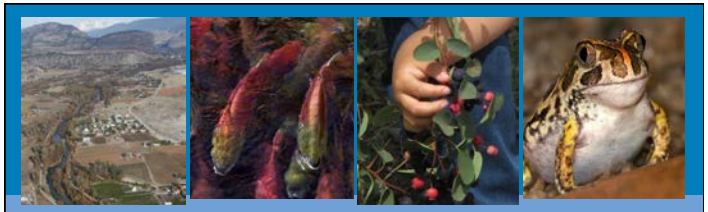


Balancing Water Management to Sustain Aquatic Ecosystems and Human Systems in the Okanagan Valley

Kim Hyatt[1], John Wagner[2] and Brian Symonds[3]

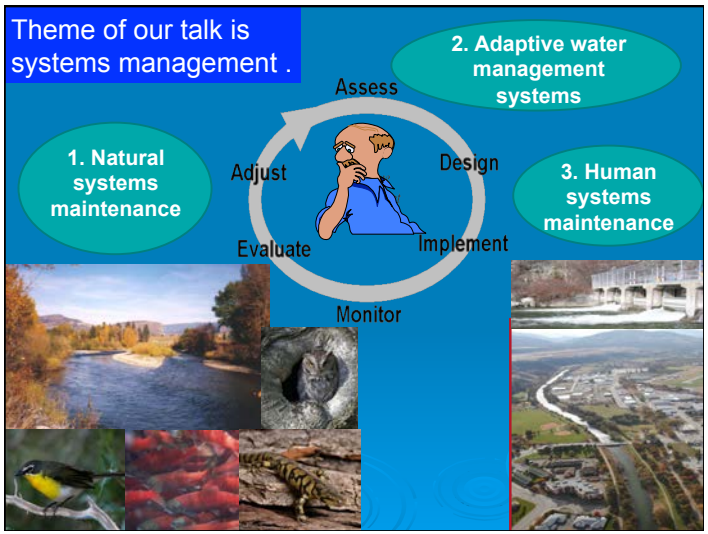
1. Fisheries and Oceans Canada, 2. UBC-Okanagan, 3. BC Ministry of Forests, Lands and Natural Resource Operations

2nd Osoyoos Lake Water Science Forum September 18-20, 2011.

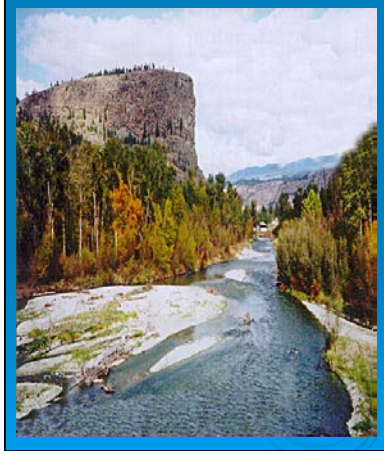
Outline for Our Talk

- A three-part talk to provide general context for 2 days of detailed OLWSF presentations.
- **Part 1**: K. Hyatt - a "thumbnail" sketch of Okanagan aquatic and human systems over the past 10-12 thousand years.
- **Part 2**: B. Symonds - water management in the Okanagan Lake & River System (OLRS) to sustain natural & human systems.
- **Part 3**: J. Wagner - water governance past, present and future .

Theme of our talk is systems management .



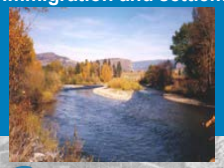
Postglacial Evolution of Okanagan Ecosystems

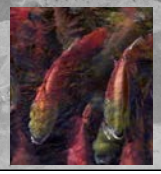


Ten to12 thousand years ago, a breach in the glacial dam at MacIntyre Bluff created a riverine corridor for northward invasions of biota from a rich unglaciated reservoir of species to the south.

Okanagan aquatic ecosystems formed in a rich complex of lakes, streams, wetlands & riparian corridors

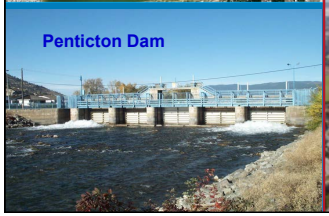
Natural and human systems developed gradually over millenia until the mid-1800s when agricultural and industrial development accelerated rapidly with a wave of human population immigration and settlement from eastern North America.



