

A History of Environmental Flow Management in Alberta

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Fish and Wildlife
Alberta Environment and Parks
Cochrane, Alberta
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Environmental Flows – *the quantity, timing and quality of water flows required to sustain freshwater and estuarine ecosystems and the human livelihoods and well-being that depend on these ecosystems.*

Brisbane Declaration (2007)

How much water can be taken out of the river?



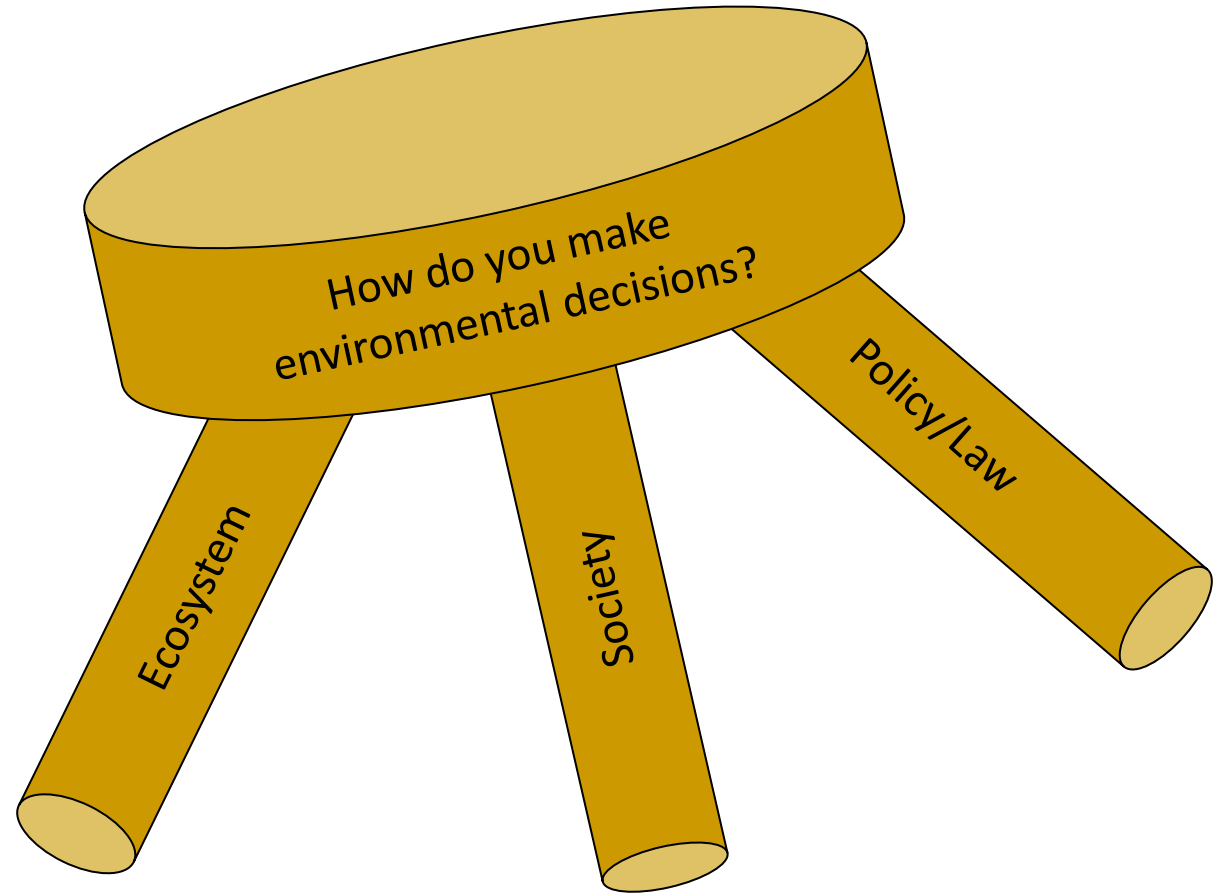
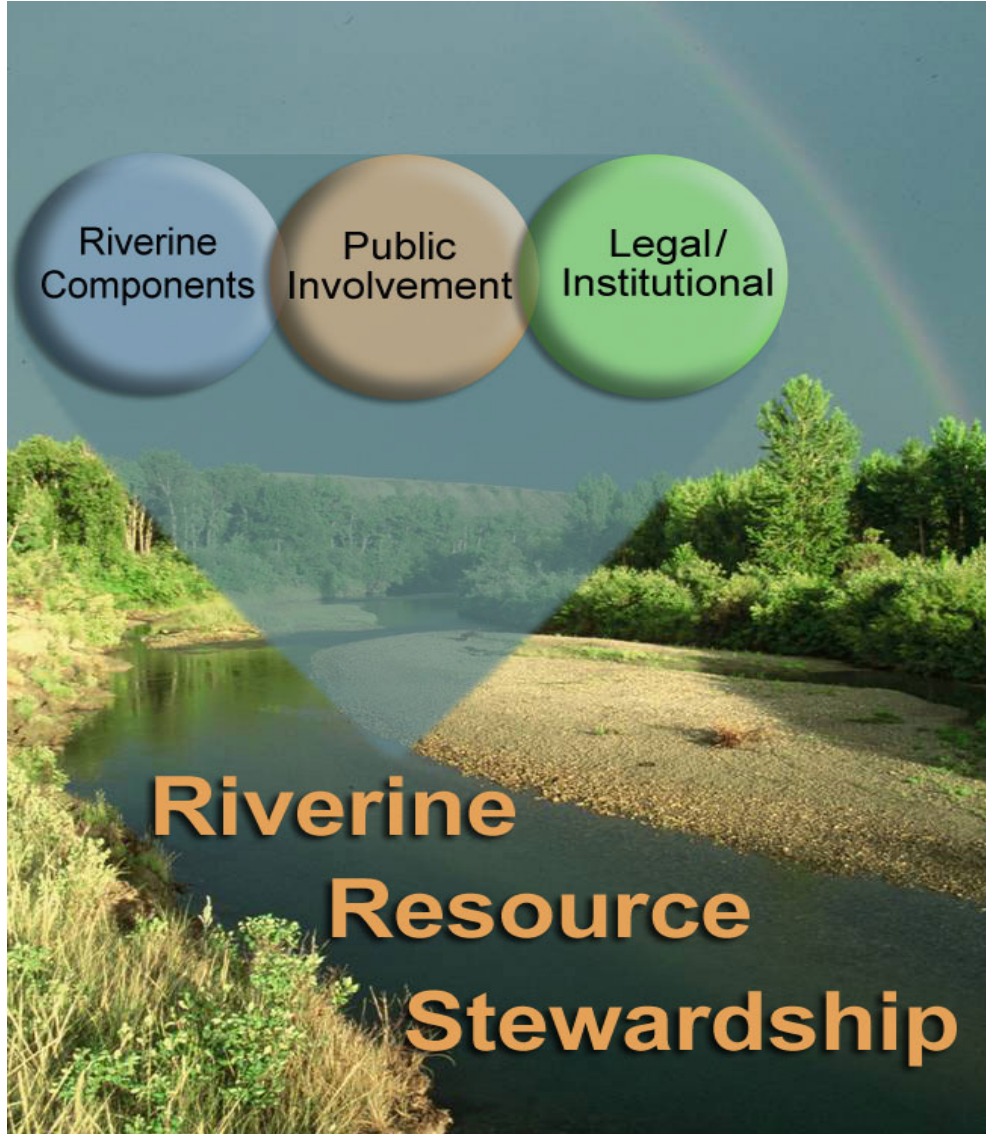
Bow Riverkeeper



