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From Trout Creek to the IPCC: Linking Climate Change Scenarios, Adaptation and Sustainable Development

Stewart Cohen

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Environment Canada

Located at Dept. of Forest Resources Management

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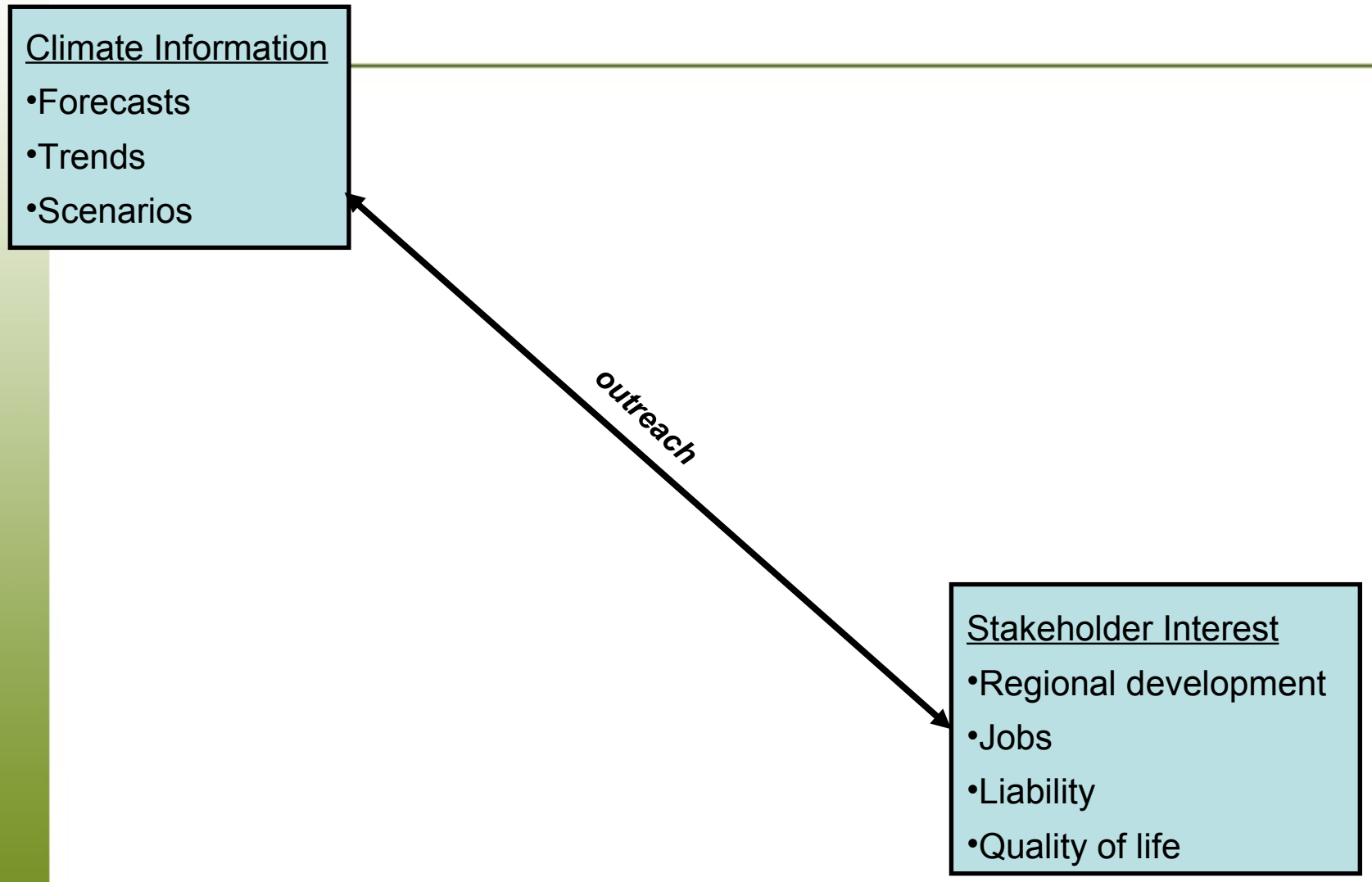
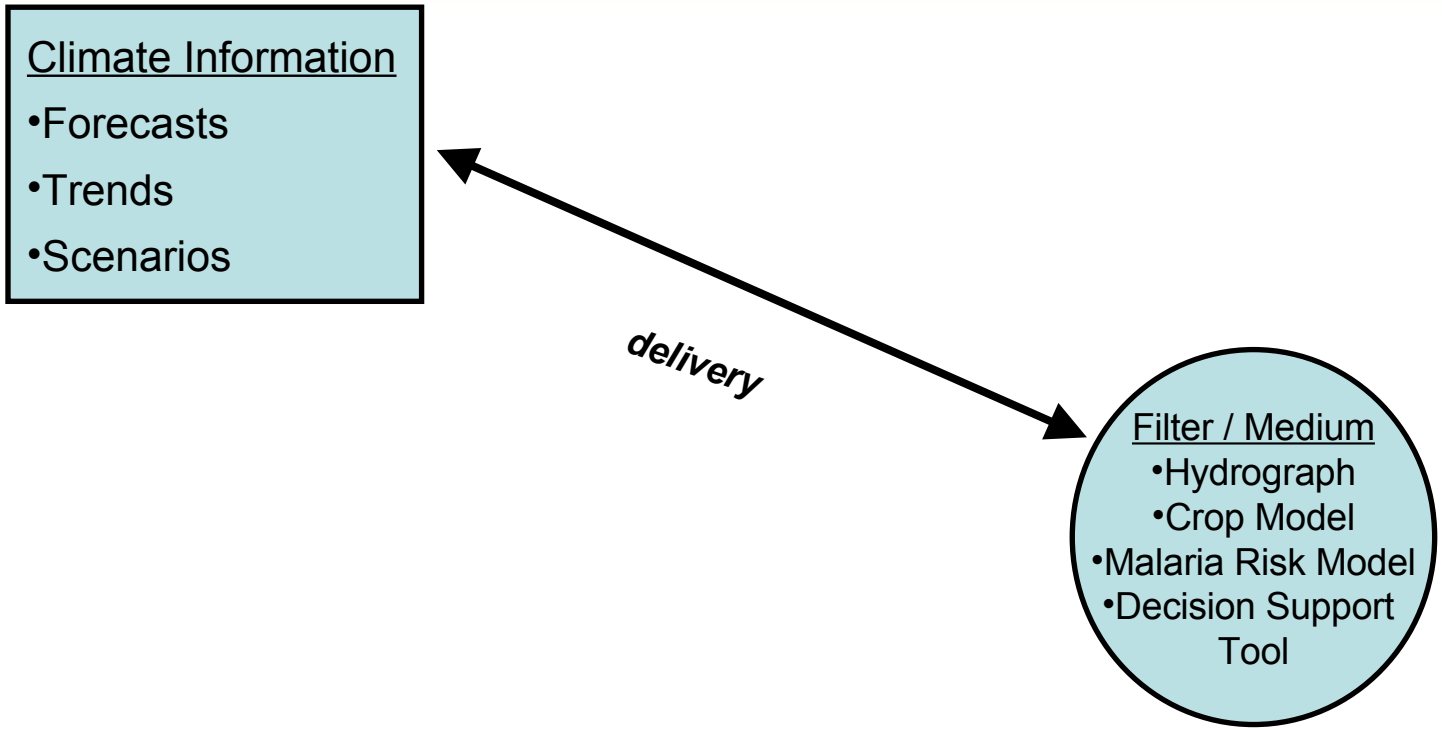
Participatory approach can help to build the science-policy bridge

- Role of local experts (practitioners, stakeholders) in climate change impacts-adaptation research
  - Local context (planning, decision-making)
  - Data, operational perspectives
  - Professional networks
  - Local governments
- Experts become extension agents for local adaptation
  - Role of research community changes from initiator of studies to resource for community-based assessments
  - Broadens base of investments in impacts-adaptation research
  - Potential for increased support for monitoring

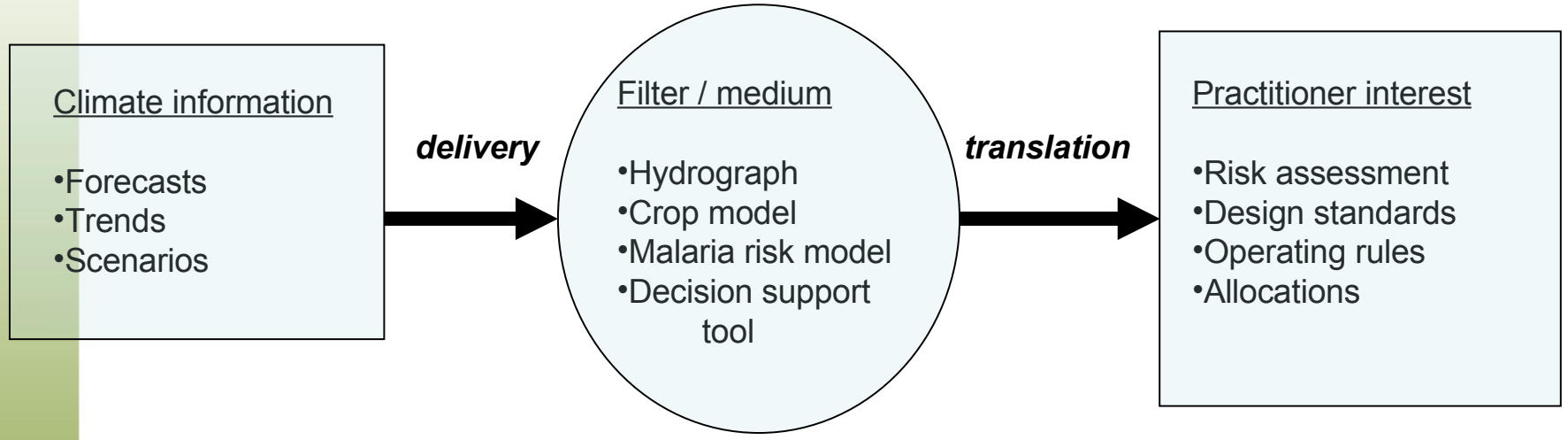
Climate change information flow to stakeholders?



