Morice

Develop collaborative governance model for Upper Morice

- examine legal context
- seek approval from Wet'suwet'en leaders
- seek funding
- use BV Centre to store funds
- note that pipeline funds may be available

Summarize and describe potential use of Upper Morice water quality data

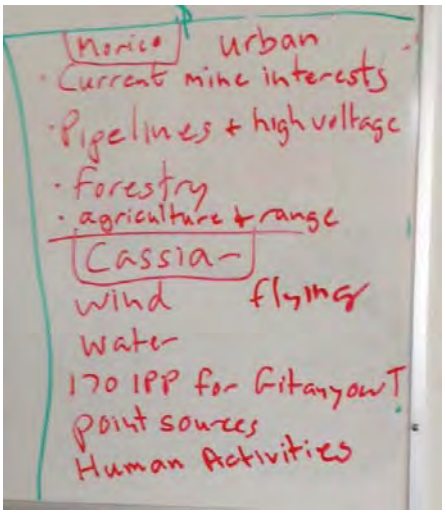
Identify natural sources of chemical water pollution

- locate geological features that can pollute water (link to enduring features work; use mineral interests as source)

Other

Scope out information needs for a socio-economic assessment

TYPES OF DEVELOPMENT TO CONSIDER



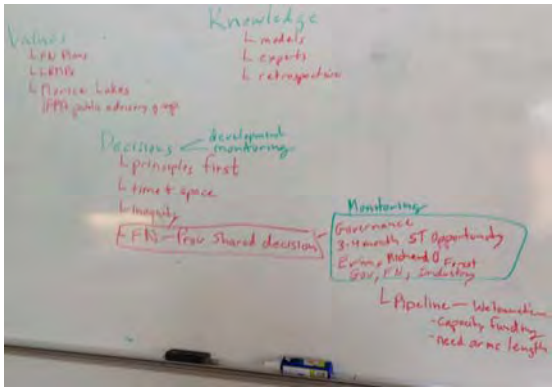
Morice

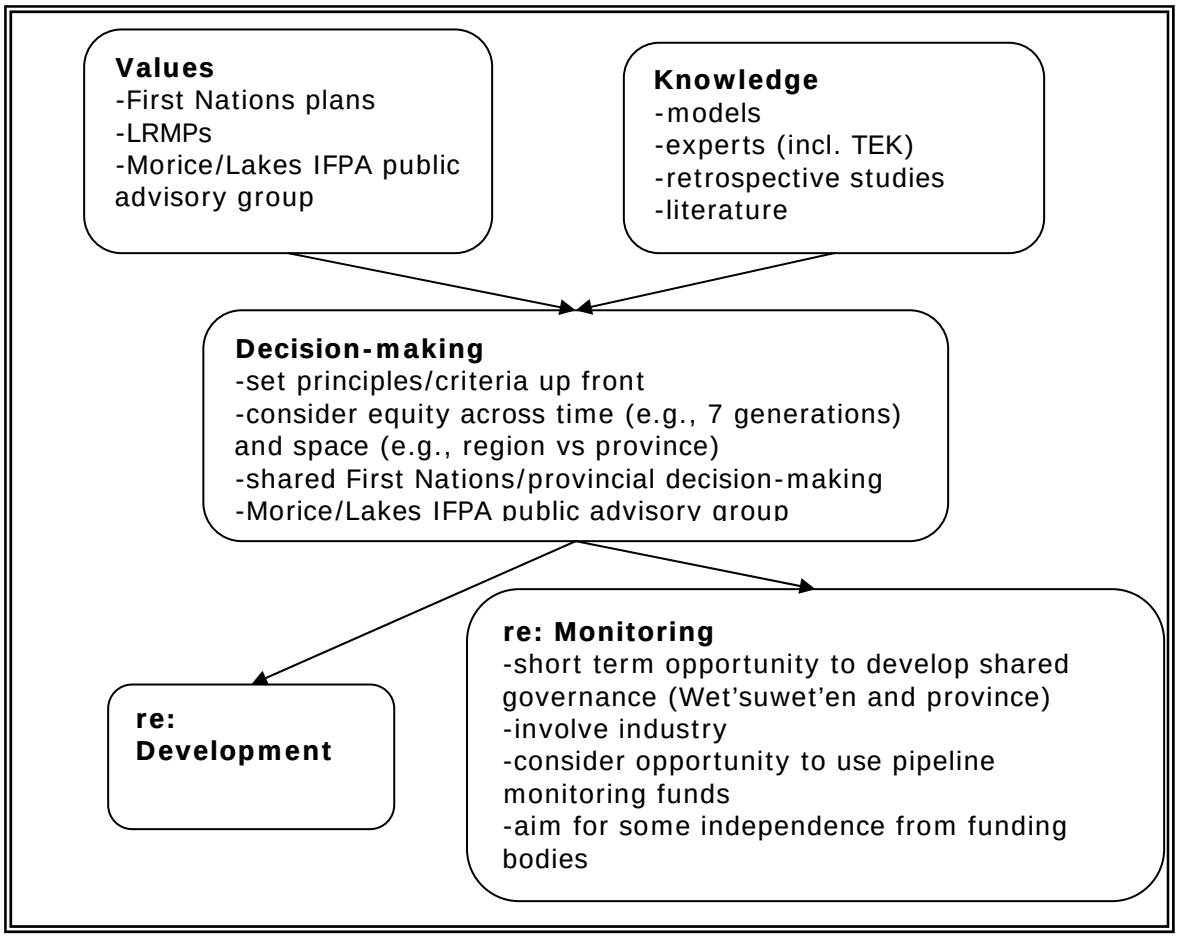
- current mine interests
- pipelines and high voltage (e.g. Morice)
- forestry
- agriculture and range
- linear – high voltage lines
- urban

Cassiar

- 170 IPP in Gitanyow Territory – investigative uses permits
- wind and water
- aircraft
- point source (urban, camp)
- access and corridors
- human activities

Decisions about resource development and subsequent monitoring should reflect knowledge and values (Picture and Figure below).





- Bulkley Valley Research Centre as interim body to monopolize on short-term opportunities.
- Bulkley Valley Research Centre to convene a quick process to design trust involving OW, government, forest companies.
- Bulkley Valley Research Centre as an entity that can receive money.
- There is some support to get some of the short-term work going in establishing a governance model.
- Bulkley Valley Research Centre going to write up a couple of pages as to what this may look like and circulate for feedback and ratification.
- Should we meet again – perhaps in 6 months?
- In the short term the geographic scope would be upper Morice.

Project Title: An integrated assessment of the cumulative impacts of climate change and industrial development on salmon in Western British Columbia

Project Term: 2 years

Project Leader: Don Morgan, Bulkley Valley Research Centre and BC Ministry of Environment, Smithers, BC

Date: 30 September 2011

Introduction

This proposal addresses the Moore Foundation's goals of scientific research and advancing environmental conservation in northwest British Columbia. Under the Wild Salmon Ecosystem Initiative the Moore Foundation is funding a range of projects in north western BC in an effort to preserve salmon stocks and the terrestrial and aquatic ecosystems that they depend (http://www.moore.org/). The provincial government is currently considering an expansion of industrial development including, mining, and hydroelectric development triggered by the extension of electrical power into the northwest. There is an urgent need to synthesize the existing science on salmon, aquatic and terrestrial ecosystems, wildlife, climate change and industrial development, and to integrate this information into current decision making in north western BC.

The project has two main objectives. The first is related to resource management operations, at the watershed scale, and it will conduct an assessment of the cumulative effects of a set of ecological and industrial scenarios on aquatic, and their dependent terrestrial, ecosystems in two study areas. The second is strategic, at the provincial scale, and is focused on methods for government/non-government collaboration on decision making and longer term environmental monitoring.

Operationally, this project proposes to collate existing science and data in order to conduct a systems assessment of the cumulative effects of climate change, hydroelectric, mining and forest development in the Skeena, Nass, Iskut and Stikine watersheds of north western BC. By taking a systems approach the project can focus on the larger context and dynamics that interact in the northwest. Detail on specific elements that are being considered under a cumulative effects assessment can be drawn from existing knowledge and research and summarized to a system level scale that is appropriate for strategic scale natural resource management decisions. Through such assessments knowledge gaps can be identified and prioritized for further research.

There is an opportunity to provide science-based information to current land use management initiatives in north western BC, including:

- Government lead cumulative effects assessment project surrounding the NTL in the Nass, Iskut and Stikine watersheds – Fred Oliemans and Don Morgan
- Individual proponent lead environmental impact assessments

- Skeena monitoring - Skeena Wild Conservation Trust – Greg Knox
- Regional First Nations – consultation on resource development impacts on wildlife and fish

Strategically, the project will be structured to integrate with existing decision making processes, including the government lead cumulative effects initiative surrounding the Northwest Transmission Line (NTL), climate change adaptation assessments and sustainable forest management planning. Further, the project will assist in establishing the technical basis for structuring long term research and monitoring systems in BC.

Managing for social-ecological resilience is emerging as an approach to resource management that recognizes the role of people in ecosystems and the inherent dynamic nature of forest and hydrological ecosystems (MA 2005, Chapin et al. 2009). Applying a social-ecological systems approach in north western BC, focused on the ecosystem services of salmon and water, would consider the dynamics of terrestrial and aquatic ecosystems, and human use of services across a range of plausible social-ecological scenarios. This will help inform decision making such that the ecosystems of north western BC can continue to provide valued ecosystem services. As part of the considerations of human dimensions, First Nations' insights into current and historic systems resilience are another invaluable source of information for decision makers. Communications with First Nations groups within the geographic region will be a significant contribution to this project.