Ok River floodplain in Oliver area *circa* 1930

"Disturbance regimes" imposed by contemporary development of human systems increasingly dominate both terrestrial and especially aquatic ecosystems.



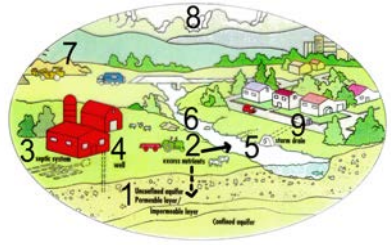
Irrigation and flood control dams block migration routes of aquatic biota.

Channelization has reduced 50% of the Okanagan R. length plus most of its wetlands & flood-plain.

Human impacts threaten a wide range of terrestrial and aquatic species (*e.g.* salmonids, molluscs etc.) subject to protection under federal (Fisheries Act, SARA) and provincial legislation.

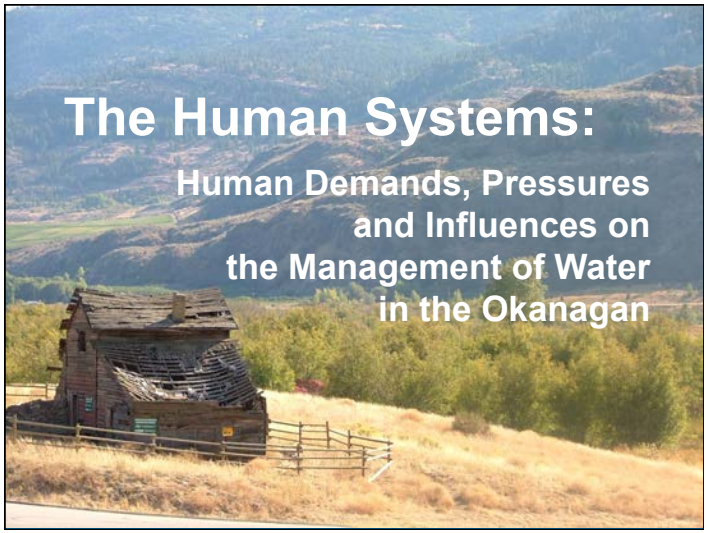
Human impact management through directed interventions to conserve, protect & restore aquatic ecosystem elements is an unavoidable activity if they're expected to retain some semblance of their historic character (e.g. healthy populations of salmon and resident fish supporting sustainable use by human populations) in the Okanagan Valley.

Human "systems" growth continues to threaten water quality, quantity and ecosystem integrity in the Okanagan !



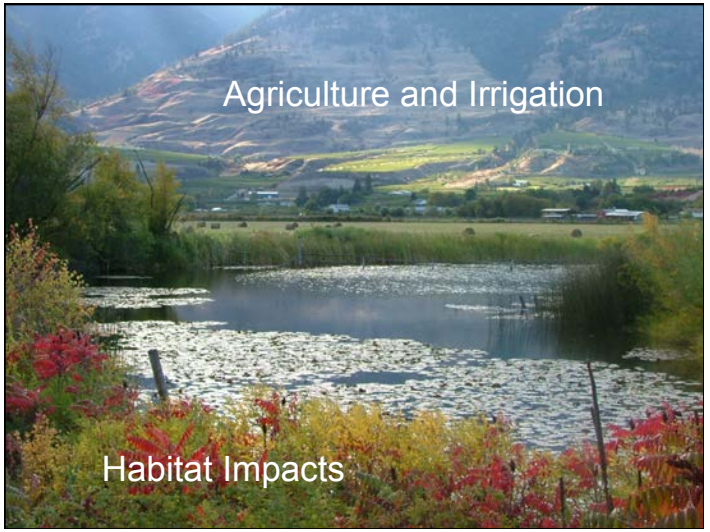
1. Groundwater supplies
2. Nutrients in effluents
3-4. Contaminants (PCB's, PBB's, DDT, heavy metals, etc.)
5. Surface water supplies
6. Invisible barriers: temp, O_2, NH_3
7. Landfills & waste
8. Climate change impacts on water.
9. Storm runoff and sediments from urban and agricultural development