Lorne Fitch

Instream Flow Council

(Annear et al. 2004)



What people say they are doing:

Making decisions that are balanced across the three legs.

What people are really doing:

Making decisions that are least wobbly across the three legs.

Instream Flow Council

(Annear et al. 2004)



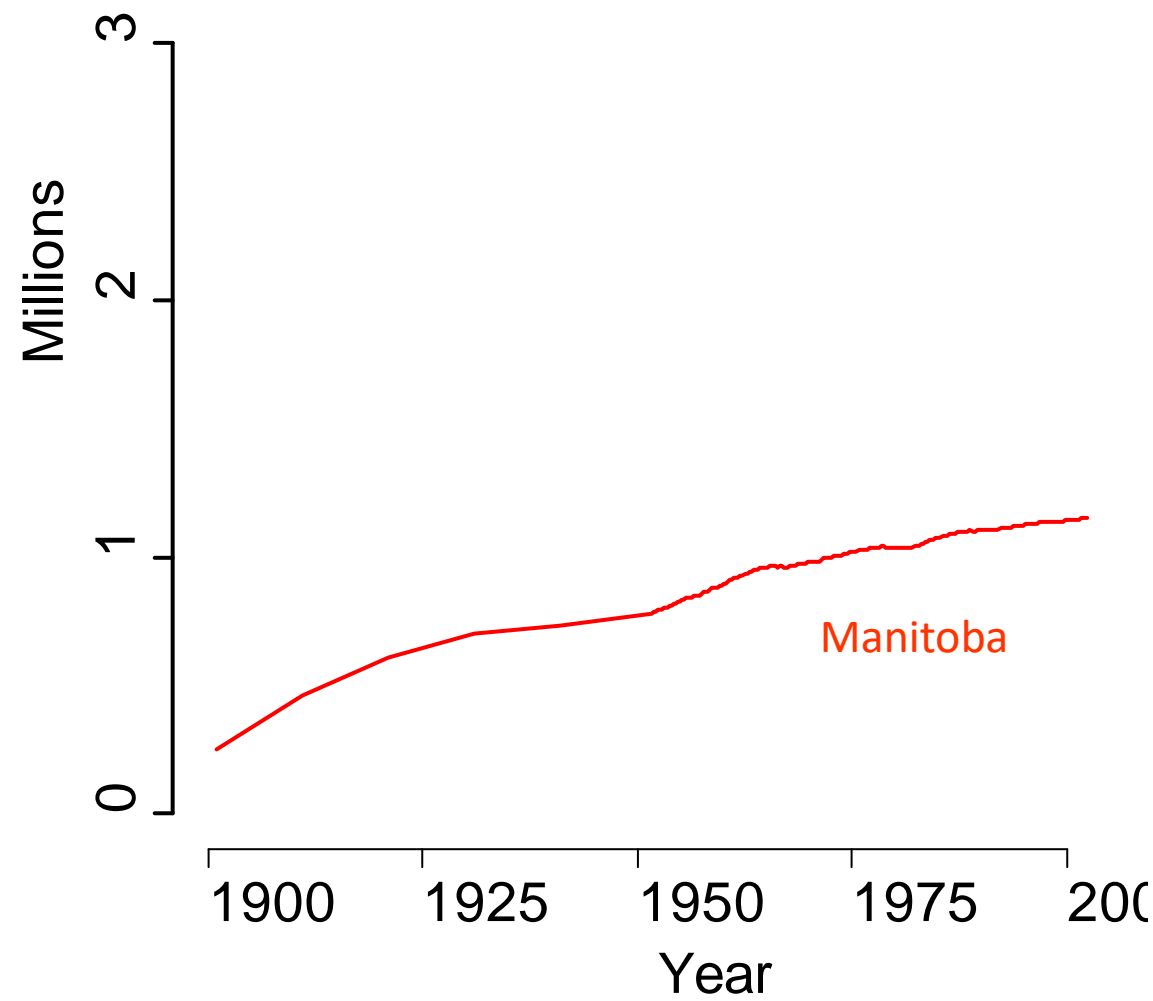
Treaty 8 (June 21, 1899)

And Her Majesty the Queen HEREBY AGREES with the said Indians that they shall have right to pursue their usual vocations of hunting, trapping and fishing...