Translation; climate change science to climate change impacts



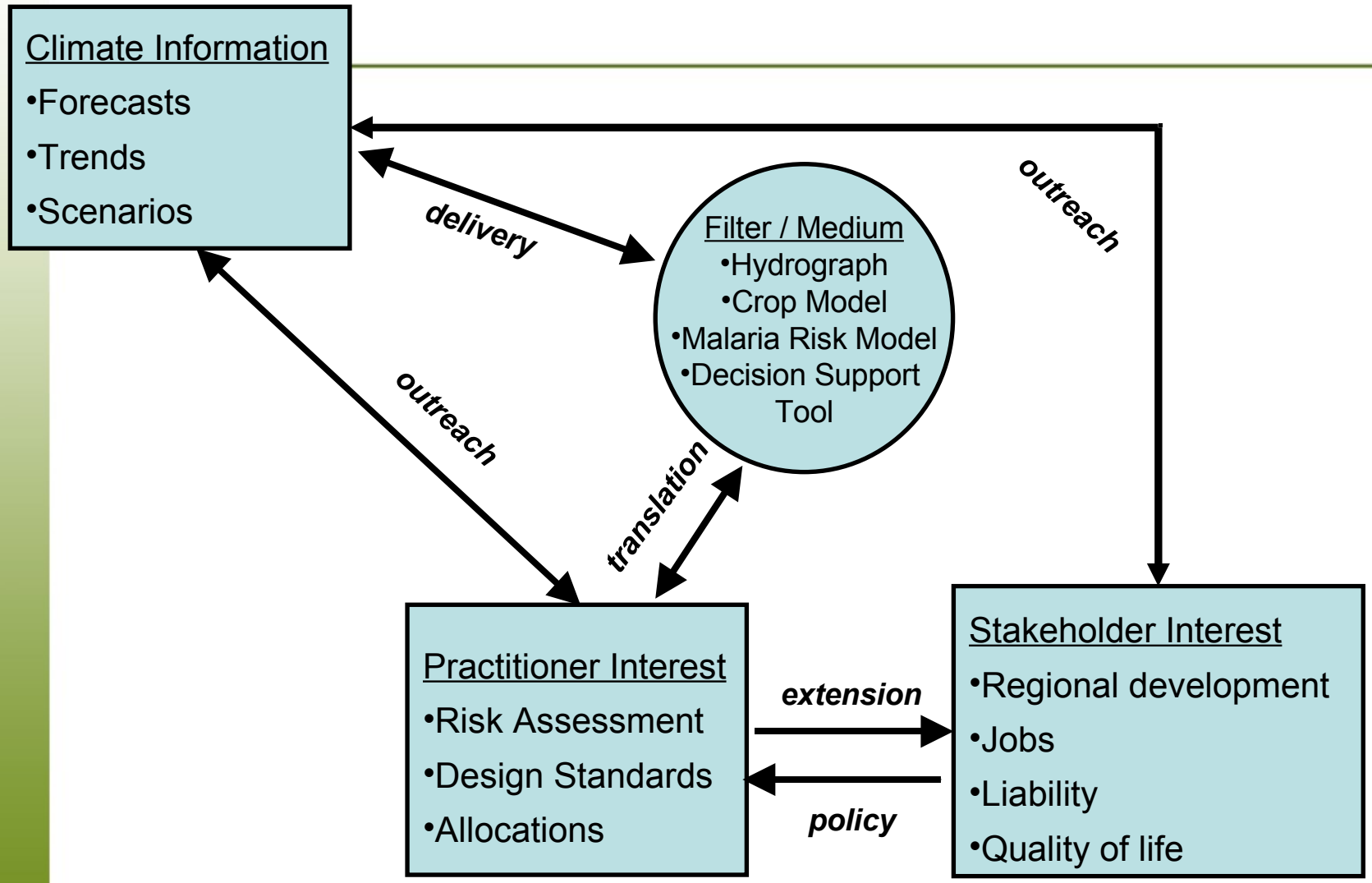
Climate Change: The Medium is the Message



….translation from climate science to practitioner inte

Participatory approach…link with practitioners

(Cohen and Waddell, in press)



Building the science-policy bridge…

- Dialogue with local experts/practitioners as part of integration; beyond serving as an information source and outreach process

Okanagan climate change study team visit to Penticton Dam, June 2002

Okanagan Study Teams (1999-2007)

- **Stewart Cohen (P.I.)** – Adaptation & Impacts Research Division-EC, Institute for Resources Environment & Sustainability-UBC, Vancouver
- **Denise Neilsen (P.I.2002-04), Scott Smith (P.I.2002-04), Grace Frank, Walter Koch** – Pacific Agricultural Research Centre-AAFC, Summerland
- **Younes Alila, Wendy Merritt*** – Forest Resources Management, UBC (*now at Australian National University)
- **Mark Barton, Roger McNeill, Bill Taylor, Dave Hutchinson, Wendy Avis** – Pacific & Yukon Region-EC
- **Tina Neale, Philippa Shepherd, James Tansey, Jeff Carmichael, Stacy Langsdale, Rachel Welbourn, Natasha Schorb, Jennifer Ardiel, Glen Hearns, Alex Russell, Aviva Savelson, Sharon Bennett, Charlie Wilson** – IRES & SCARP, UBC
- **Brian Symonds**, B.C. MOE, Penticton
- **Bob Hrasko,** Agua Consulting, Kelowna.
- **Barbara Lence**, Civil Engineering, UBC
- **Craig Forster**, U. Utah
- **Allyson Beall**, Washington State University

Study team (2002-04) & invited guests at team meeting, Summerland, June 2002

*Thanks to **Andrew Reeder**, RDOS (formerly City of Summerland); **Toby Pike**, Water Supply Association; **Greg Armour**, OBWB; **Patrick Deakin**, Town of Oliver; **Phil** Epp, BC MOE; **Jillian Tamblyn**, Okanagan Nations Alliance; **Leah Hartley**, RDCO; **Peter Waterman**, BC Fruit Growers Assoc. & City of Summerland; & many others.*

Supported by grants from the CCAF/CCIAP (#A206, A463/433, A846), Natural Resources Canada, Ottawa.

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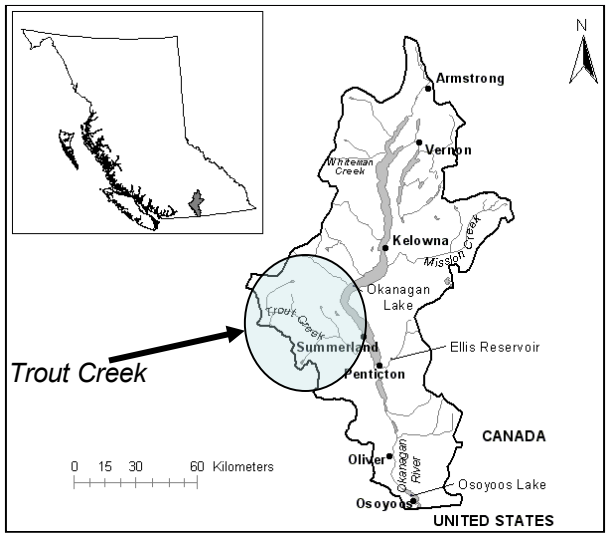
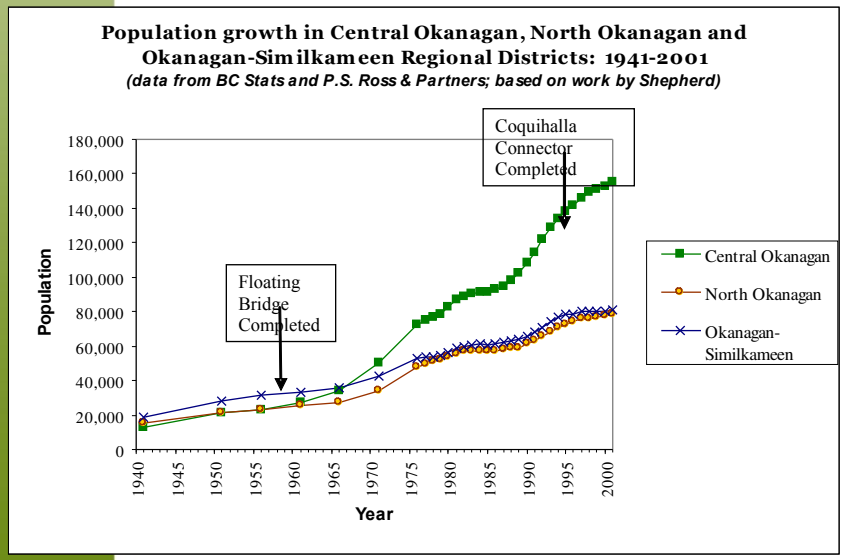
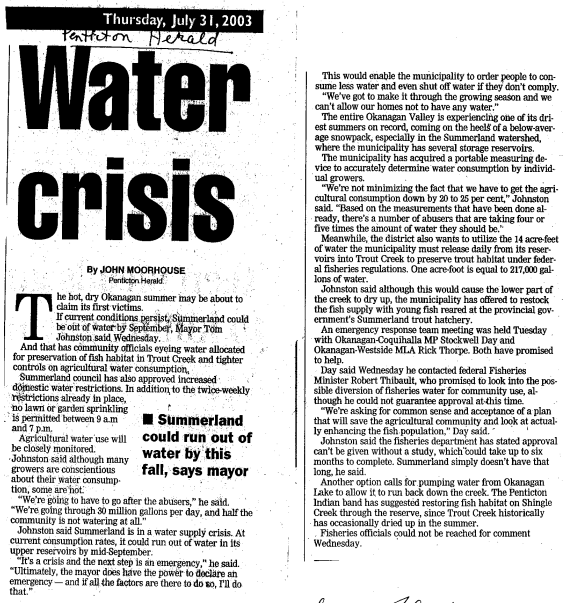
Okanagan Basin