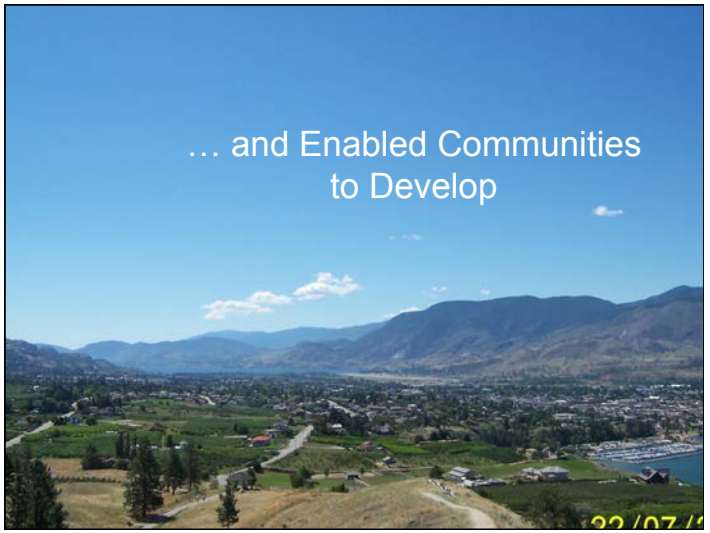
Okanagan aquatic ecosystems are subjected to "disturbance regimes" induced by discharge of nutrients, toxins, introduction of invasive species, dams, channelization & ongoing development of irrigation, flood control & engineered systems where water management represents a common interface for interactions between aquatic and human systems. Prudent water management in this arid landscape is key to the sustainability of both natural ecosystems (biodiversity in lakes, rivers, wetlands, riparian habitat) and human systems (agro-ecosystems, urban ecosystems etc...).



Beginnings of Water Development and Large Scale Use in the Okanagan

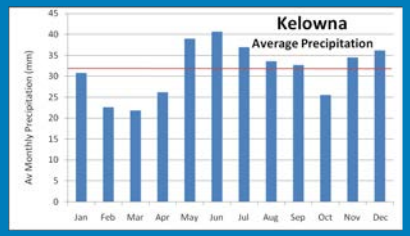
- Development of community water systems began in early 1900's to support a rapidly expanding agricultural industry
- Early systems consisted of upland storage reservoirs, and gravity fed distribution and irrigation works

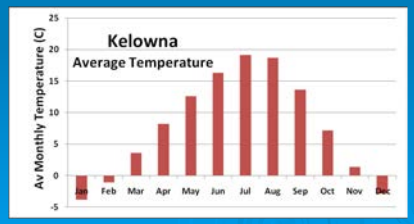




Okanagan Hydrology

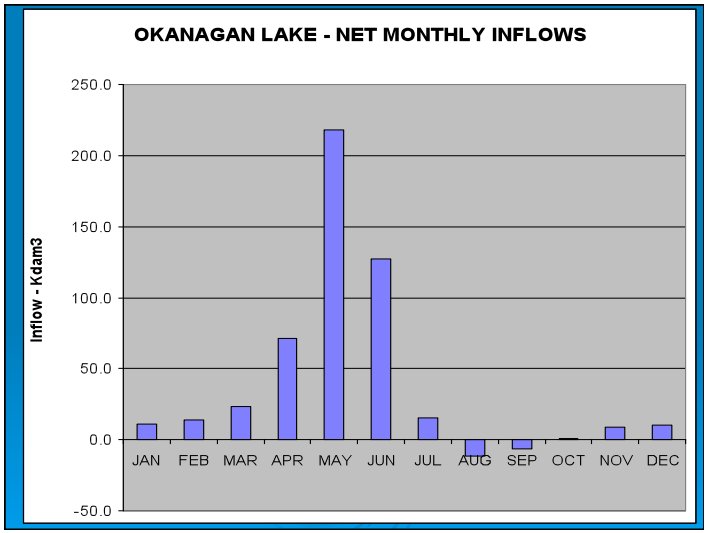
Annual hydrograph dominated by spring snowmelt