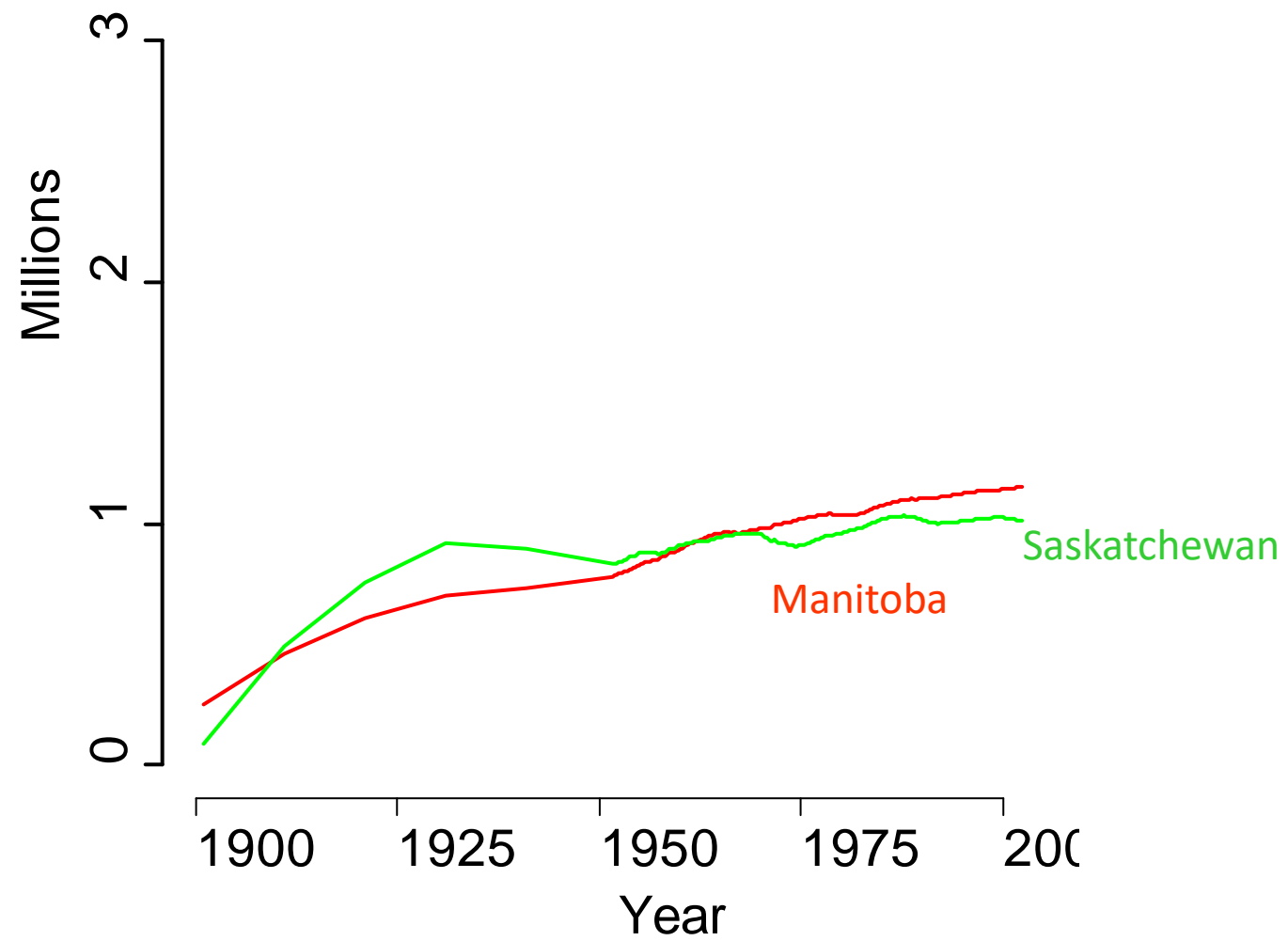
...excepting such tracts as may be required or taken up from time to time for settlement, mining, lumbering, trading or other purposes.