- Area = 8200 km^2
- Okanagan Valley = 160 km in length
- 80% of streams fully recorded
- 2003 drought – water shortage in Summerland





Thursday, July 31, 2003

Penticton Herald

Water crisis

By JOHN MOORHOUSE
Penticton Herald

The hot, dry Okanagan summer may be about to claim its first victims.

If current conditions persist, Summerland could be out of water by September, Mayor Tom Johnston said Wednesday.

And that has community officials eyeing water allocated for preservation of fish habitat in Trout Creek and tighter controls on agricultural water consumption.

Summerland council has also approved increased domestic water restrictions. In addition to the twice-weekly restrictions already in place, no lawn or garden sprinkling is permitted between 9 a.m and 7 p.m.

Agricultural water use will be closely monitored. Johnston said although many growers are conscientious about their water consumption, some are not.

"We're going to have to go after the abusers," he said. "We're going through 30 million gallons per day, and half the community is not watering at all."

Johnston said Summerland is in a water supply crisis. At current consumption rates, it could run out of water in its upper reservoirs by mid-September.

"It's a crisis and the next step is an emergency," he said. "Ultimately, the mayor does have the power to declare an emergency — and if all the factors are there to do so, I'll do that."

■ Summerland could run out of water by this fall, says mayor

This would enable the municipality to order people to consume less water and even shut off water if they don't comply.

"We've got to make it through the growing season and we can't allow our homes not to have any water."

The entire Okanagan Valley is experiencing one of its driest summers on record, coming on the heels of a below-average snowpack, especially in the Summerland watershed, where the municipality has several storage reservoirs.

The municipality has acquired a portable measuring device to accurately determine water consumption by individual growers.

"We're not minimizing the fact that we have to get the agricultural consumption down by 20 to 25 per cent," Johnston said. "Based on the measurements that have been done already, there's a number of abusers that are taking four or five times the amount of water they should be."

Meanwhile, the district also wants to utilize the 14 acre-feet of water the municipality must release daily from its reservoirs into Trout Creek to preserve trout habitat under federal fisheries regulations. One acre-foot is equal to 217,000 gallons of water.

Johnston said although this would cause the lower part of the creek to dry up, the municipality has offered to restock the fish supply with young fish reared at the provincial government's Summerland trout hatchery.

An emergency response team meeting was held Tuesday with Okanagan-Coquihalla MP Stockwell Day and Okanagan-Westside MLA Rick Thorpe. Both have promised to help.

Day said Wednesday he contacted federal Fisheries Minister Robert Thibault, who promised to look into the possible diversion of fisheries water for community use, although he could not guarantee approval at this time.

"We're asking for common sense and acceptance of a plan that will save the agricultural community and look at actually enhancing the fish population," Day said.

Johnston said the fisheries department has stated approval can't be given without a study, which could take up to six months to complete. Summerland simply doesn't have that long, he said.

Another option calls for pumping water from Okanagan Lake to allow it to run back down the creek. The Penticton Indian band has suggested restoring fish habitat on Shingle Creek through the reserve, since Trout Creek historically has occasionally dried up in the summer.

Fisheries officials could not be reached for comment Wednesday.

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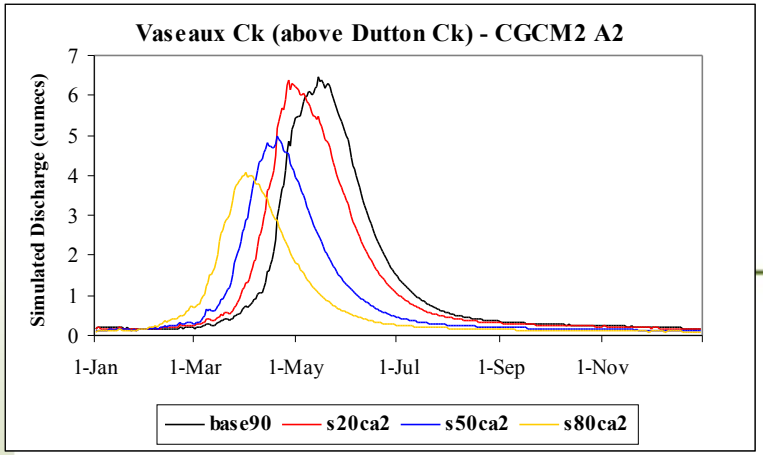
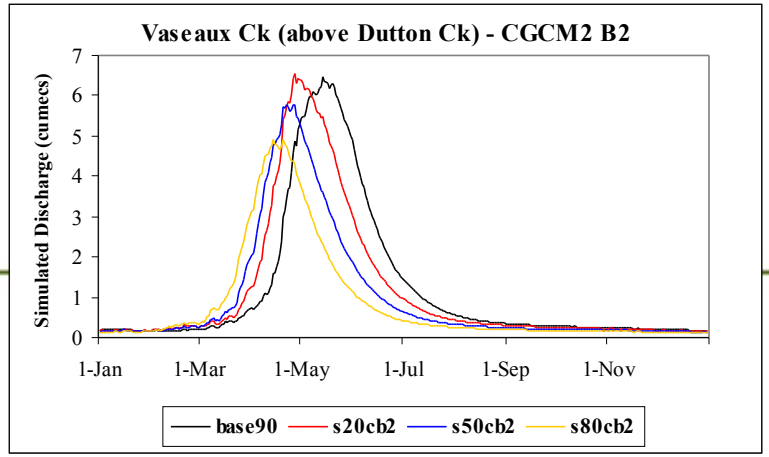
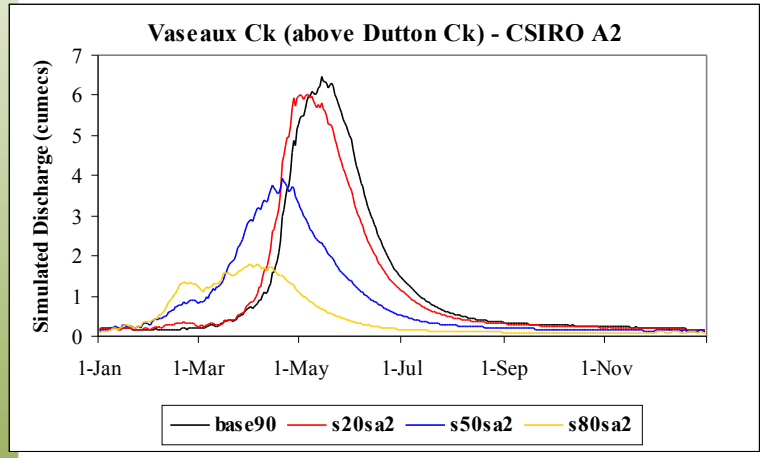
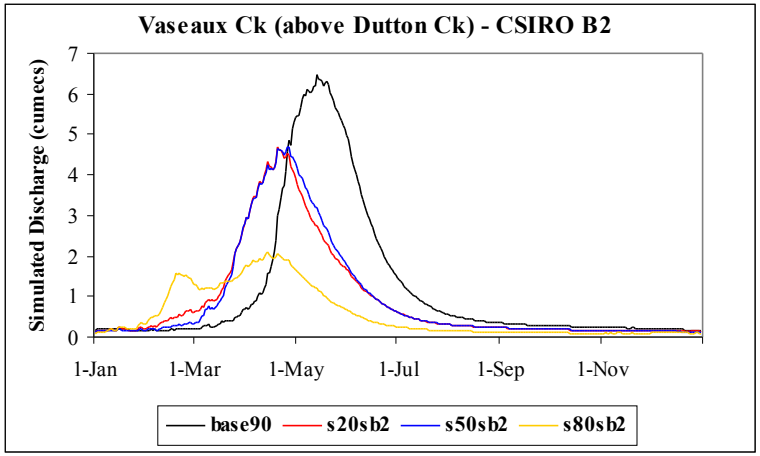
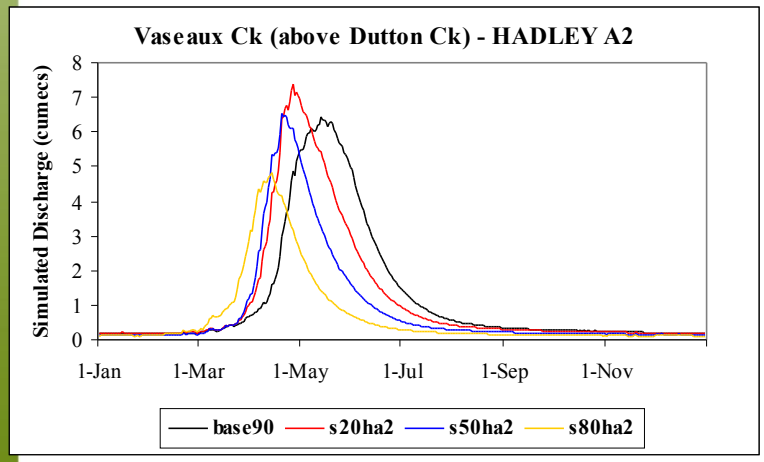
Streamflow Scenarios for Vaseux Creek (Merritt et al.)