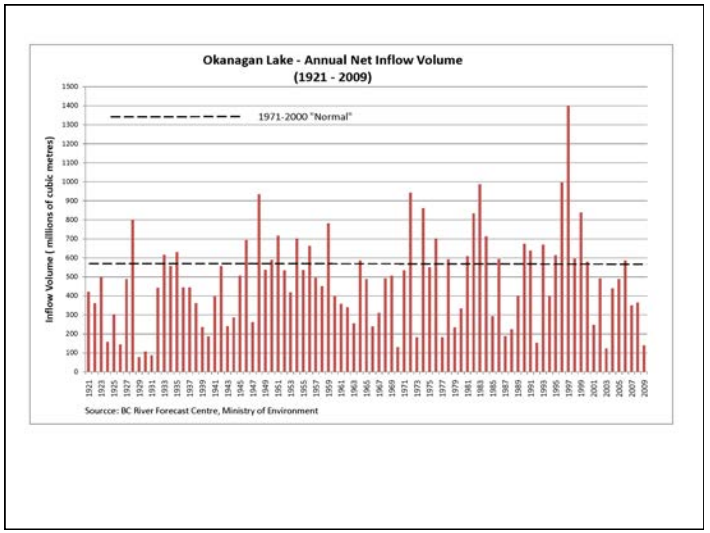


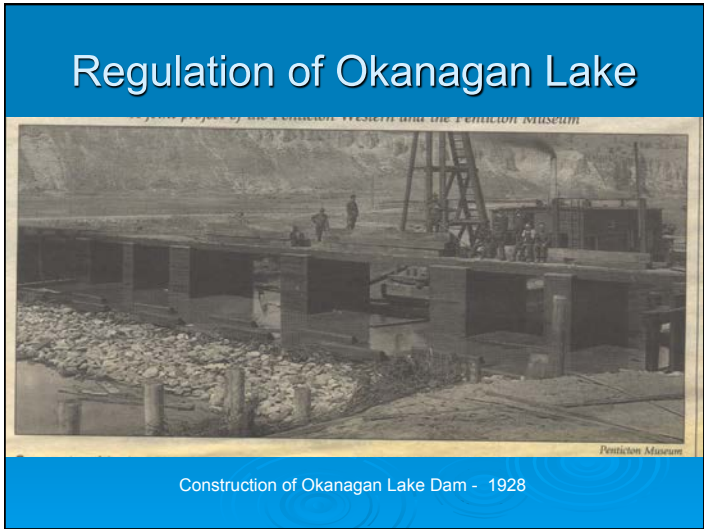


Kelowna

Mean Monthly Precipitation & Temperature


OKANAGAN LAKE - NET MONTHLY INFLOWS
Inflow - Kdam3
250.0
200.0
150.0
100.0
50.0
0.0
-50.0
JAN
FEB
MAR
APR
MAY
JUN
JUL
AUG
SEP
OCT
NOV
DEC

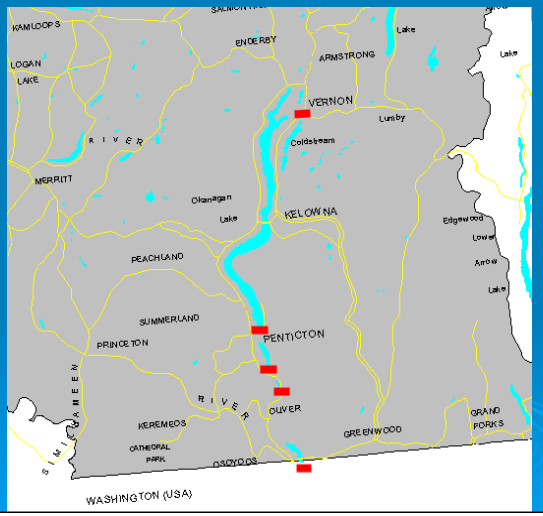

Okanagan Lake - Annual Net Inflow Volume
(1921 - 2009)
1971-2000 "Normal"
Inflow Volume (millions of cubic metres)
Sourcce: BC River Forecast Centre, Ministry of Environment