People

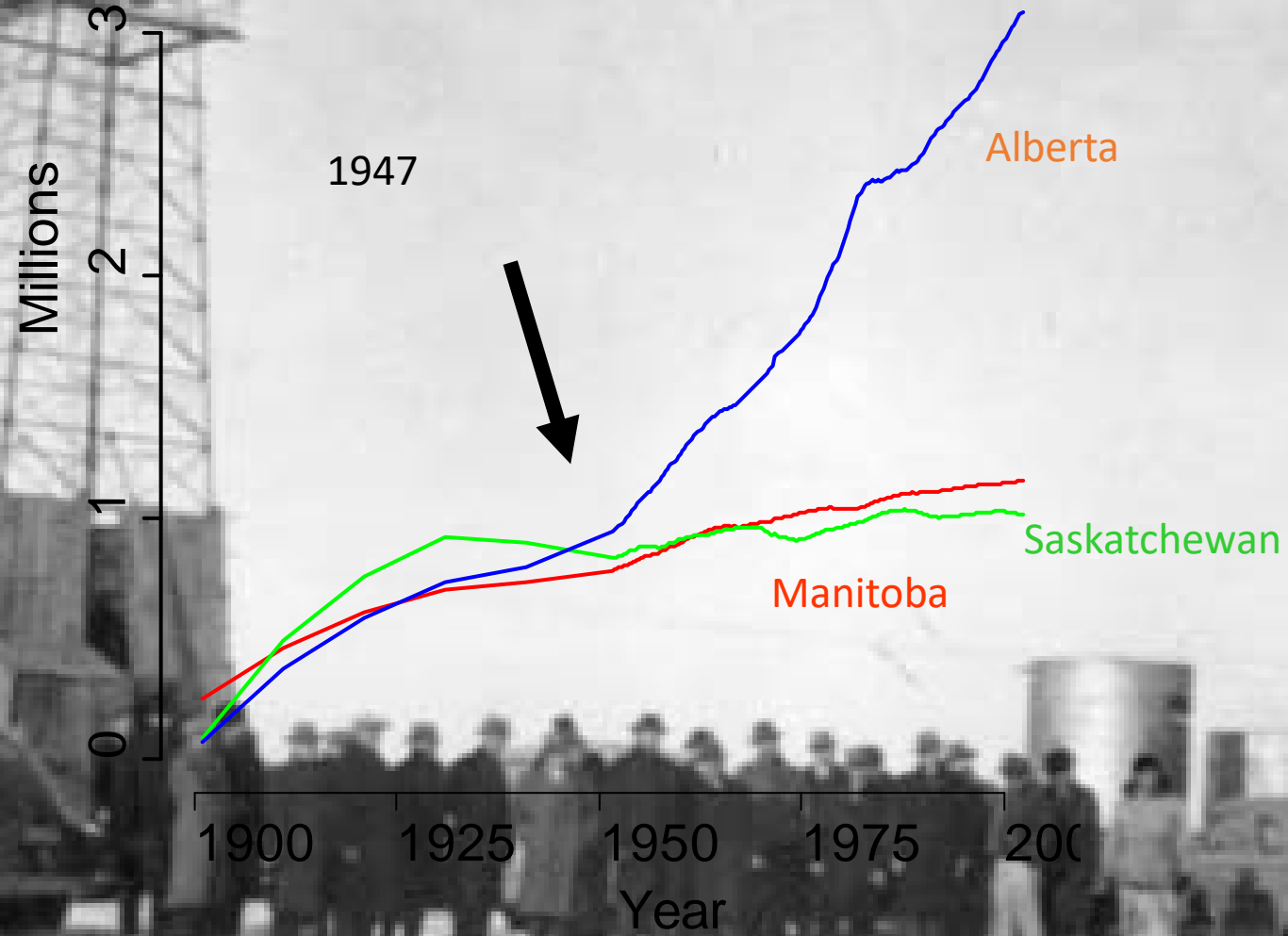


People

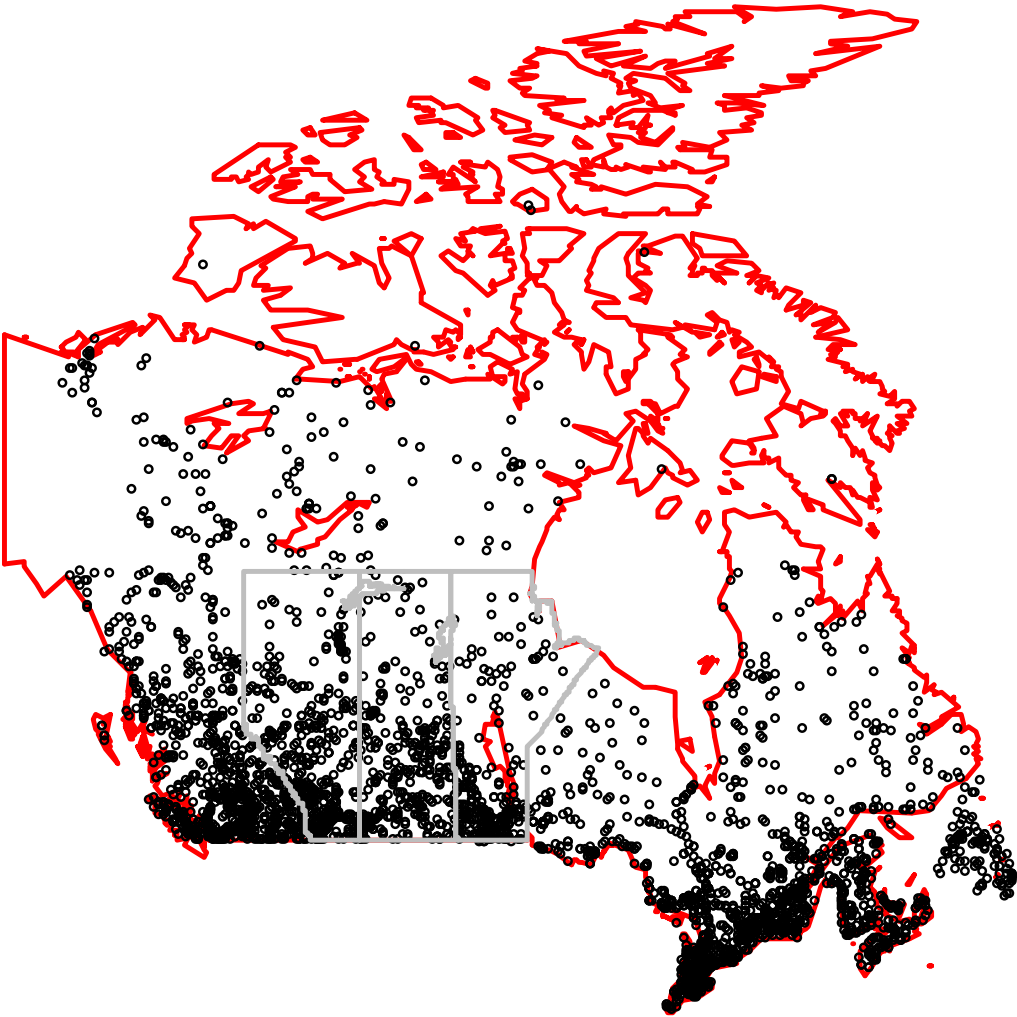