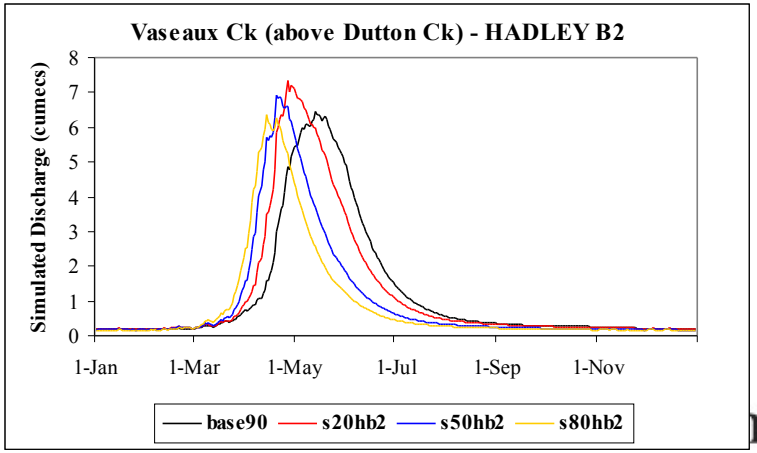






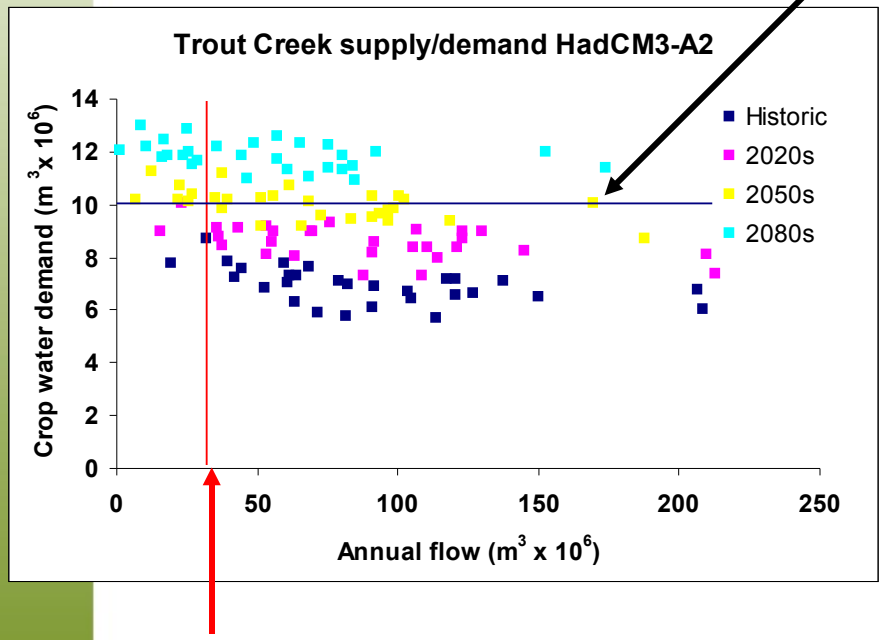


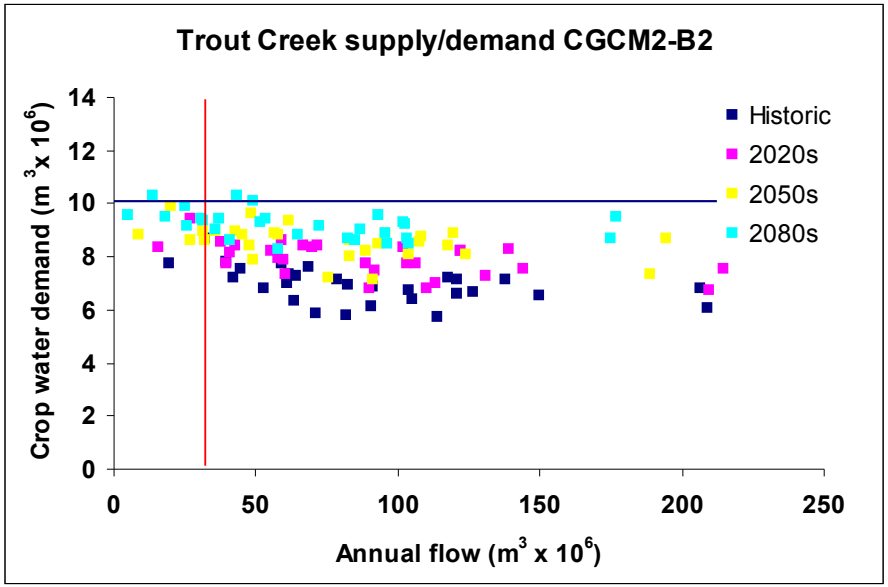




Risks associated with water supply and demand in response to climate change *(Neilsen et al., 2004)*

Maximum allowable demand – 2002 use





Local defined drought – 30% average annual flow

Costs of Adaptation Options in the Okanagan

(McNeill, Hrasko, 2004)

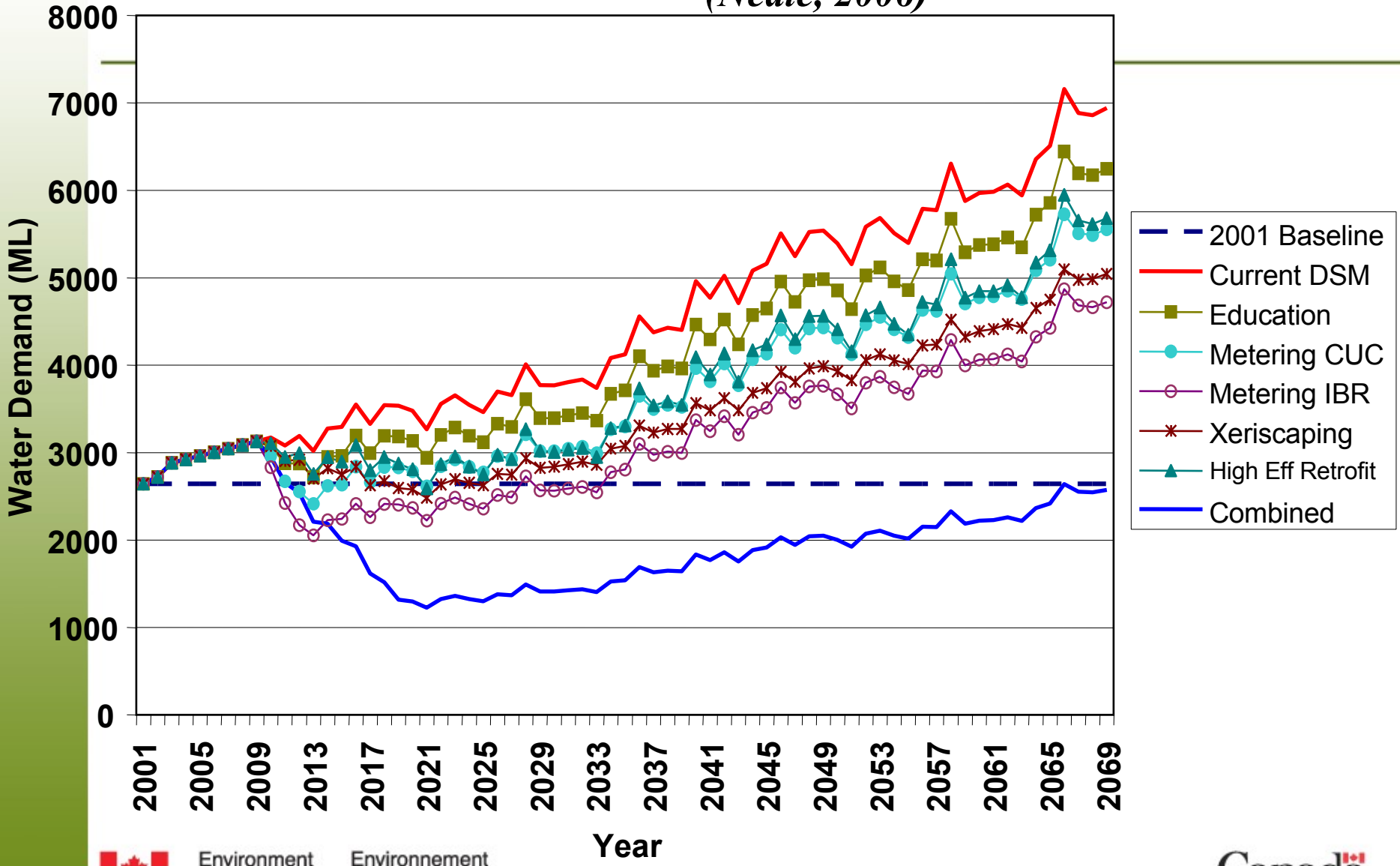
		Cost (CAN$/acre-ft.)	Water saved or supplied
Irrigation scheduling:	-large holdings	$500	10%
	-small holdings	835	10%
Trickle irrigation:	-high demand areas	1500	30%
	-medium demand areas	1666	30%
Metering:	-lowest cost	1882	30%
	-higher cost	2300-3400	20-30%
Public education:	-large & medium communities	835	10%
Leak detection:	-average	1567	10-15%
Storage:	-lowest cost	600	limited
	-medium-high cost	1000-1500	limited
Lake pumping:	-lowest cost	648	0-100%
	-low cost (no balancing)	1160	0-100%
	-higher cost	2200-2700	0-100%