The results of this project will provide government and stakeholders with key metrics to assess the long-term impacts of different development scenarios on the abundance and diversity of wild salmon and habitat disturbance measures, including shifts in hydrology, road development and extent of industrial development. Further, it will provide a context for First Nation and community engagement in the northwest on the impacts of a changing climate and expanded human development on ecosystem services. As well, it will provide a foundation for providing more detailed, scientifically credible information to government decision making.

Project Objectives

The project has two high level outcomes, each with a series of objectives:

1. Technical assessment of cumulative effects of two study areas in Northwest British Columbia
    a. Organizing existing knowledge of the current and historic system dynamics;
    b. Models of social, economic and ecological metrics;
    c. Cataloging potential future system dynamics; and
    d. Developing scenarios of possible futures.
2. Integrating independent science into government decision making in British Columbia

a. Alternative institutional mechanisms for government/non-government collaboration on cumulative effects assessments and decision making; and

b. Evaluating risk and trade-offs from cumulative effects;

c. Project extension.

Proposed Methods

1. Technical assessment of cumulative effects in Northwest British Columbia

The project will collect data and information for the Skeena, Iskut, Stikine and Nass drainages. For the more detailed work the project will initially focus on two proof of concept areas; one the "Iskut", containing the Iskut, Stikine, Nass area that is aligned with a current government lead cumulative effects pilot project, and the other is in the upper Morice river in the Skeena River basin.

a. Current and historic system dynamics

i. Assemble background information: Collate existing and emerging science relevant to project area (see linkages section below).

ii. Assess past and current human and ecological processes – traditional use, forest dynamics, climate change, hydrology, forestry, hydroelectric power, etc – and their interaction with terrestrial and aquatic ecosystems, and salmon habitat integrity. Use paleoecological information and other sources to determine past shifts in climate and resulting changes and dynamics of natural processes, such as the influence of the Pacific Decadal Oscillation (PDO).

iii. Assess current decision processes, such as environmental impact assessment and government tenure approval process. Document legal land use designation from existing legislation and land use plans.

b. Models of key metrics

i. Identify the species and ecosystem components that are most likely to be adversely impacted by climate change and industrial development in the study area, such as:

1. Wildlife – wildlife habitat implications of increased road density, wind power installations, mining roads, etc.

2. Fish – implications for fish habitat and populations of hydroelectric and mineral development

3. Hydrological stream flow - Approaches to estimating or quantifying relative streamflow (flood, debris flow, low flow) response in un-gauged basins based on readily available metrics of watershed sensitivity, land use, natural disturbance, climate change and run of river hydrological development.

4. Sediment generation - Estimating and quantifying relative changes in rate of sediment generation based on watershed characteristics and land use activities such as Placer mining , Road density, road location, use and maintenance

5. Riparian function - Estimating or quantifying relative changes in stream temperature due to effects of loss of streamside vegetation

6. Ecosystems – Dendrochronology and historic disturbance regimes

7. Ecosystems – stand dynamics and vegetation re-colonization following multiple overlapping or interacting disturbances including interaction with a changing climate.

8. Ecosystem – landscapes –estimating and quantifying combined effects of habitat loss due to insects, forest harvesting and or industrial development on population dynamics of wildlife (direct habitat loss, human induced harassment or direct mortality, predator prey interactions)

ii. Using analytical methods, such as Bayesian statistics, develop a set of species and ecosystem component models to be used as key metrics in the project and that document the uncertainty associated with both input parameters and model outputs (McNay et al. 2011).

iii. Develop a set of decision making metrics that capture the potential shift in regional decision making resulting from the project.

c. Future system dynamics

i. Climate change scenarios downscaled to the study area and the construction of climate-envelope models for interpreting ecological change (Hamann and Wang 2006).

ii. Develop conceptual models of the major natural and human processes influencing salmon and related aquatic and terrestrial ecosystems based on existing research and expert workshops.

d. Future scenarios

i. Develop a set of future scenarios for assessment. The current climate is changing at an accelerated rate and is already affecting hydrological and forest ecosystems through changes in stream flow and temperature, and patterns and rate of natural disturbance (Pojar 2010). At the same time there is increasing demand for alternative supplies of energy, such as hydroelectric and wind farms as well as commodities to supply emerging Pacific economies. Scenarios will be developed that capture the possible range of social-economic and environmental change.

ii. Scenario assessment. The conceptual models of system change will be implemented in a landscape scale simulation model and parameterized according to the proposed future scenarios. A scenario based approach exposes the range of uncertainty in how drivers of change could influence the supply of ecosystem services through time. The future scenarios will be assessed for key metrics of focal species and ecosystem components, including salmon and grizzly bears. The state of the system, and its resilience to future perturbation, will be used to interpret the scenario's capacity to continue to provide ecosystem services (Morgan 2011). Provisioning services Indicators will also be generated from the model, such as power production and timber supply.

2. Integrating independent science into government decision making in British Columbia

a. Alternative institutional mechanisms for government/non-government collaboration on cumulative effects assessments and decision making

i. Investigate alternative institutional arrangements for organizations to collaborate with the Provincial government on cumulative effects assessment and monitoring.

b. Evaluating risk and trade-offs from cumulative effects

i. Develop a risk management framework to assist decision makers in assessing the level of risk to ecosystem services, such as water and salmon, under a range of development and environmental scenarios.

ii. Link to monitoring and research initiatives to assist with the further development of monitoring frameworks and future government lead decision processes.

iii. Identify risk assessment linkages to decision making processes and develop a methodology to integrate with existing decision making processes, such as Timber Supply Review and government cumulative effects initiatives.

c. Project extension and outreach

i. Peer review - engage academia, government and non-government personal throughout the project.

ii. Assist with the delivery of a cumulative effects conference in Smithers, BC intended to systematically gather and share information needed for cumulative effects analysis and regional development planning.

Project Benefits

- Organize existing salmon and salmon habitat information in north western BC into a social-ecological system framework providing an integrated perspective on salmon and industrial development.
- Linkage to government initiatives. Provide timely information to government's decision making on the cumulative effects of development in north western BC.
- Provide the necessary background information to assist in the development of north western BC salmon and salmon habitat monitoring systems.
- Create awareness (public, industry, government, First Nations) regarding the importance of conserving salmon habitat and the regional impacts of climate change

Linkages

This proposal has potential links to the following Moore funded initiatives:

- University of Washington
    - Portfolio effect and habitat synthesis.
- Skeena Wild Conservation Trust
    - Adoption of sustainable salmon harvest
    - Habitat protection
- Pacific Salmon Foundation
    - Monitoring baseline information
- Wild Salmon Center
    - Salmon stock assessment
- Tides Canada Foundation
    - Skeena integrated management reform

- University of California, Santa Barbara, National Centre for Ecological Analysis and Synthesis
    - Synthesis of climate effects on salmon

Linkages to other initiatives:

- Provincial Area Based Analysis - developing methods for government led cumulative effects assessment – Leah Malkinson, Ministry of Forests, Lands and Natural Resource Operations.
- Provincial Area Based Analysis, Skeena Region Pilot project – Regional pilot of methods for cumulative effects assessment –Fred Oliemans, Ministry of Forests, Lands and Natural Resource Operations.
- Office of the Wet'suwet'en and Provincial Government Upper Morice Watershed Management Area monitoring plan –Ian Sharpe, Ministry of Environment, David DeWitt Office of the Wet'suwet'en.
- Future Forest Ecosystem Scientific Council (FFESC) Multi-scale Transdisciplinary Vulnerability Assessment project - evaluating climate change vulnerability of ecosystem services in the Skeena basin –Bulkley Valley Research Centre.
- Skeena watershed monitoring initiative – Greg Knox, Skeen Wild Conservation Trust
- Processes and Dynamics of the Ecosystems of the Skeena Islands – BV Research Centre – Adrian de Groot, Anne Hetherington, Sybille Hauseler.
- Skeena River Water Conservation Project – WWF-Canada, Coast Tsimshian Resources, Cortex Consultants, Brinkman Forest.
- Northwest Community College – Earth and Environmental Studies and Cultural Resource Management Degrees, Rick Trowbridge.

Project Team

- Multi-disciplinary team coordinated by the Bulkley Valley Research Centre
    - Project Manager and First Nations Engagement: Rick Budhwa MA, BV Research Centre.
    - Project coordinator: Don Morgan MSc, RPBio, BV Research Centre and BC Ministry of Environment. Has 15 years of experience in decision support of land use planning in BC, developed and implemented decision support systems for a variety of land use planning initiatives, including the North Coast Land and Resource Management Plan. Designed, implemented and managed a natural resource data management system for the Provincial government in northwest BC. He has a Master's of Science

in Biology and specializes in resilience theory, climate change, and the modelling of landscape scale natural and human disturbance and wildlife habitat supply.

- Project Strategic Advisors: Jane Lloyd Smith, Director of Resource Management, Skeena Region, Ministry of Forests, Lands and Natural Resource Operations, Kevin Kriese, Assistant Deputy Minister Northern Region, Ministry of Forests, Lands and Natural Resource Operations, Mark Zacharias Assistant Deputy Minister, Environmental Sustainability and Strategic Policy, Ministry of Environment.

- Project team members: Greg Knox, Skeen Wild Conservation Trust, Andrew Fall PhD, Gowland technologies, SFU adjunct, Dave Daust MSc, consultant, Sybille Haussler PhD UNBC adjunct, consultant, Laurence Turney EIA consultant

- Project advisors: Jim Pojar PhD, Phil Burton PhD and Chris Johnson PhD University of Northern British Columbia, Peter Duinker PhD, Dalhousie University

Literature Cited

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An Integrated Assessment of the Cumulative Impacts of Climate Change and Industrial Development on Salmon in Western British Columbia

Project Strategic Planning Workshop
February 17, 2012

Project Objectives

1. Technical assessment of cumulative effects the Upper Morice River and the Nass/Iskut/Stikine.
2. Integrating independent science into government decision making in British Columbia

Defining Cumulative Effects

"changes to environmental, social, and economic values caused by an action or event in combination with other past, present and reasonably foreseeable future human activities and/or natural disturbances on the land base".