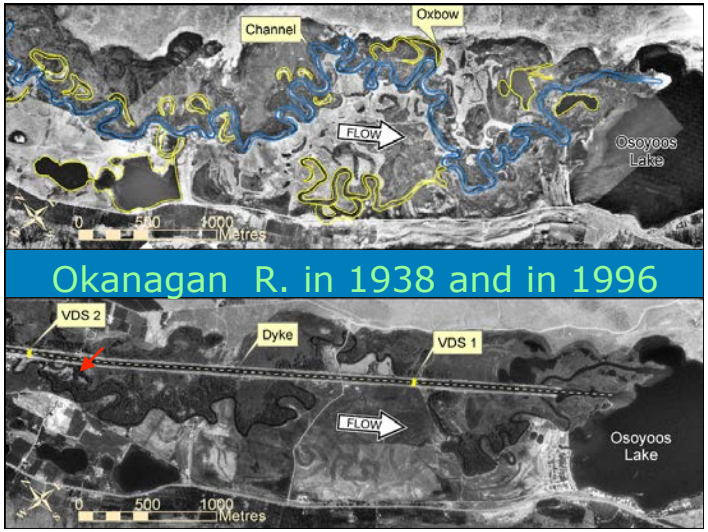

Regulation of Okanagan Lake
Penticton Museum
Construction of Okanagan Lake Dam - 1928


OKANAGAN LAKE
REGULATION SYSTEM

Okanagan Lake Regulation System

- Extends from Kalamalka Lake to north end of Osoyoos Lake
- 4 dams (Kalamalka/Wood, Okanagan, Skaha & Vaseux Lakes)
- 17 vertical drop structures
- 38 km of engineered channel, including 68 km of dikes
- 5 sediment basins





Okanagan Basin Agreement

"The Comprehensive Framework Plan"

(Provides the general rules for operating the Okanagan Lake Regulation System)

OBA Framework Plan (1974)

A Comprehensive Frame Work Plan for managing the water resources of the Okanagan to "achieved a desirable balance between the goals" of:

- Economic Development
- Environmental Quality (including fisheries, wildlife & recreation)
- Social Betterment

OLRS OPERATIONS

- OLRS is operated by the Penticton office of the BC Ministry of Forest, Lands and Natural Resource Operations.
- General operating rules contained in Okanagan Basin Agreement (i.e., target lake levels and river flows)
- Operating plan developed to meet multiple objectives of flood control, fisheries, water supply, recreation, navigation, tourism, international agreements, etc.
- Decisions regarding releases are based on operating plan and inflow forecasts

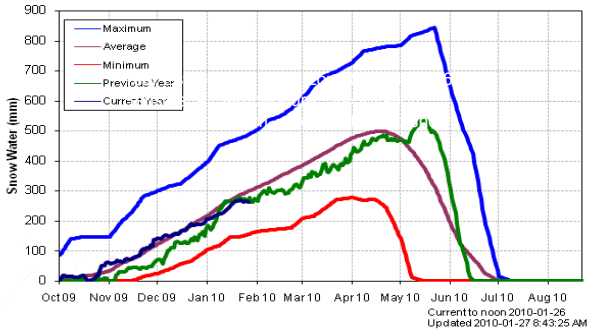
INFLOW FORECASTS

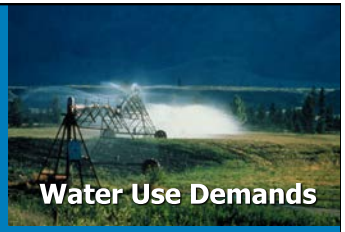
- Forecasts of freshet inflow volumes are made beginning February 1 and updated throughout the winter and spring
- Volume forecasts are made using fall & winter precipitation, mountain snow packs and over-winter lake inflow data.