1 acre-ft. = 1233.5 m^3; 1 m^3 = 1000 litres

Demand Side Management Impact on Water Demand

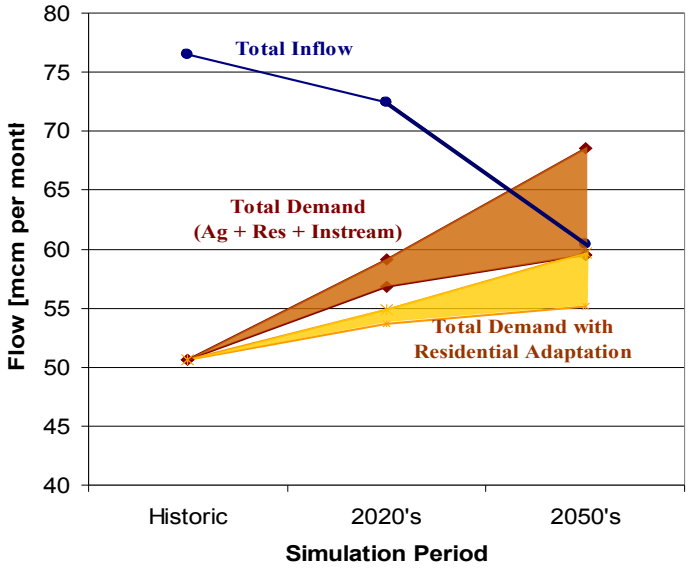
Oliver, CGCM2 A2, Medium Population Growth

(Neale, 2006)

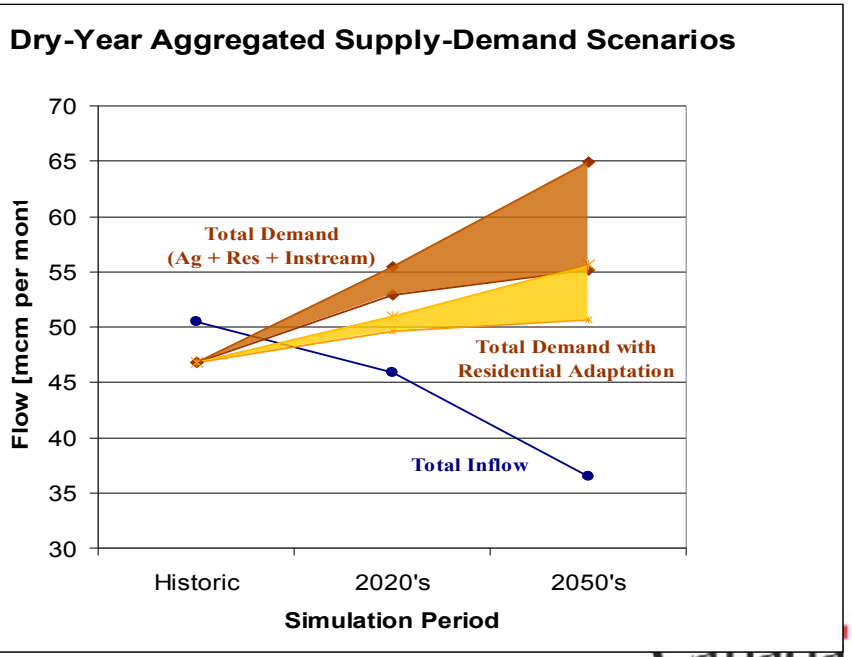


AVERAGE YEAR

Okanagan Inflows vs. Water Demands, HadCM3-A2 *(source: Langsdale et al., 2006; in Cohen and Neale 2006)*

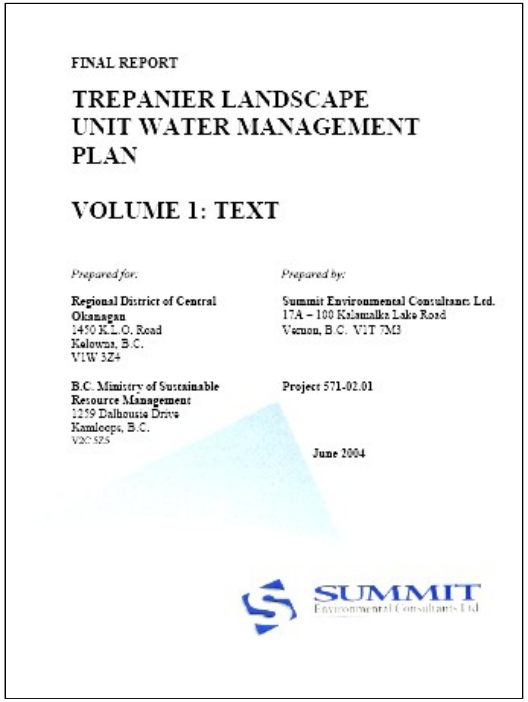


DRY YEAR



Impact on Okanagan Water Management

- **Incorporation of climate change into Trepanier Landscape Unit Water Management Plan**
  - **Recommends demand management as first priority, along with supply augmentation, by 2050 if no climate change assumed, and by 2020 if climate change is assumed**



FINAL REPORT

TREPANIER LANDSCAPE UNIT WATER MANAGEMENT PLAN

VOLUME 1: TEXT

Prepared for:

Regional District of Central Okanagan
1450 K.L.O. Road
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B.C. Ministry of Sustainable Resource Management
1259 Dalhousie Drive
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Project 571-02.01

June 2004

SUMMIT Environmental Consultants Ltd

Moving Beyond The Damage Report

an opportunity for participatory integrated assessment (PIA) & decision support….

Technical Info & Data

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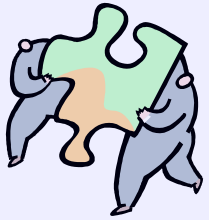