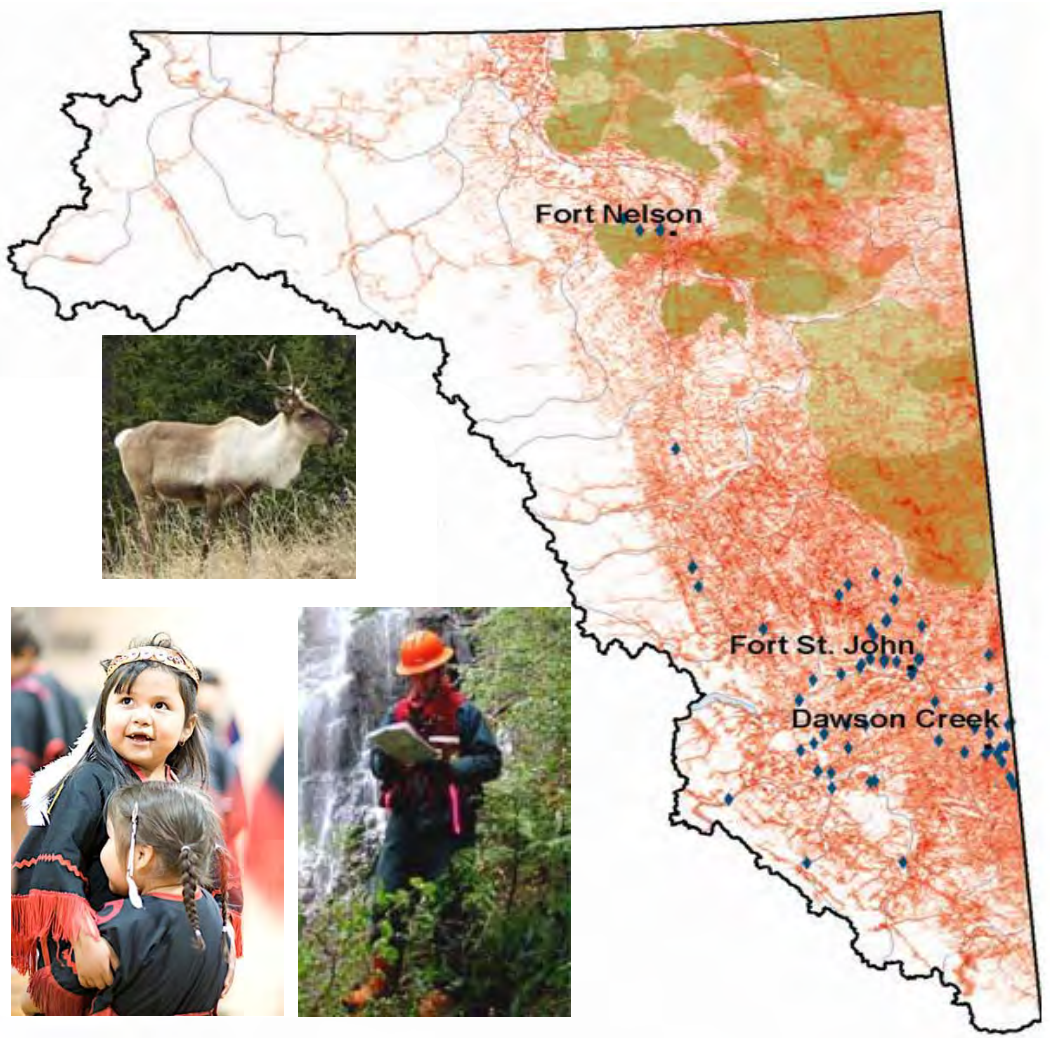
Why do we need to consider CE?

Cumulative development footprint:

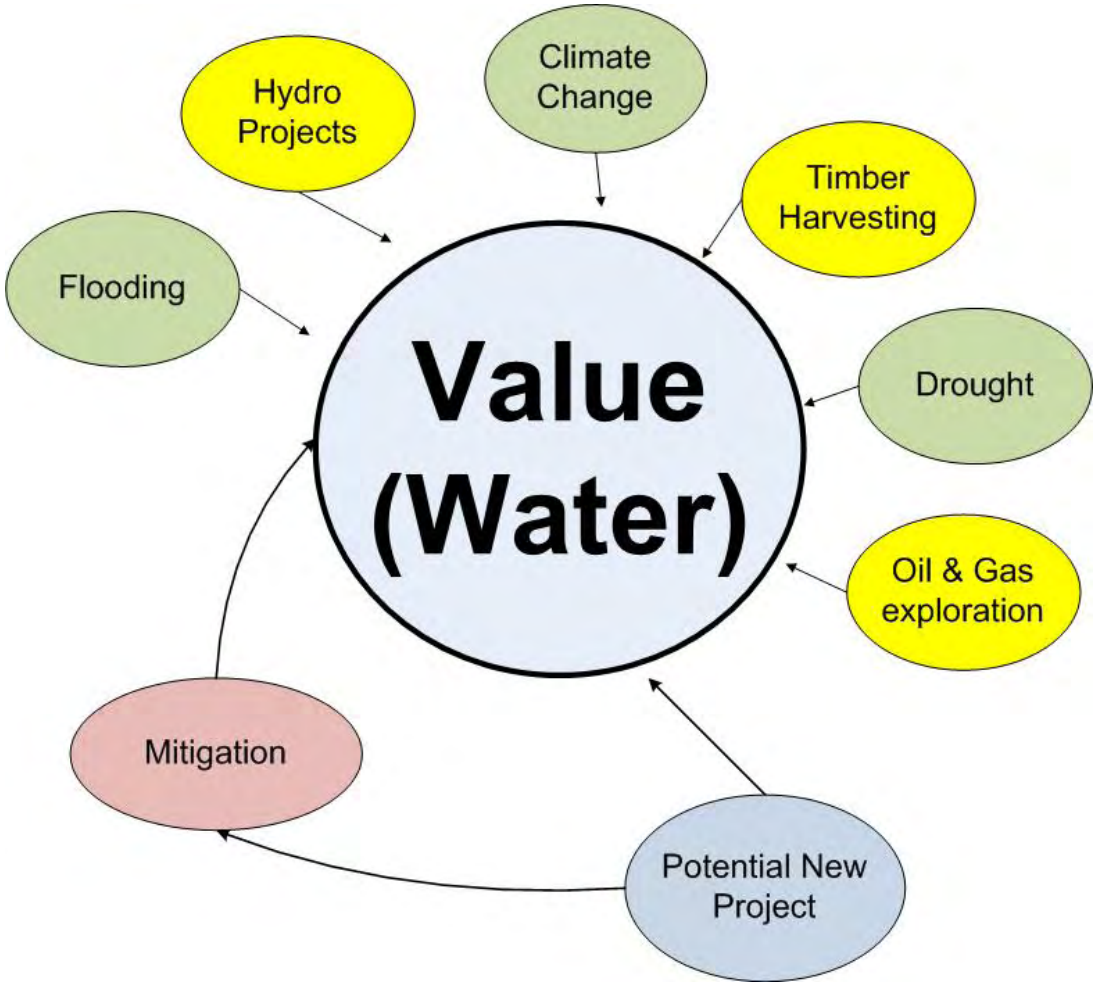
- Risk to key environmental values in some areas
  e.g. Water, species at risk