Mission Creek Snow Pillow

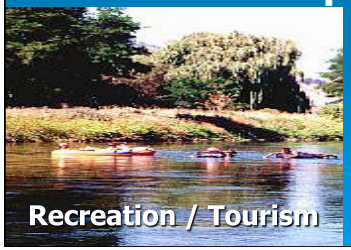
Year Established: 1969
Elevation: 1,794 m

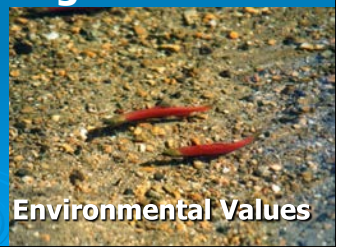
Sensors: Air temp., precipitation., snow water and snow depth

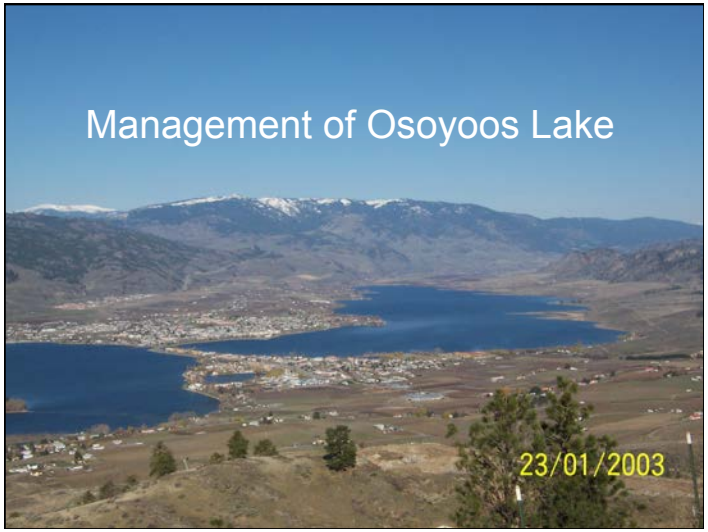




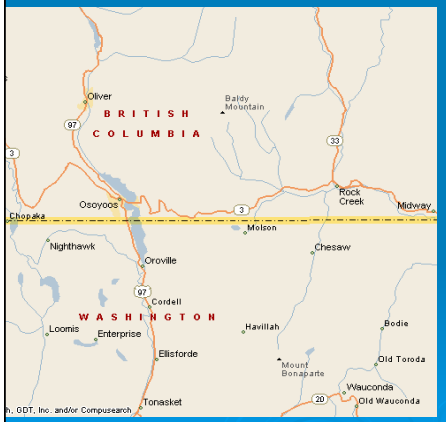
Balance competing interests





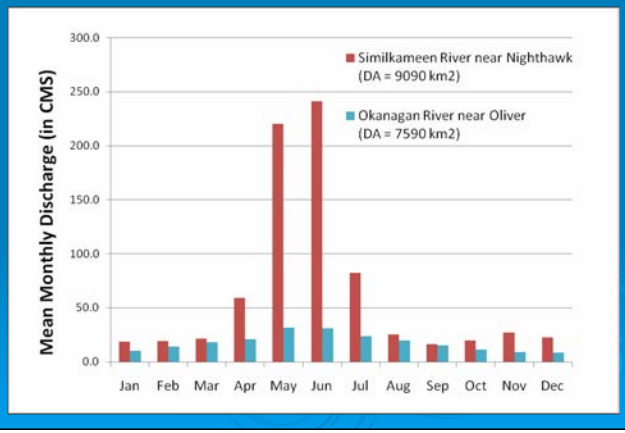


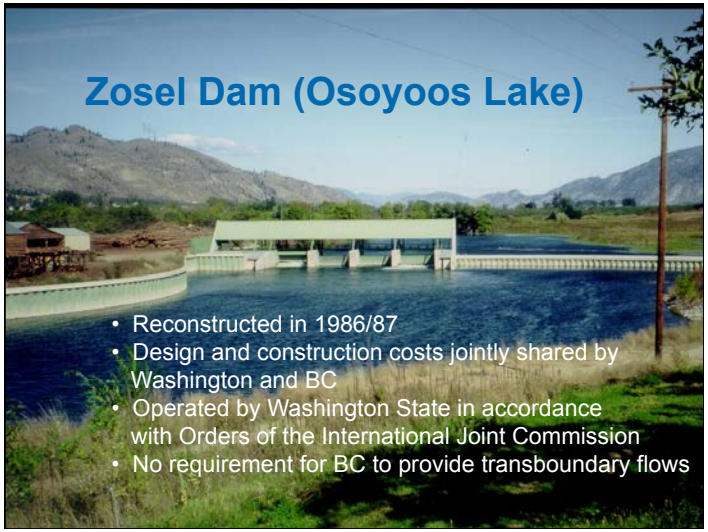
Osoyoos Lake



- Transboundary lake (2/3 Canada, 1/3 USA)
- Levels regulated by Zosel Dam in Oroville
- Subject to backwater from Similkameen River

Comparison of Similkameen River and Okanagan River Hydrographs





Zosel Dam (Osoyoos Lake)

- Reconstructed in 1986/87
- Design and construction costs jointly shared by Washington and BC
- Operated by Washington State in accordance with Orders of the International Joint Commission
- No requirement for BC to provide transboundary flows

The Social Life of Water

John Wagner
Environmental Anthropology
UBC Okanagan

The concept of a 'total' social phenomenon

- Theory developed by French Sociologist Marcel Mauss over one hundred years ago
- Some human activities generate institutions and behaviour that affect all aspects of our lives
- Early examples:
  - The Kula trading system in Papua New Guinea
  - The Potlatch in the Pacific Northwest
- Total social phenomena encompass economic, political, religious, artistic, and recreational domains

Water as a 'total' social phenomenon

- water as a biological necessity for all species
- water as the source of all life
- water as a symbol of purity and renewal
- water and agriculture
- water as a source of energy
- water and aesthetics
- All domains of our social and institutional lives are affected by our relationship to water

Water Governance Principles for the 21st Century

- United Nations Conventions and Agreements
  - Convention on the Law of the Non-Navigational Uses of International Watercourses (1997)