Experience Based Knowledge & Values

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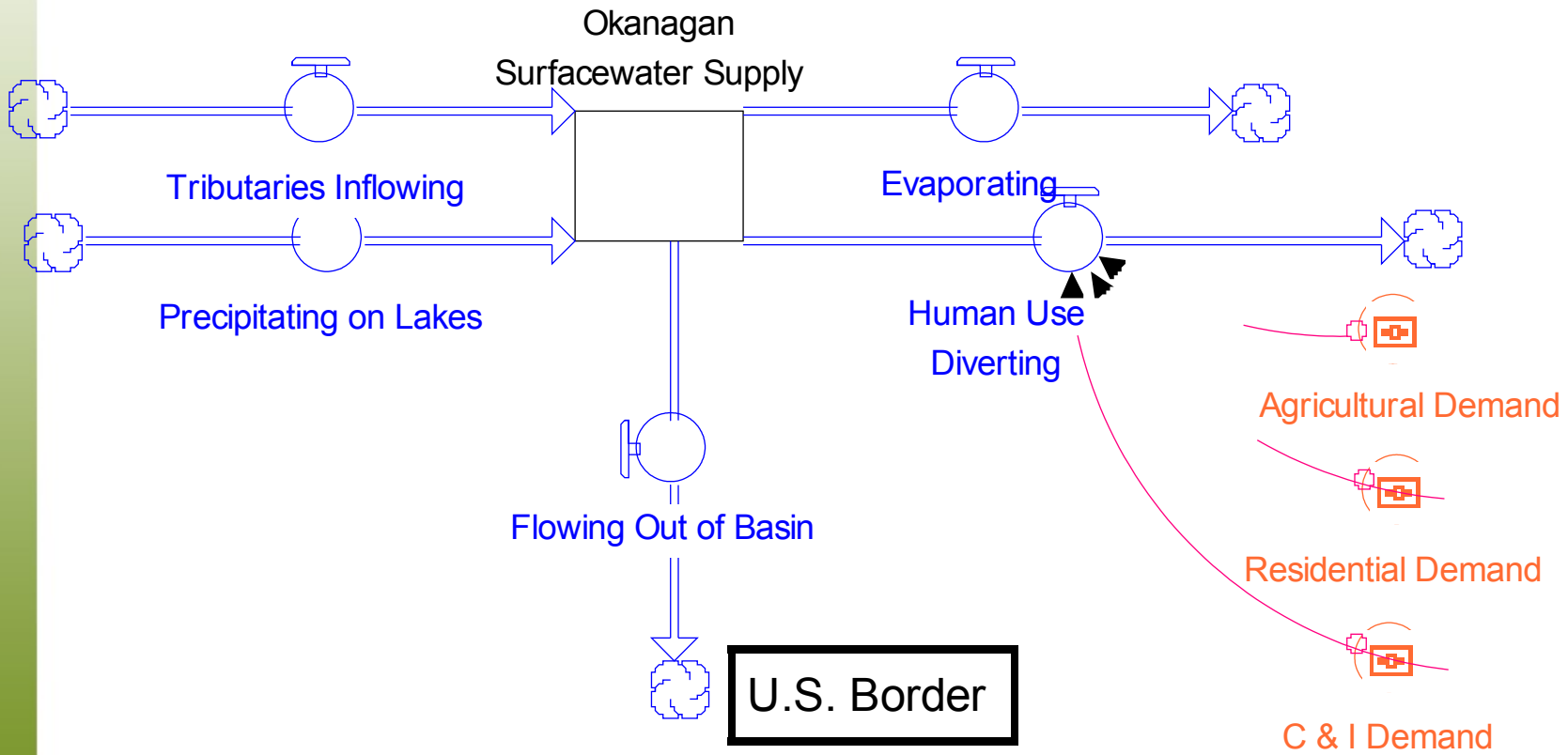
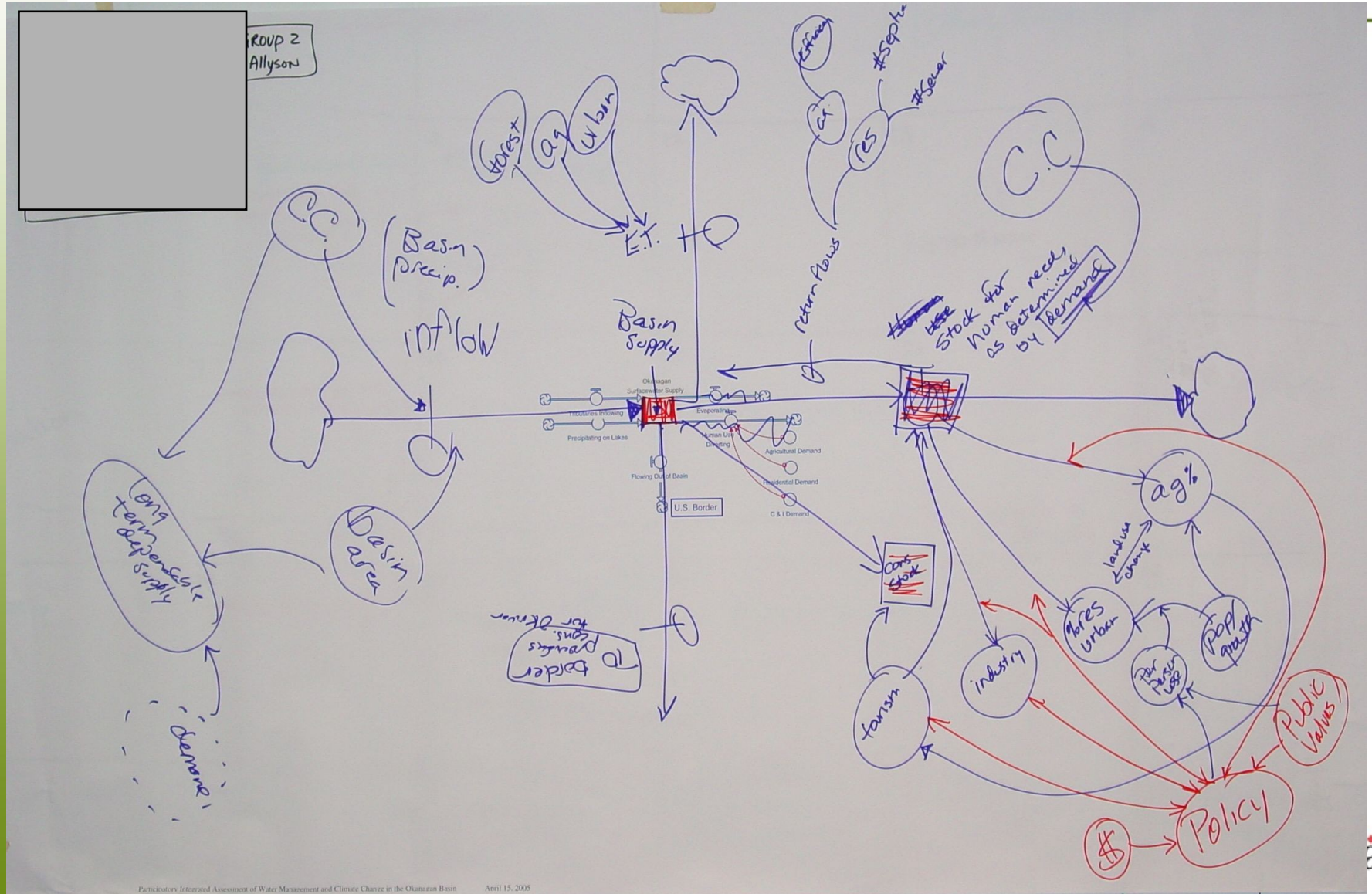
Decision Support Model

Preliminary sketch of decision model
(Langsdale et al., 2006, 2007)



Input from some participants at Okanagan study model building workshop, April 2005 *(Cohen & Neale, 2007)*



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Edit Interface Run Help

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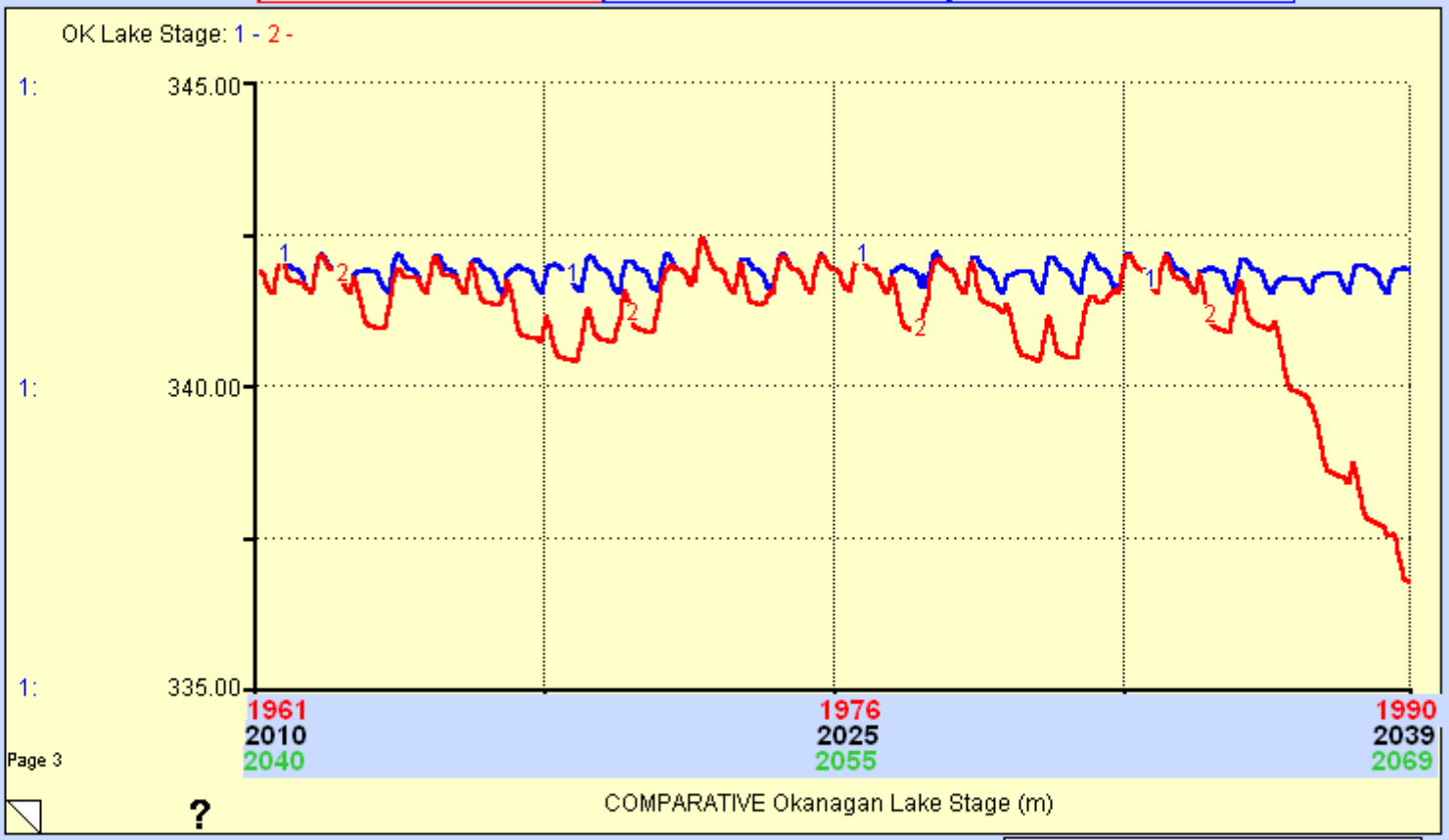
Consequences: Okanagan Lake Issues

Run in Pause Mode | Run | Stop | Clear Graphs

Initial Year	2040	Current Year	2069	Current Month	12

2040-2069 case; Okanagan Lake stage; (1) No adaptation; (2) supplement with Okanagan Lake; no other adaptation