- First Nations rights – legal challenges

- Uncertainty/ instability for industry investment
  e.g. THLB impacts



Cumulative Effects

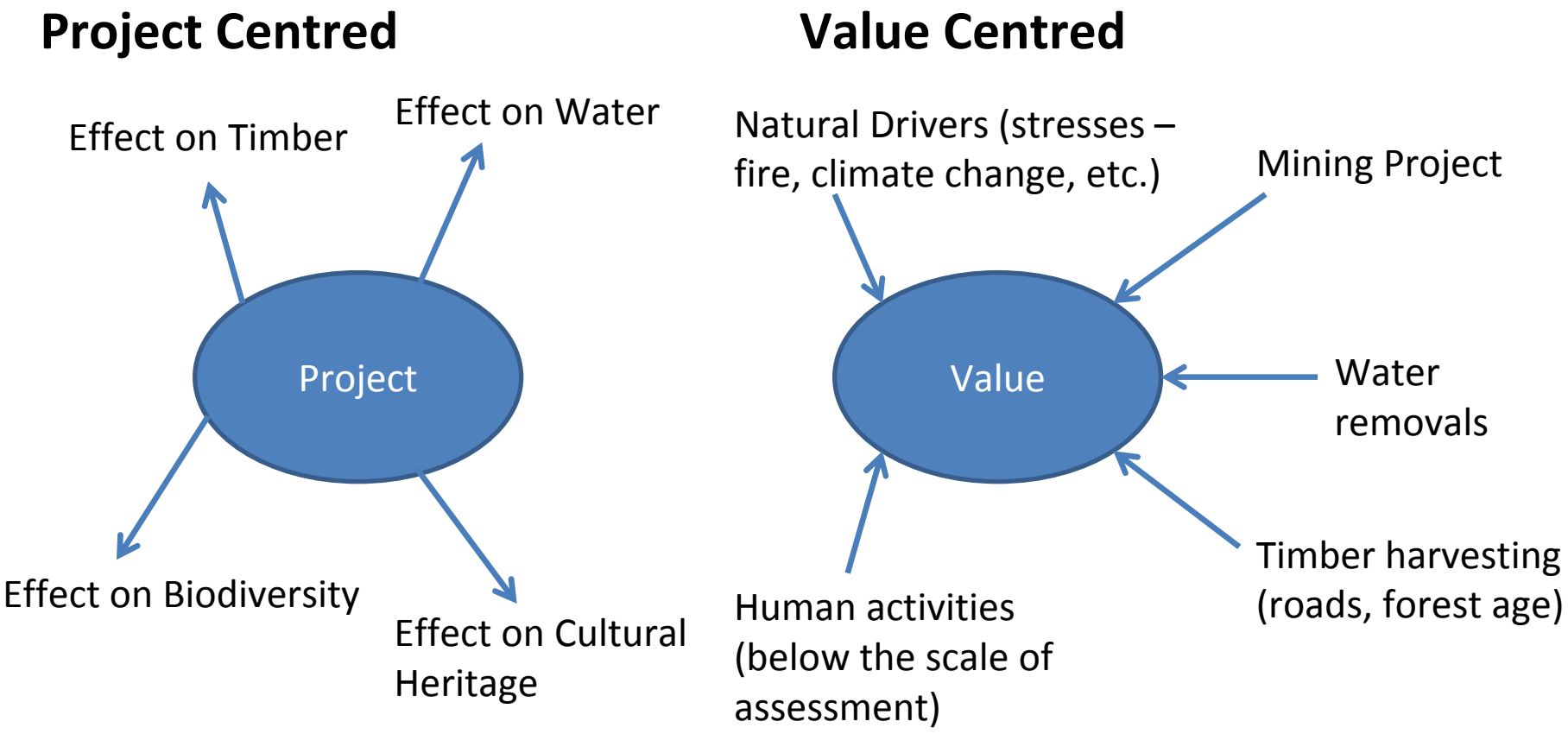


Cumulative Effects – “No One to Tell”

There is no requirement to assess the cumulative effects of the myriad of ‘minor’ activities that are continually authorized on the land. The result is that cumulative effects of the natural resource development remain largely unknown and unmanaged. A commonly proposed solution to this problem is to conduct broad scale assessments (e.g., regional strategic environmental assessments). These solutions meet with limited success because there are no institutional mechanisms to use the results of the assessments – that is, there is **no one to tell**.