  - General Assembly resolution declaring that water is a human right (2010)
  - Declaration of the rights of Indigenous Peoples (2007)
  - Declarations concerning human rights that are water dependent (e.g. food security, health)
- Initiatives of the International Law Association
  - Helsinki Rules (1966), Berlin Rules (2004)
- Agreements for the management of international rivers
  - Nile, Ganges, Brahmaputra, Zambesi, Mekong, Danube, Rhine, Columbia, Colorado, etc.

Governance Theory in General

- Governance a much broader and more inclusive concept than government
- Emphasis on distributed or polycentric approaches to decision making
- How do we balance multiple and conflicting interests?
  - process must be inclusive and transparent
  - principles of equity and sustainability
  - emphasis collaboration, consensus building
  - recognize the importance of social learning

The Okanagan Watershed Governance System (Canada only)

- Federal and Provincial Governments
  - multiple ministries and agencies
- Indigenous Okanagan (Syilx) communities
  - Seven communities
  - Reserve lands and aboriginal title lands
  - multiple interests and agencies
- Regional Institutions
  - Okanagan Basin Water Board
  - Water Supply Association
  - Interior Health Authority
  - Environmental Groups
  - User groups and other non-governmental organizations
- Local Institutions
  - municipal and regional district water utilities
  - irrigation districts
  - water user associations
  - private water utilities
  - individual license holders

Columbia Basin Governance

- thousands of agencies and institutions from Federal, State, Provincial, and Tribal levels down through regional and local levels
- Lack of consensus on how to achieve a balance among competing interests
- Lack of an over-arching governance model that all actors can support
- Lack of an international agreement on the full range of governance issues at stake (terms of the Columbia River Treaty are too limited)