Graphs of Consequences

Future Settings | Review History

Manage Lake for Sockeye
Red = No
Green = Yes

Climate Scenario Selected
Red = Base Case
Yellow = Hadley A2
Green = Hadley A2

isee Player

Edit Interface Run Help

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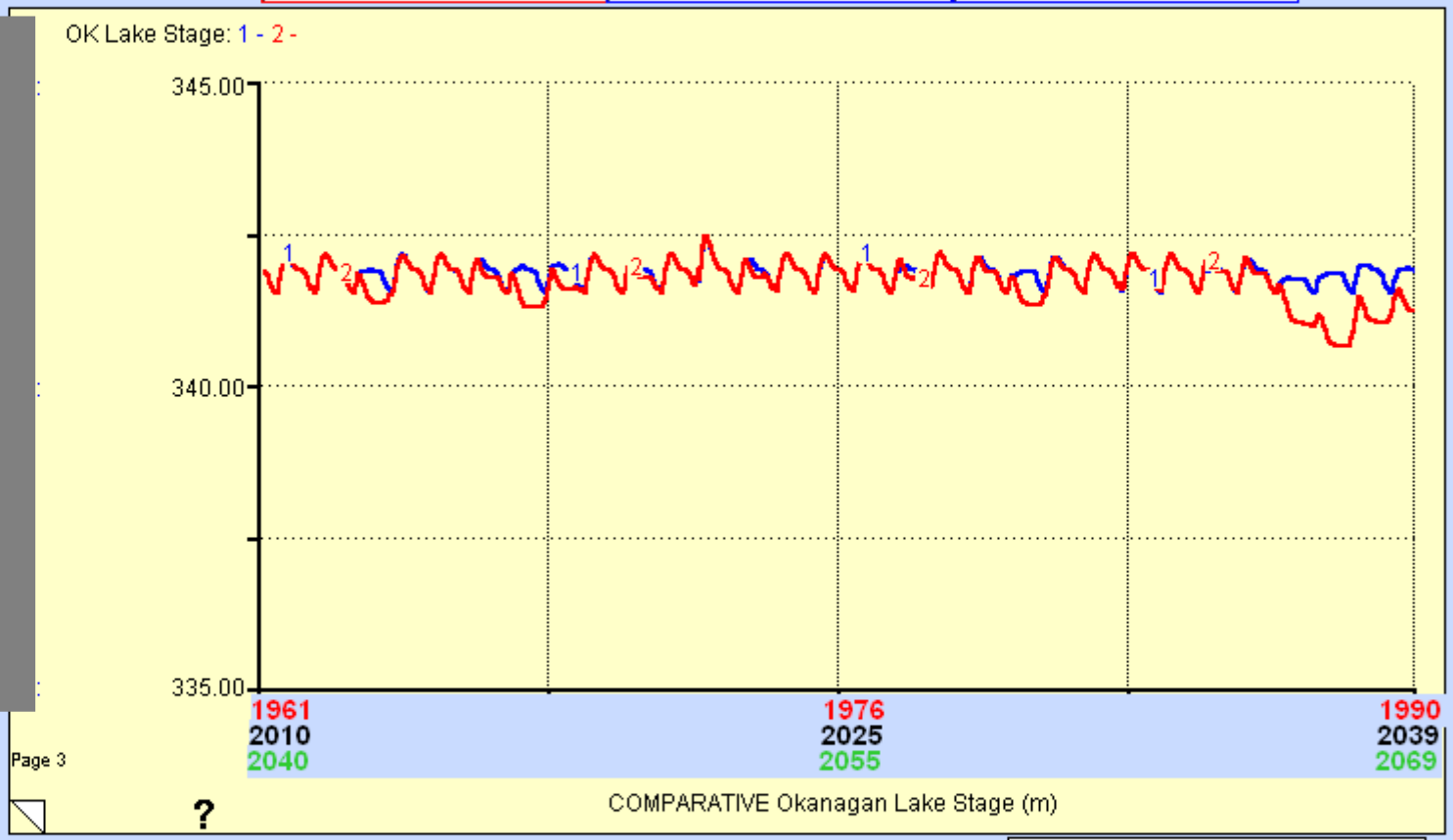
Consequences: Okanagan Lake Issues

Run in Pause Mode | Run | Stop | Clear Graphs

Initial Year	2040	Current Year	2069	Current Month	12

2040-2069 case; Okanagan Lake stage;
(1) No adaptation;
(2) agriculture & residential DSM adaptation, plus supplement with Okanagan Lake; no sockeye management



Graphs of Consequences

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Manage Lake for Sockeye
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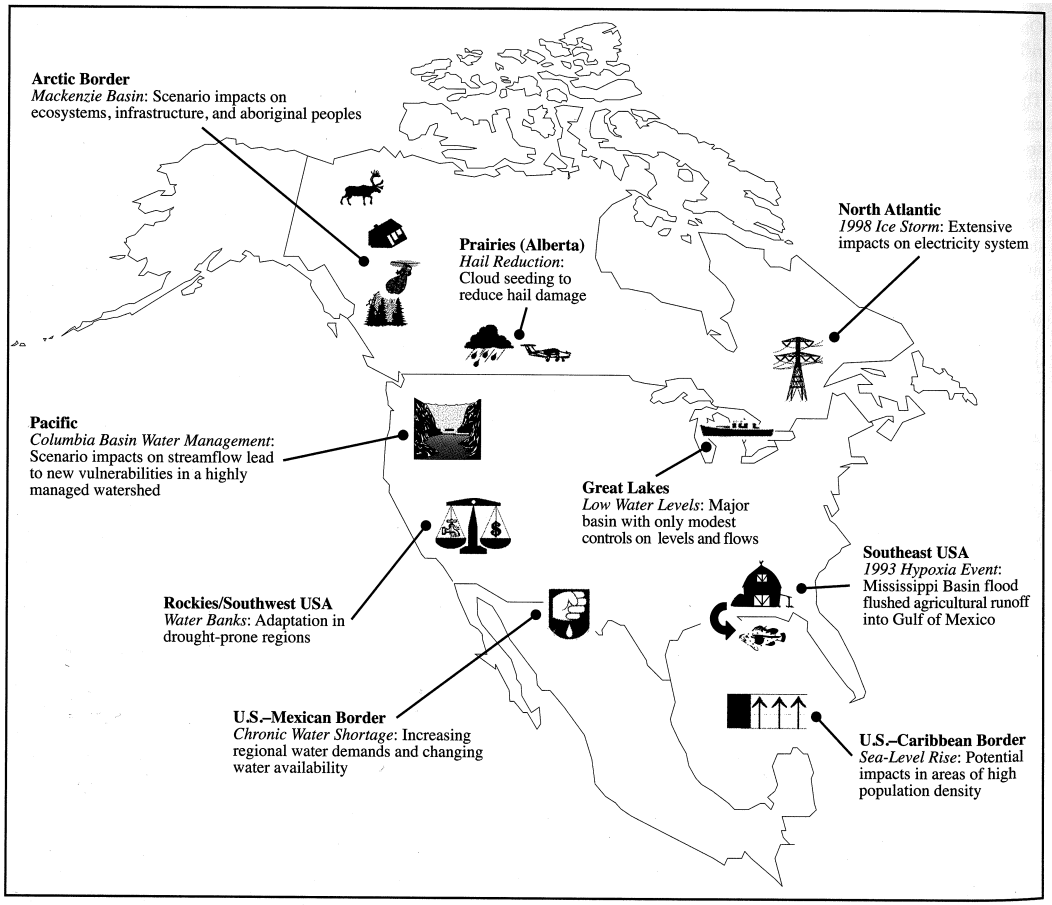
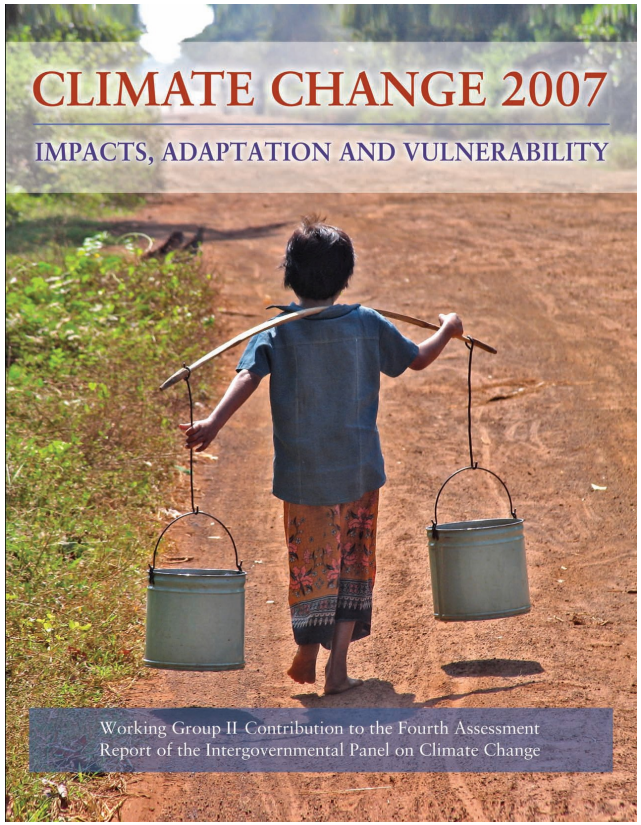
Columbia Basin highlighted among subregional cases from North America

(IPCC 2001; TAR, WG2, Ch. 15)



Okanagan Study Highlighted in IPCC 4AR



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Box 3.1. Costs of climate change in Okanagan, Canada

The Okanagan region in British Columbia, Canada, is a semi-arid watershed of 8,200 km² area. The region's water resources will be unable to support an increase in demand due to projected climate change and population growth, so a broad portfolio of adaptive measures will be needed (Cohen and Neale, 2006; Cohen et al., 2006). Irrigation accounts for 78% of the total basin licensed water allocation.