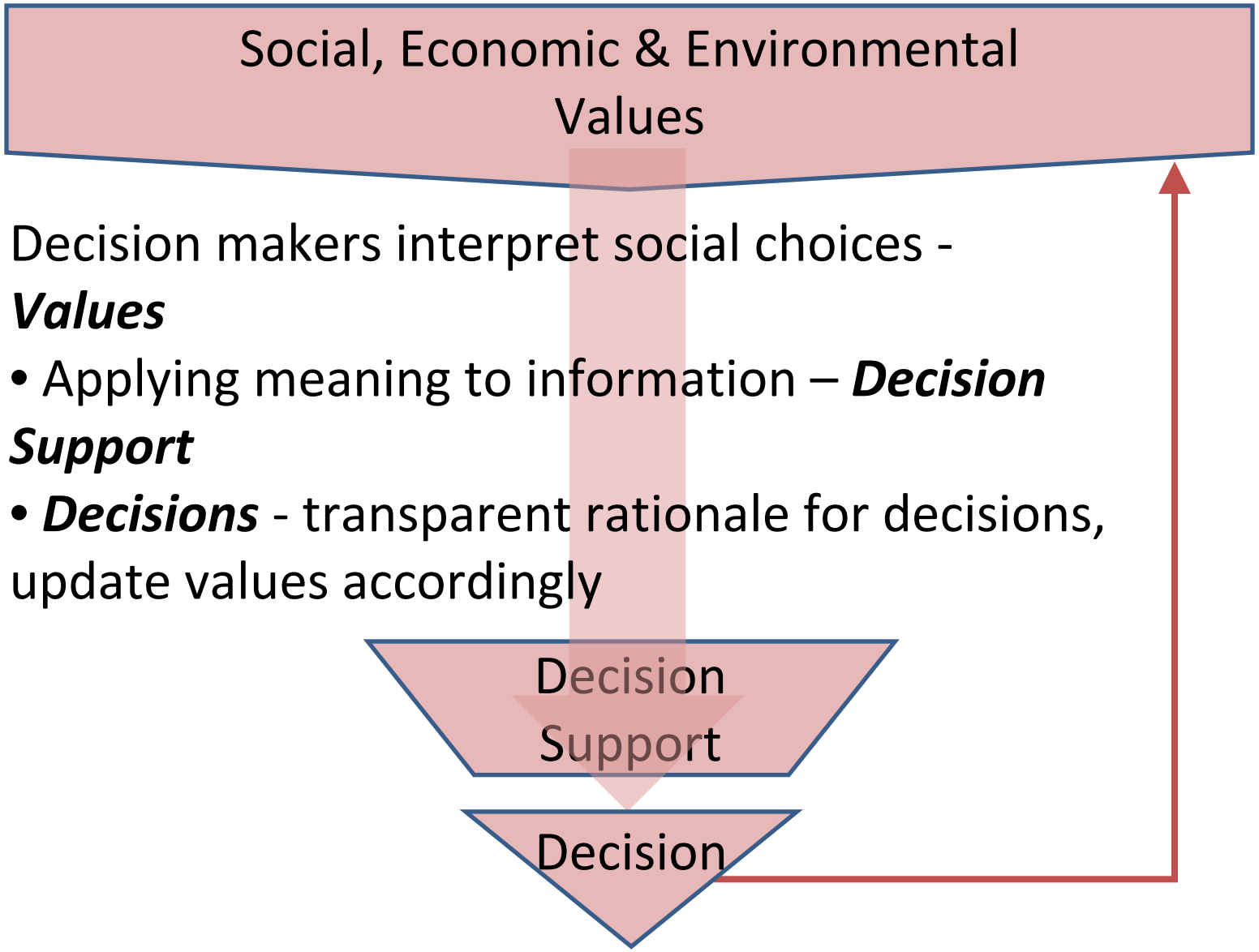
Marvin Eng 2011

Value Centred Approach



After Greig 2008

Values & Decision Making



Decision makers interpret social choices -

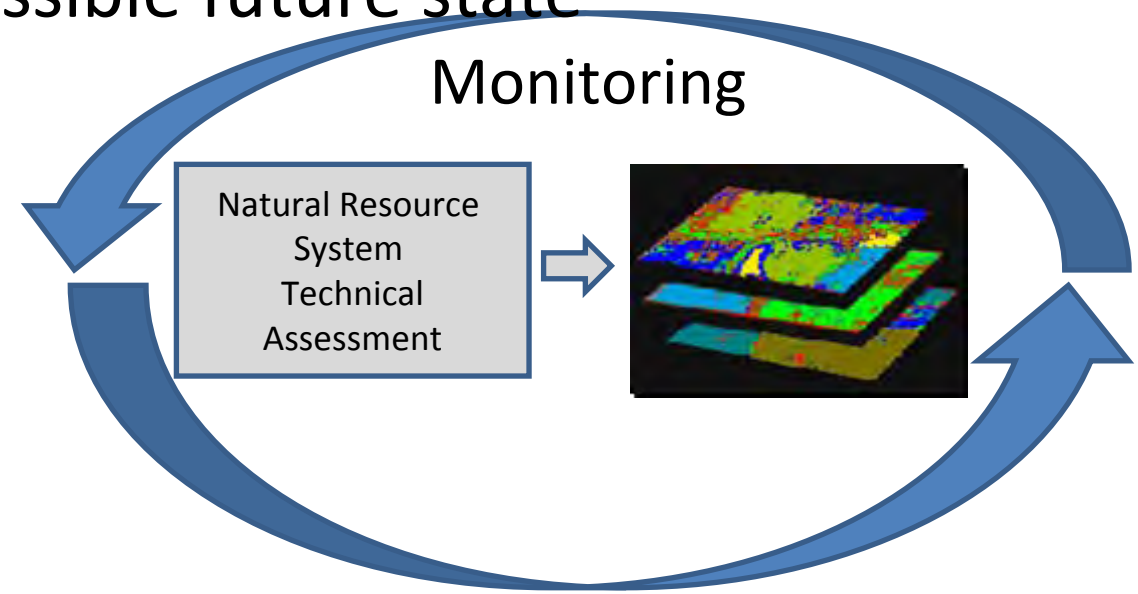
Values

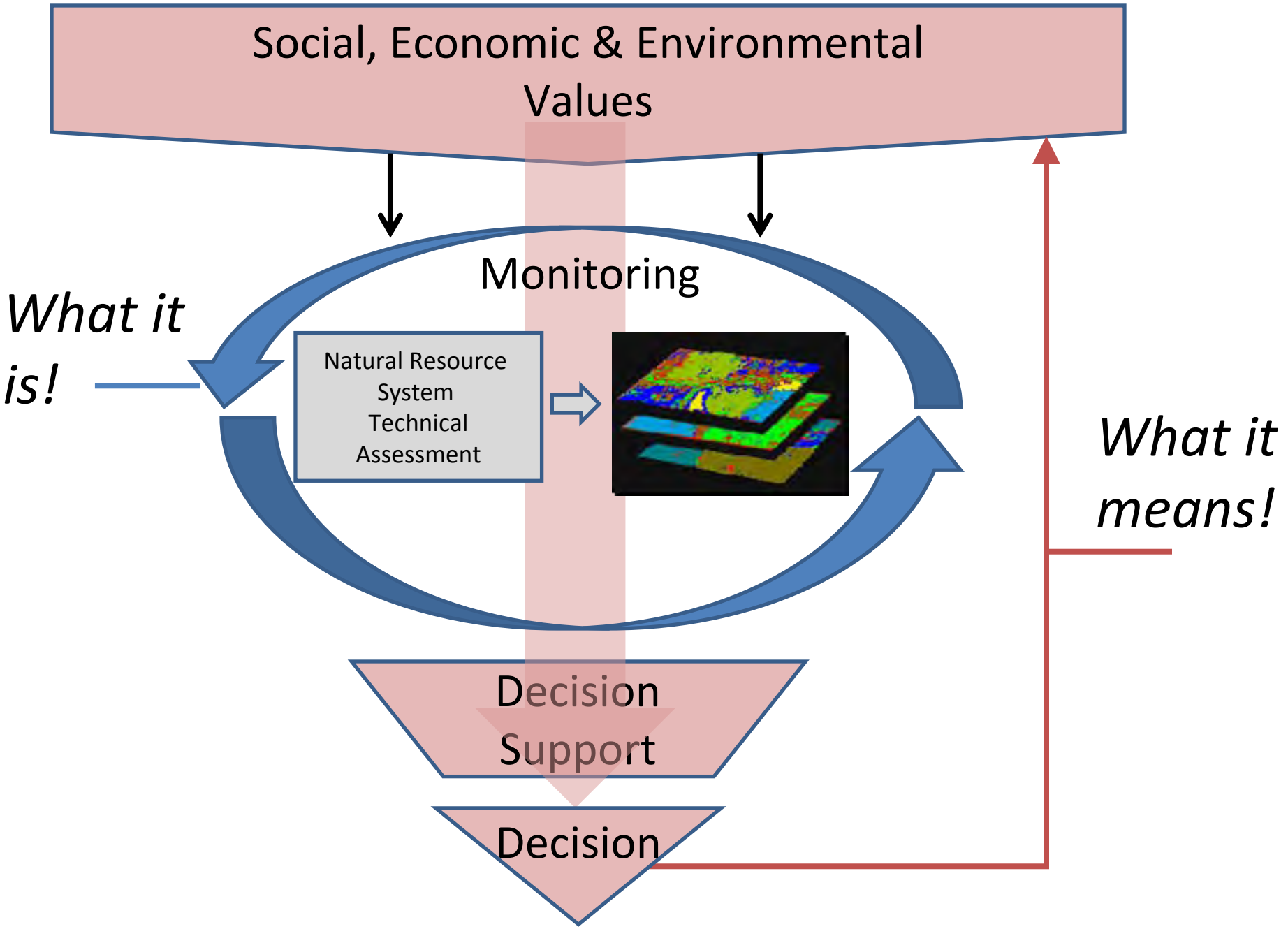
• Applying meaning to information – ***Decision Support***

• ***Decisions*** - transparent rationale for decisions, update values accordingly

Assessment and Monitoring

- Technical assessment of the ***Natural Resource System***
- ***Ecosystem services*** and our dependent social, economic and environmental values
- Current and possible future state – ***Monitoring***



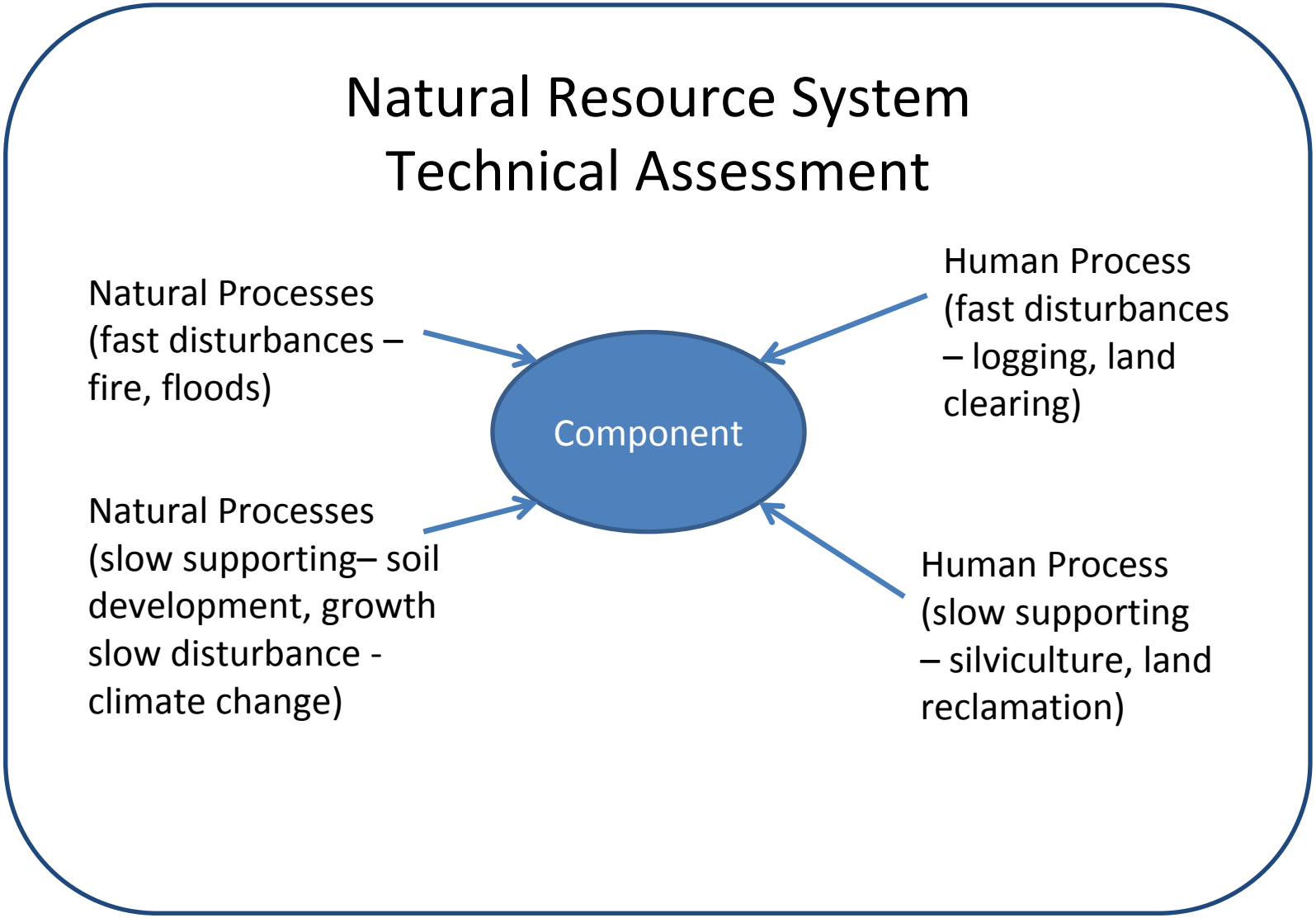

Social, Economic & Environmental Values
Monitoring
What it is!
Natural Resource System Technical Assessment
What it means!
Decision Support
Decision

Values

Social, Economic & Environmental Values

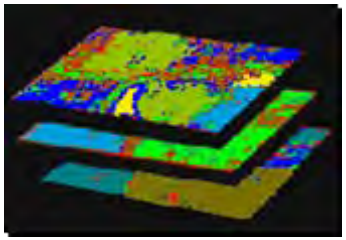
Environmental	**Economic**	**Social**
Biodiversity	Economic Development & Employment	Infrastructure & Services
Wildlife	Government Revenue	Social Wellbeing & Community Resilience
Fish/Riparian	Land and Resource Capability (by sector)	Human Health
Water		Recreation & Fish & Wildlife Use
Air		Visual Quality & Aesthetics
Carbon Balance		Heritage
Soil		
Ecological Features		

Assessment & Monitoring



Assessment & Monitoring

Natural Resource System Technical Assessment



Natural Resource System

Biophysical and Human Components:

Processes:
-Disturbance/Supporting
-
Human/Natural

Monitoring:

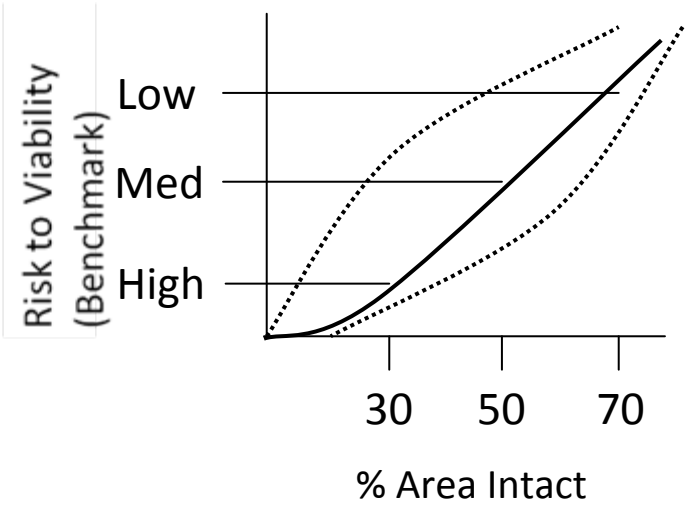
- System indicators
  - landscape structure
  - economic activity
  - roads, etc
- Values state
  - biodiversity
  - productive forest
  - social infrastructure