Governance as a Process of Evolution

- Governance systems cannot be legislated in their entirety but legislation can be used to enable key institutions within a governance system
- They include informal as well as formal mechanisms. Informal mechanisms include
  - individual social networks and alliances
  - institutional memory
  - the quality of communication among actors
  - appointed vs. elected representatives
  - incentives and disincentives for consensus based approaches
  - unspoken political agendas
  - the 'culture' of the governance system

Evolution of the IJC Osoyoos Lake Process

Original Criteria for Order of Approval for Zosel Dam, December 9, 1982

"Whereas the spokesman for the Applicant stated that failure of Zosel Dam to maintain established lake level would result in appreciable damage and financial loss to agriculture, recreational and municipal interests on both sides of the International Boundary; that the cooperation plan provides for emergency storage in Osoyoos Lake during water short years; that this emergency storage would be used for fisheries protection, domestic use and irrigation in both countries; and that the Applicant and the Province of British Columbia, hereinafter called the Province, are now working together to develop suitable financial arrangements for funding the proposed works."

The IJC Process

The 2006 Plan of Study for Renewal of the IJC Osoyoos Lake Orders

"The first step in preparing the Plan of Study was to scope out the issues connected with the present Orders of Approval. This was done by notifying 492 groups or individuals, directly contacting about 90 parties known to have interests relating to Osoyoos Lake, and making presentations at two public meetings, a meeting of the international Bilateral Okanagan Basin Working Group and a meeting of the Okanagan Shuswap Land and Resource Management Plan Implementation Committee. In addition we looked for issues as we reviewed over 150 technical reports, meeting minutes, and government files"
(Glenfir Resources 2006:5)

Evolution of the IJC Process

Osoyoos Lake Water Science Forum Summary Report 2007

"The Osoyoos Lake Water Science Forum (OLWSF) was held September 16-19, 2007 in Osoyoos, British Columbia. 40 presenters and panelists gave 35 presentations and held two round-table discussions over these three days. The Forum was attended by over 190 participants from both Canada and the United States."

Osoyoos Lake Water Science Conference 2011

Opportunities for Further Improvement to the Governance Process

- In addition to supporting the immediate goal of renewing the Osoyoos Lake Orders the conference provides us with opportunities for institutional innovation
- opportunities for social learning
- opportunity to build consensus around fundamental principles that can be applied in other water governance settings including international settings outside of NA
- opportunity to assess whether fundamental principles have changed over the past 30 years and what further change might be desirable

Some Parting Questions

- how many people can the Okanagan support and at what ecological, social, and economic costs or benefits as population increases *i.e.* define "limits to growth" ?
- how resilient are water resources, human and biological communities to increasing pressures from interacting factors such as population growth and climate change ?
- what is an appropriate "balance" between human population growth, increasing economic activity & fundamental issues such as maintenance of water quality, native biota & ecosystem services ?
- how should this balance be identified (*e.g.* given another 100 years will Okanagan compare favourably to today's Switzerland) ?
- once identified, what do we need to do to achieve it (*e.g.* new knowledge, new management systems, governance and wealth distribution issues) ?

Questions ?

Fisheries and Oceans Canada | Pêches et Océans Canada

Canada

Science Gaps and What is Being Done Now.

Science "Gaps":

- definition of ecological integrity and sustainability
- development of effective indicators of ecological integrity for aquatic ecosystems
- establishment of effective assessment and monitoring systems to track and/or predict aquatic ecosystem state changes in the Okanagan
- development of ecosystem-based water management systems and tools
- knowledge of climate variation and change effects on Okanagan ecosystems

What is Being Done ?

- research by agencies (IJC, EC, DFO, BC-FLNRO etc.) and universities some of which will be presented over the next two days.

For more info: www.obwb.ca

Okanagan Basin Water Board

Okanagan Nation Alliance

British Columbia – The Best Place on Earth

Ministry of Environment

Ministry of Agriculture and Lands

Ministry of Community Services

Canada – Agriculture and Agri-Food Canada | Agriculture et Agroalimentaire Canada

Fisheries and Oceans Canada | Pêches et Océans Canada

Environment Canada | Environnement Canada

BCAC – BC Agriculture Council

UBC Okanagan

Water Supply Association of BC

SFU Department of Earth Sciences