Figure 3.7 illustrates, from a suite of six GCM scenarios, the worst-case and least-impact scenario changes in annual water supply and crop water demand for Trout Creek compared with a drought supply threshold of 30 million m³/yr (36% of average annual present-day flow) and observed maximum demand of 10 million m³/yr (Neilsen et al., 2004). For flows below the drought threshold, local water authorities currently restrict water use. High-risk outcomes are defined as years in which water supply is below the drought threshold and water demand above the demand threshold. For all six scenarios, demand is expected to increase and supply is projected to decline. Estimated crop water demand increases most strongly in the HadCM3 A2 emissions scenario in which, by the 2080s, demand exceeds the current observed maximum in every year. For HadCM3 A2, high-risk outcomes occur in 1 out of 6 years in the 2050s, and in 1 out of 3 years in the 2080s. High-risk outcomes occur more often under A2 than under the B2 emissions scenario due to higher crop water demands in the warmer A2 world.

Table 3.3 illustrates the range of costs of adaptive measures currently available in the region, that could either decrease water demand or increase water supply. These costs are expressed by comparison with the least-cost option, irrigation scheduling on large holdings, which is equivalent to US$0.35/m³ (at 2006 prices) of supplied water. The most expensive options per unit of water saved or stored are metering and lake pumping to higher elevations. However, water treatment requirements will lead to additional costs for new supply options (Hrasko and McNeill, 2006). No single option is expected to be sufficient on its own.

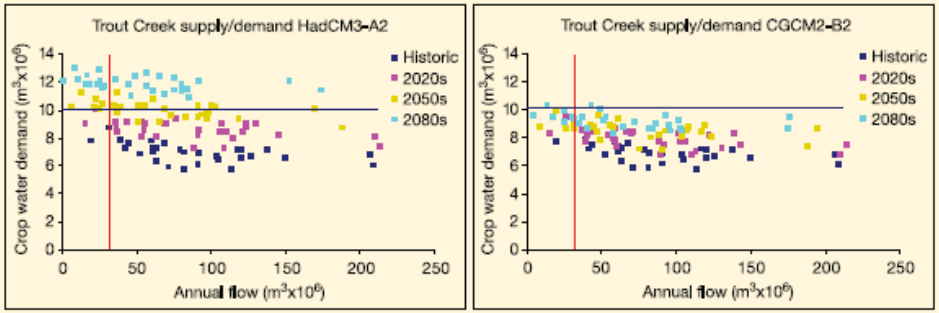
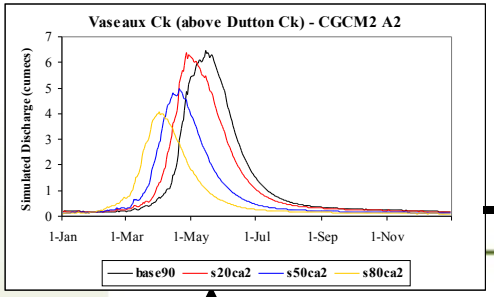
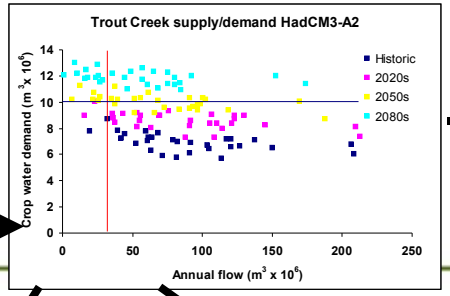


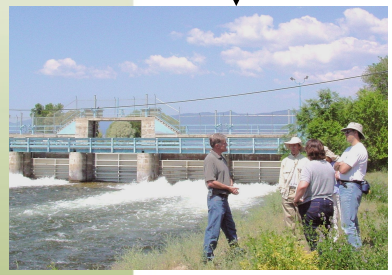
Figure 3.7. *Annual crop water demand and water supply for Trout Creek, Okanagan region, Canada, modelled for 1961 to 1990 (historic) and three 30-year time slices in the future. Each dot represents one year. Drought supply threshold is represented by the vertical line, maximum observed demand is shown as the horizontal line (Neilsen et al., 2004).*

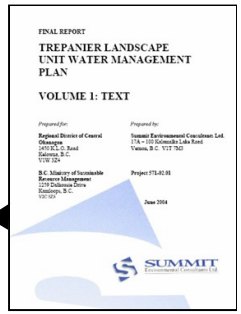
Table 3.3. *Relative costs per unit of water saved or supplied in the Okanagan region, British Columbia (adapted from MacNeil, 2004).*

Adaptation option	Application	Relative unit cost	Water saved or supplied in % of the current supply
Irrigation scheduling	Large holdings to small holdings	1.0 to 1.7	10%
Public education	Large and medium communities	1.7	10%
Storage	Low to high cost	1.2 to 3.0	Limited (most sites already developed)
Lake pumping	Low (no balancing reservoirs) to high cost (with balancing reservoirs)	1.3 to 5.4	0 to 100%
Trickle irrigation	High to medium demand areas	3.0 to 3.3	30%
Leak detection	Average cost	3.1	10 to 15%
Metering	Low to high cost	3.8 to 5.4	20 to 30%









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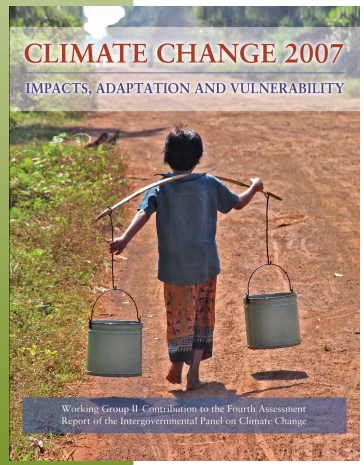

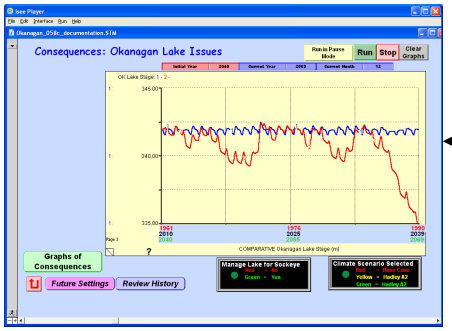

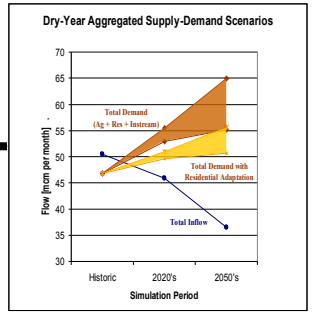

From Trout Creek to the IPCC, 1999-2007

Canada

Adaptation in the Okanagan and Columbia-Kootenay regions

- Okanagan Basin Water Board [www.obwb.ca]
  - Okanagan Watershed Stewardship Council
  - Okanagan Water Supply and Demand Study
- Columbia Basin Trust [www.cbt.org]
  - Communities Adapting to Climate Change

COLUMBIA BASIN TRUST
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For Immediate Release
April 2, 2008

CBT LAUNCHES NEW CLIMATE CHANGE INITIATIVE

Basin communities start planning to adapt to climate change

(Columbia Basin) - The City of Kimberley and the District of Elkford will partner with the Columbia Basin Trust (CBT) in a year-long initiative to learn how to adapt to local climate change impacts.

Communities Adapting to Climate Change is a new planning and action initiative for local governments in the Basin. The initiative is being spearheaded by CBT with input from an advisory committee consisting of a number of provincial, federal, and academic organizations as well as First Nations and local governments.

For further information on Okanagan climate change studies:

stewart.cohen@ec.gc.ca
scohen@forestry.ubc.ca
neilsend@agr.gc.ca
tinan@interchange.ubc.ca
slangsdale@gmail.com

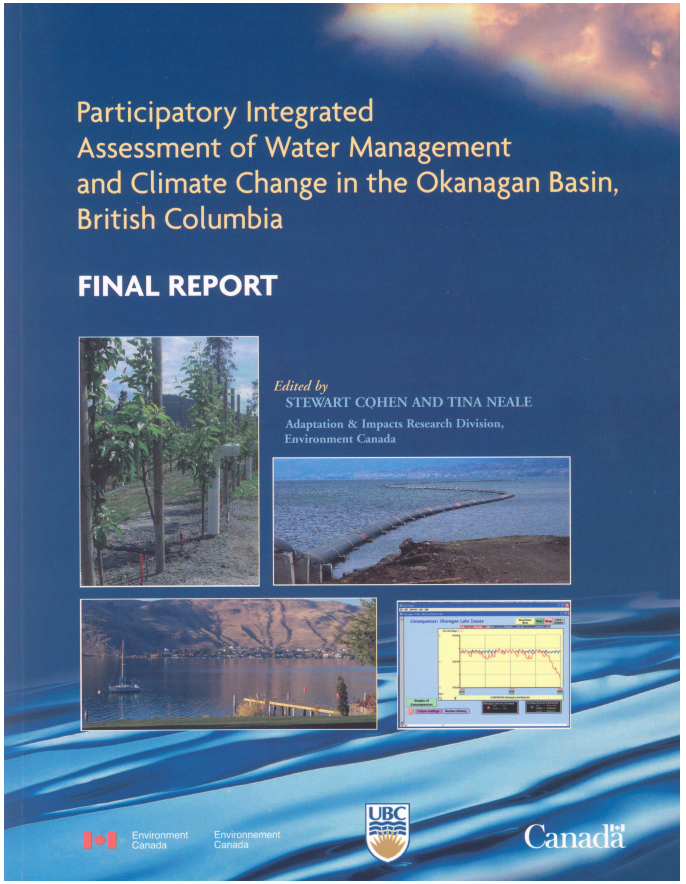
Reports:

http://www.forestry.ubc.ca/aird

http://www.adaptation.nrcan.gc.ca

Model and model guide:

http://www.forestry.ubc.ca/aird



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