Decision Support

Grizzly Bear

Components:
- Habitat
- Population

Processes:
- Mortality
- Human activity
- Forest growth
- Disturbance

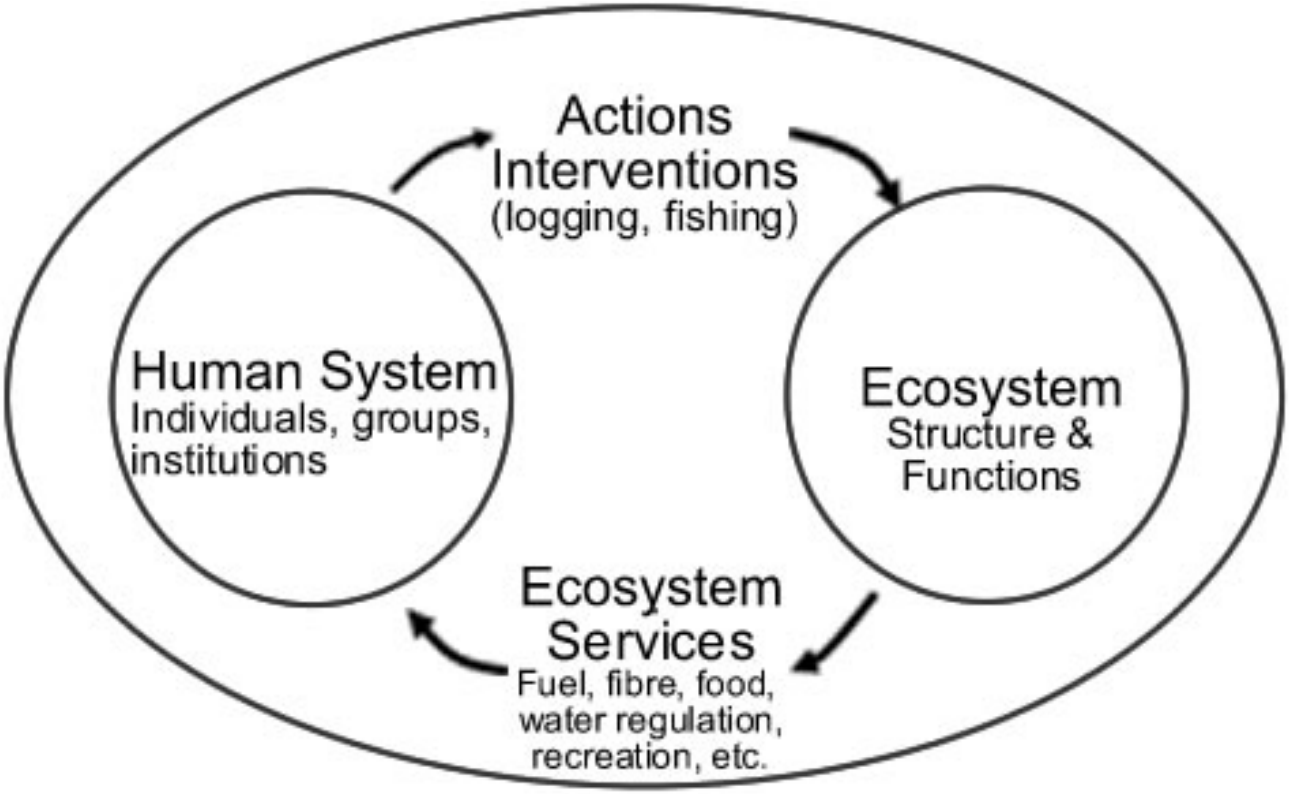


Value	Component	Indicator
Grizzly Bear	Habitat	% Area Disturbed

Mgmt Target	Benchmarks			Current Condition	Trend
	Poor	Fair	Good		
	>70	70 to 30	<30	50	⇨

Decision

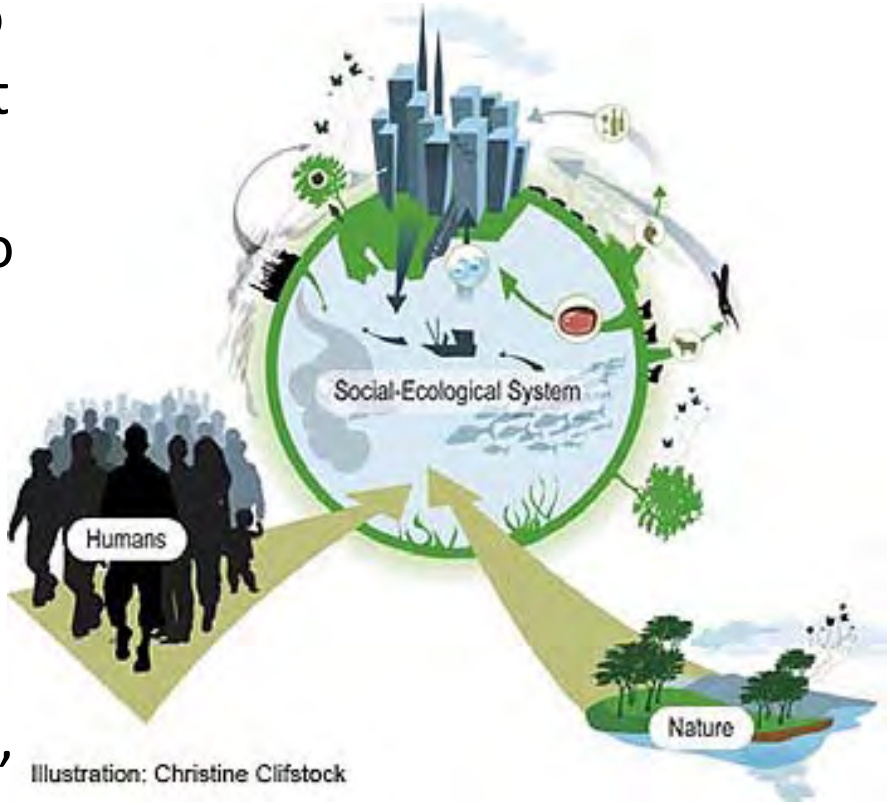
Social-Ecological System



Social-ecological systems are complex, integrated systems in which humans are part of nature (Resilience Alliance 2012).

Managing for Sustainability

- **Sustainability**: use of the environment and resources to meet the needs of the present without compromising the ability of future generations to meet their needs.
- **Ecosystem services**: the benefits that society derives from ecosystems.
- **Human well-being**: quality of life in terms of material needs, freedom and choice, good social relations and personal security.



Technical Assessment

1. Current and historic system dynamics
2. Models of key metrics
   - fish, wildlife, hydrology, terrestrial ecosystems
3. Future system dynamics
4. Future scenarios

1. Current & Historic System Dynamics

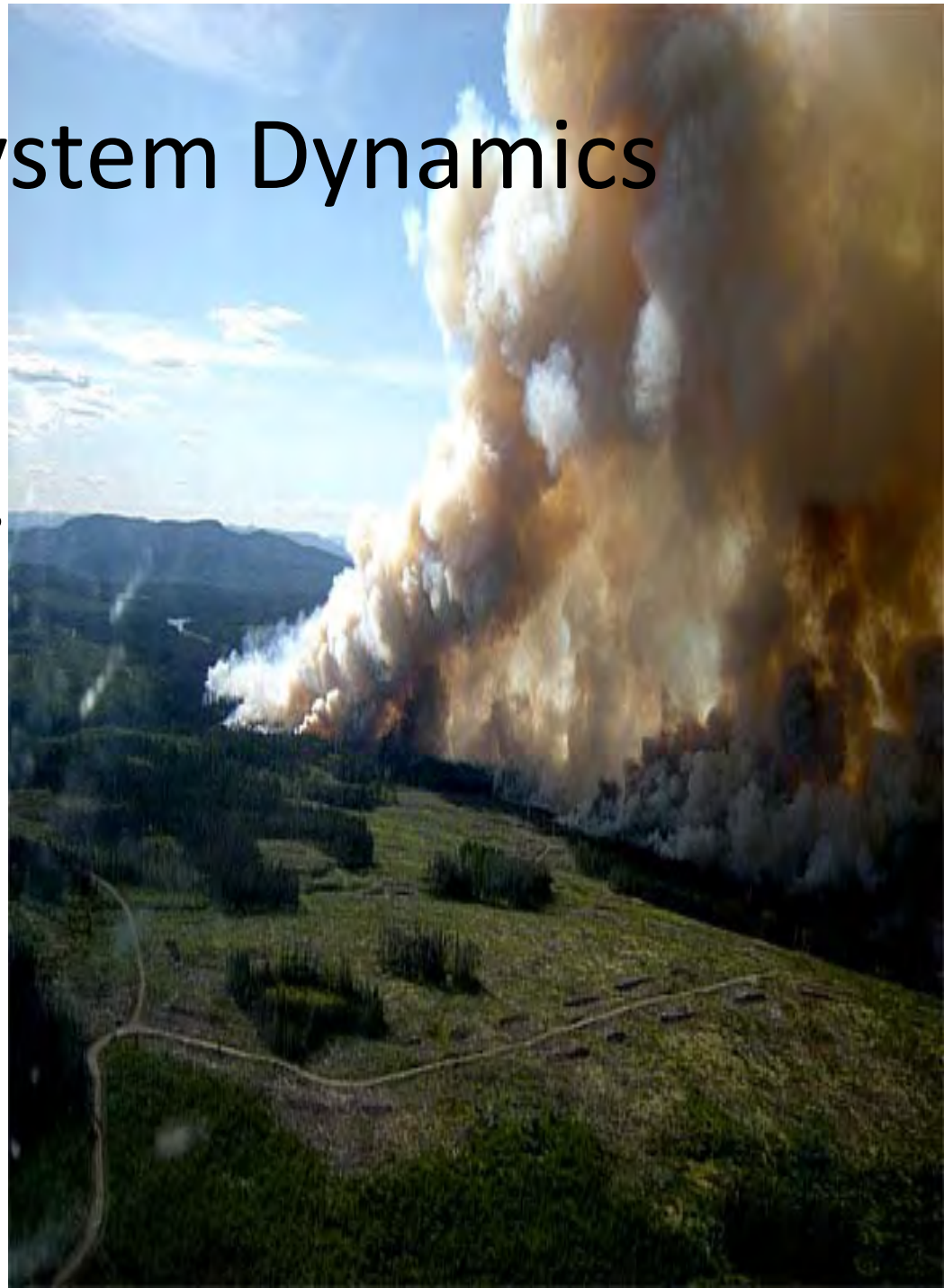
- Background information
- Assess past and current human and ecological processes
- Determine past shifts in climate and resulting changes and dynamics of natural processes
- Assess current decision processes, such as environmental impact assessment and government tenure approval process.
- Document legal land use designation from existing legislation and land use plans.

2. Models of Key Metrics

- Identify the species and ecosystem components that are most likely to be adversely impacted by climate change and industrial development in the study area, such as:
  - fish, wildlife, hydrology, terrestrial ecosystems
- Develop a set of species and ecosystem component models to be used as key metrics in the project
- Develop a set of decision making metrics that capture the potential shift in regional decision making resulting from the project.

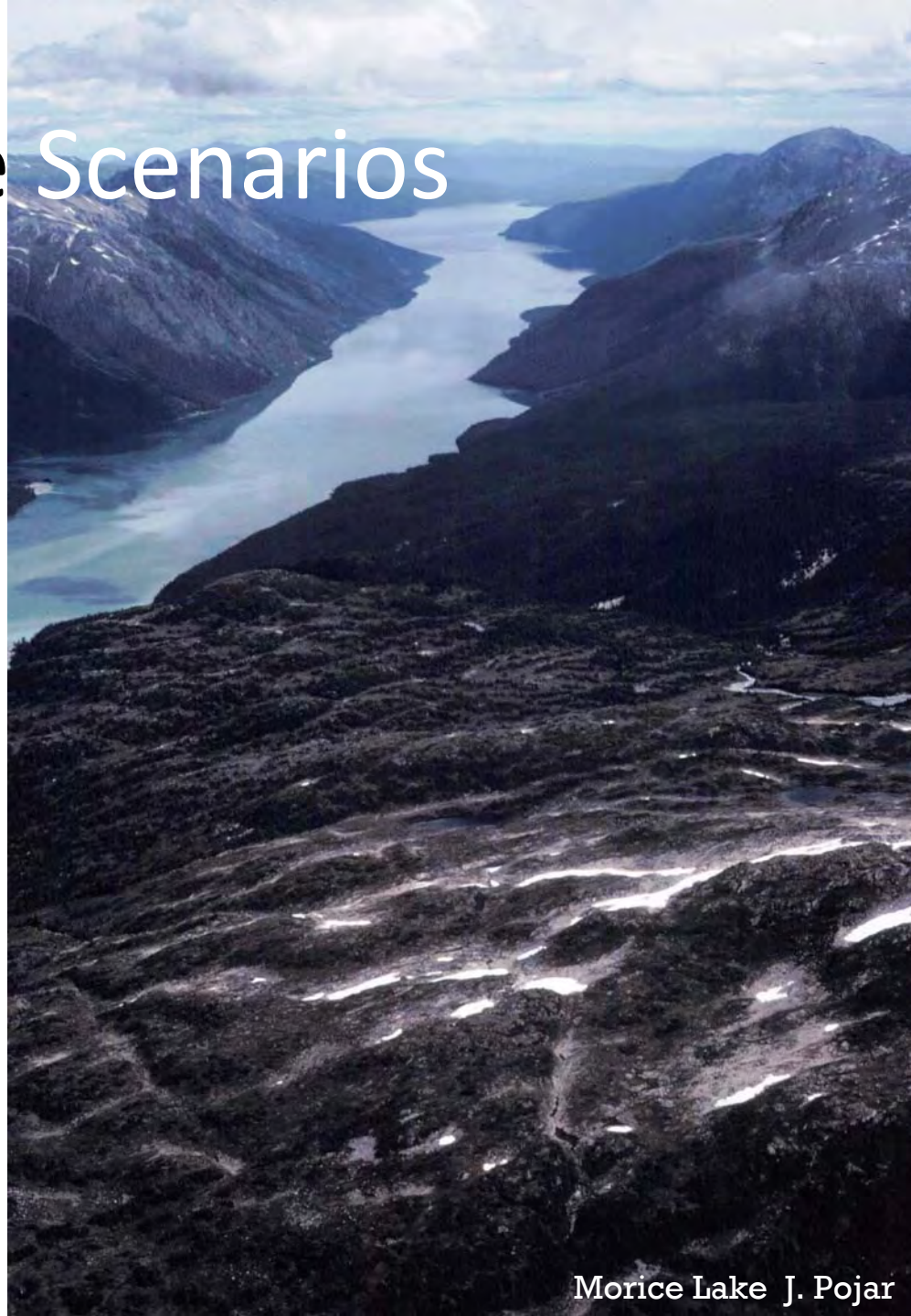
3. Future System Dynamics

- Climate change scenarios downscaled to the study area and the construction of climate-envelope models for interpreting ecological change
- Develop conceptual models of the major natural and human processes influencing salmon and related aquatic and terrestrial ecosystems based on existing research and expert workshops.



4. Future Scenarios

- Develop a set of future scenarios for assessment that capture the possible range of social-economic and environmental change.
- Scenario assessment. The conceptual models of system change will be implemented in a landscape scale simulation model and parameterized according to the proposed future scenarios.



Integrating Independent Science

1. Alternative institutional mechanisms for collaboration
2. Evaluating risk and trade-offs from cumulative effects
3. Project extension and outreach

1. Alternative Institutional Mechanisms for Collaboration and Decision Making

- Alternative arrangements for organizations to collaborate with the Provincial government on cumulative effects assessment and monitoring.

2. Evaluating Risk and Trade-offs from Cumulative Effects

- Develop a risk management framework to assist decision makers in assessing the level of risk to ecosystem services, such as water and salmon, under a range of development and environmental scenarios.
- Link to monitoring and research initiatives to assist with the further development of monitoring frameworks and future government lead decision processes.
- Identify risk assessment linkages to decision making processes and develop a methodology to integrate with existing decision making processes, such as Timber Supply Review and government cumulative effects initiatives

3. Project Extensions and Outreach

- Peer review - engage academia, government and non-government personal throughout the project.
- Assist in the delivery of a cumulative effects conference in Smithers to share information needed for cumulative effects analysis and regional development planning.

Project Benefits

- Organize existing salmon and salmon habitat information in north western BC into a social-ecological system framework.
- Linkage to government initiatives. Provide timely information to government's decision making.
- Provide the necessary background information to assist in the development of north western BC salmon and salmon habitat monitoring systems.
- Create awareness (public, industry, government, First Nations) regarding the importance of conserving salmon habitat and the regional impacts of climate change

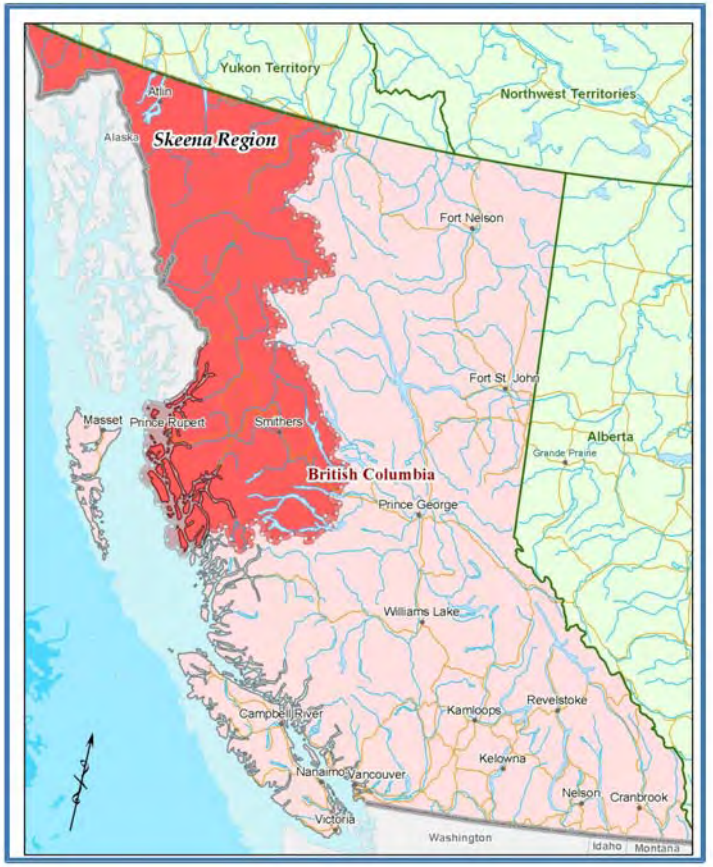
Project Team

- Multi-disciplinary team coordinated by the Bulkley Valley Research Centre
  - Project Manager and First Nations Engagement: Rick Budhwa MA, BV Research Centre.
  - Project coordinator: Don Morgan MSc, RPBio, BV Research Centre and BC Ministry of Environment.
  - Project Strategic Advisors: Jane Lloyd Smith, Director of Resource Management, Skeena Region, Ministry of Forests, Lands and Natural Resource Operations, Kevin Kriese, Assistant Deputy Minister Northern Region, Ministry of Forests, Lands and Natural Resource Operations, Mark Zacharias Assistant Deputy Minister, Environmental Sustainability and Strategic Policy, Ministry of Environment.
  - Project team members: Greg Knox, Skeen Wild Conservation Trust, Andrew Fall PhD, Gowland technologies, SFU adjunct, Dave Daust MSc, consultant, Sybille Haussler PhD UNBC adjunct, consultant, Laurence Turney EIA consultant
  - Project advisors: Jim Pojar PhD, Phil Burton PhD and Chris Johnson PhD University of Northern British Columbia, Peter Duinker PhD, Dalhousie University

Linkages to Other Initiatives

- **Provincial Area Based Analysis** – Don Morgan, Blair Ells, Barry Watson, Jane Lloyd-Smith
- **Provincial Area Based Analysis, Skeena Region Pilot project** – Regional pilot of methods for cumulative effects assessment – Don Morgan, Blair Ells, Barry Watson, Jane Lloyd-Smith
- **Office of the Wet'suwet'en and Provincial Government Upper Morice Watershed Management Area monitoring plan** –Ian Sharpe, Ministry of Environment, David DeWitt Office of the Wet'suwet'en.
- **Future Forest Ecosystem Scientific Council (FFESC**) Multi-scale Transdisciplinary Vulnerability Assessment project - evaluating climate change vulnerability of ecosystem services in the Skeena basin –Bulkley Valley Research Centre.
- **Skeena watershed monitoring** initiative – Greg Knox, Skeen Wild Conservation Trust
- **Processes and Dynamics of the Ecosystems of the Skeena Islands** – BV Research Centre – Adrian de Groot, Anne Hetherington, Sybille Hauseler.
- **Skeena River Water Conservation Project** – WWF-Canada, Coast Tsimshian Resources, Cortex Consultants, Brinkman Forest.
- **Northwest Community College** – Earth and Environmental Studies and Cultural Resource Management Degrees, Rick Trowbridge.

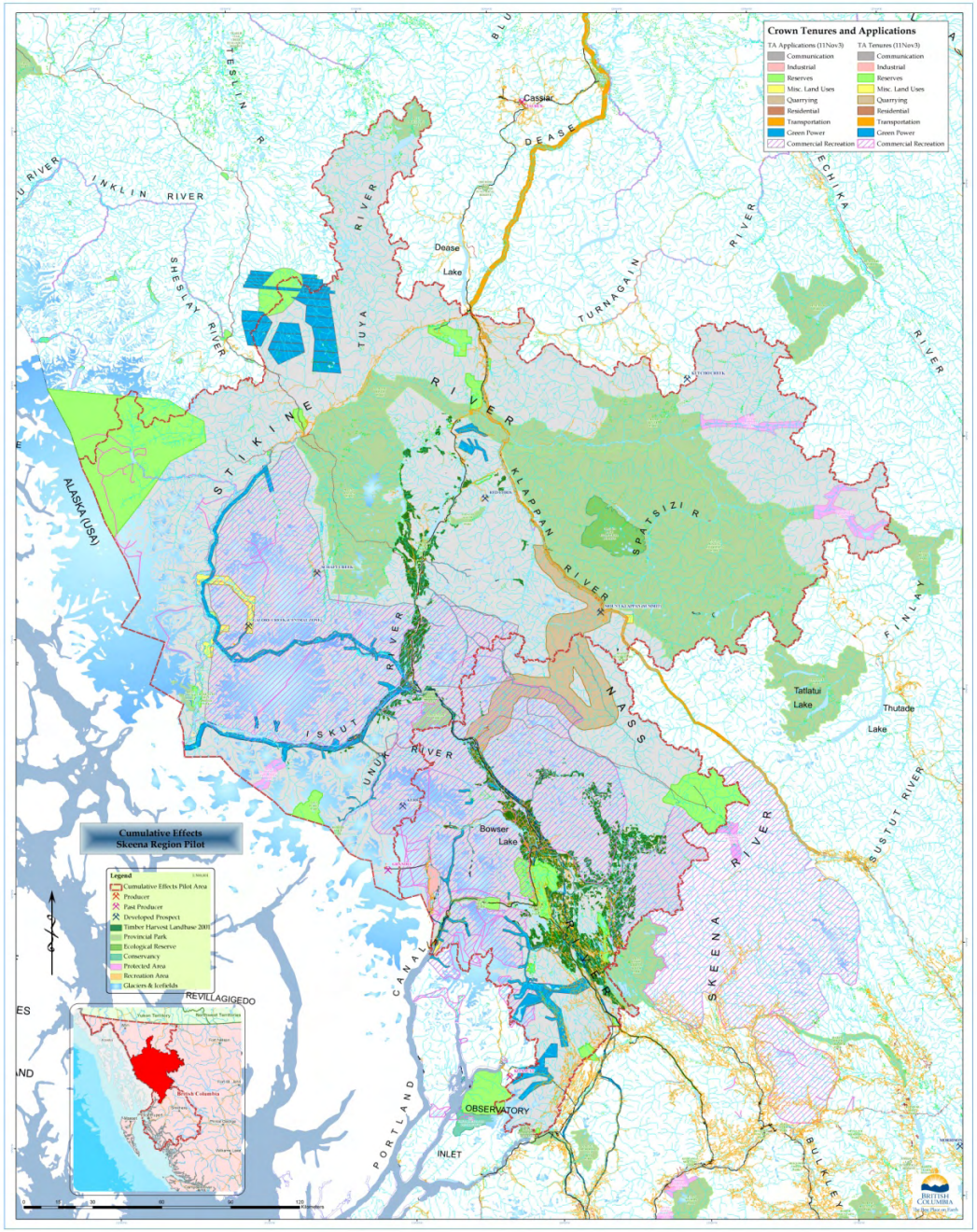
Skeena Region



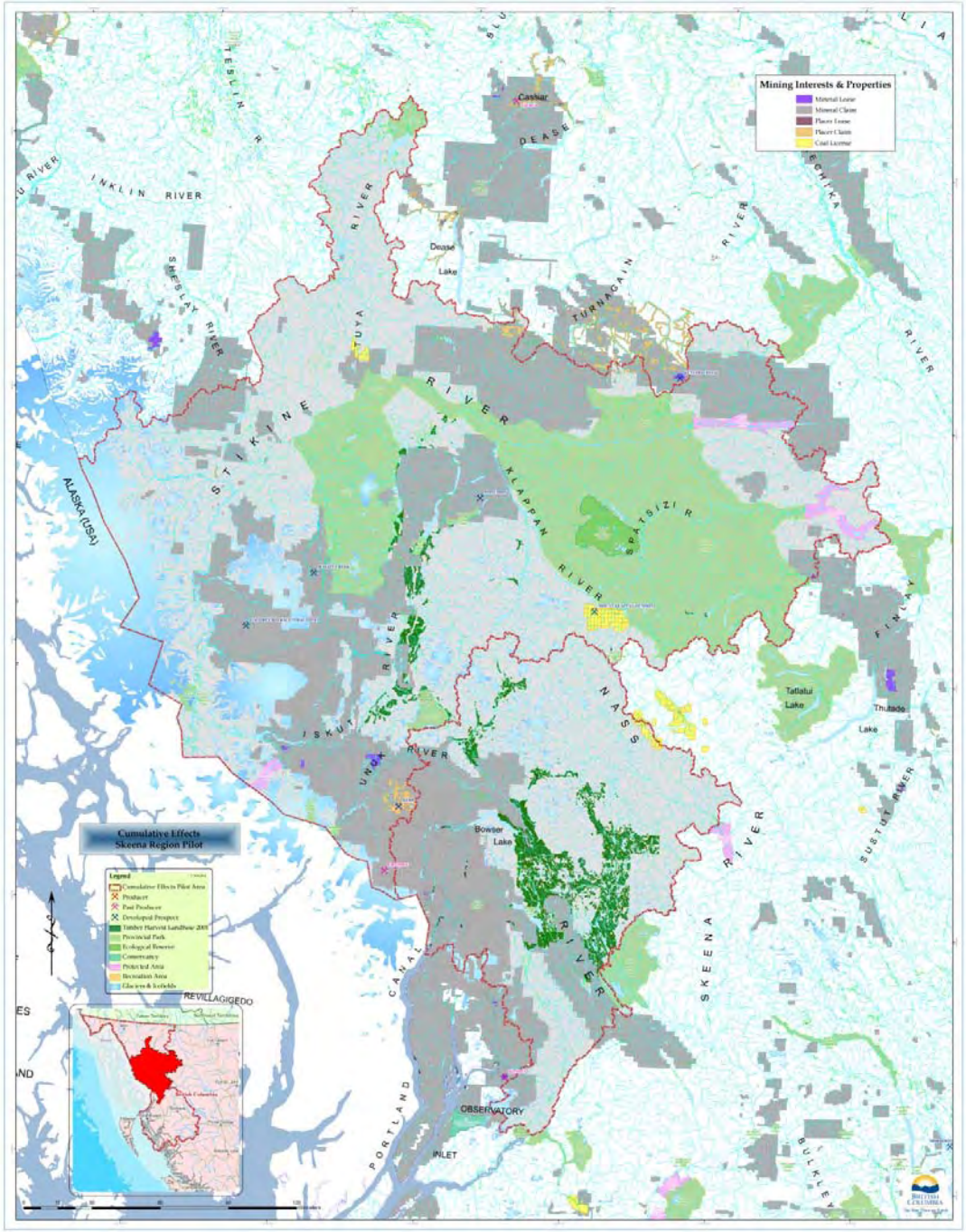
NW Cumulative Effects Pilot Study Area

Footprint Analysis: Tenures:

- Communication
- Industrial
- Timber Harvest Land Base
- Reserves
- Miscellaneous Land Use
- Quarrying
- Residential
- Transportation
- Green Power
- Commercial Recreation



Northwest Pilot Mining Interests



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