People

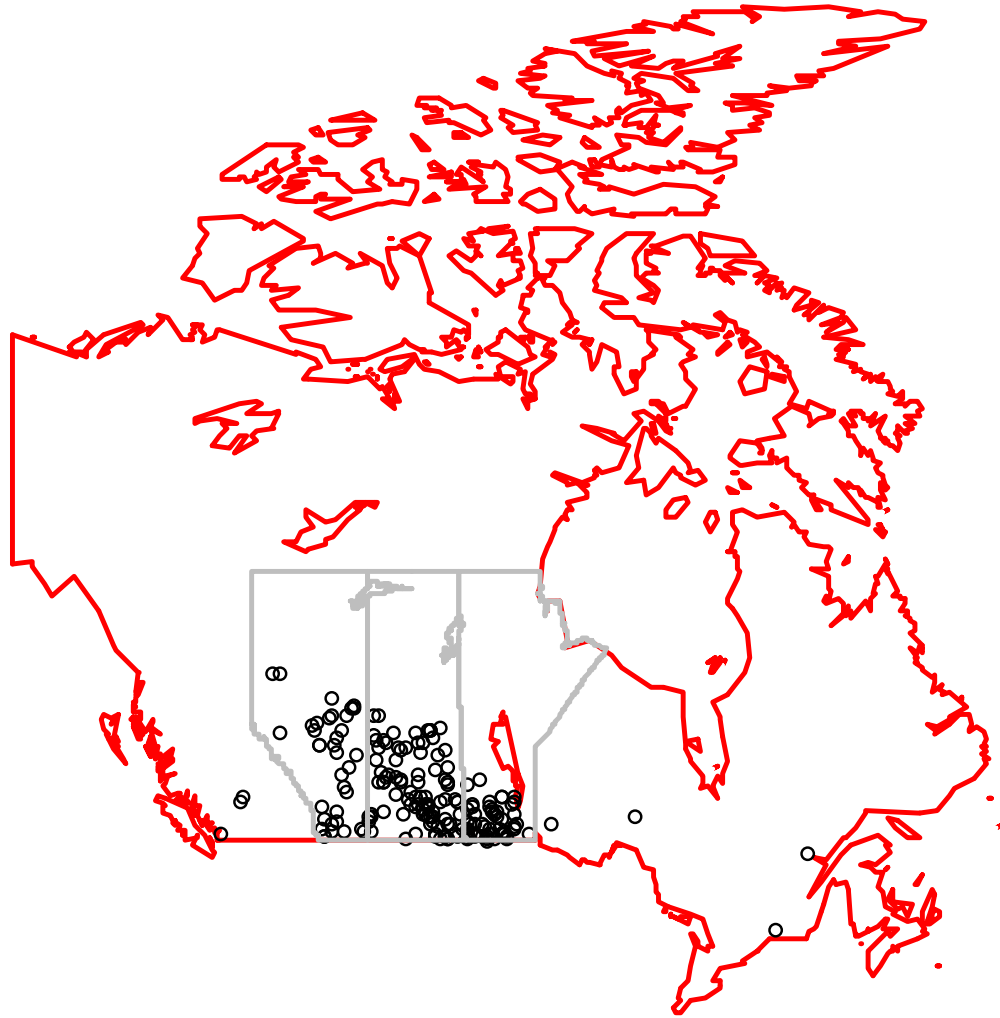
Glenbow Archives NA-5470-6



Gauging Stations in Canada

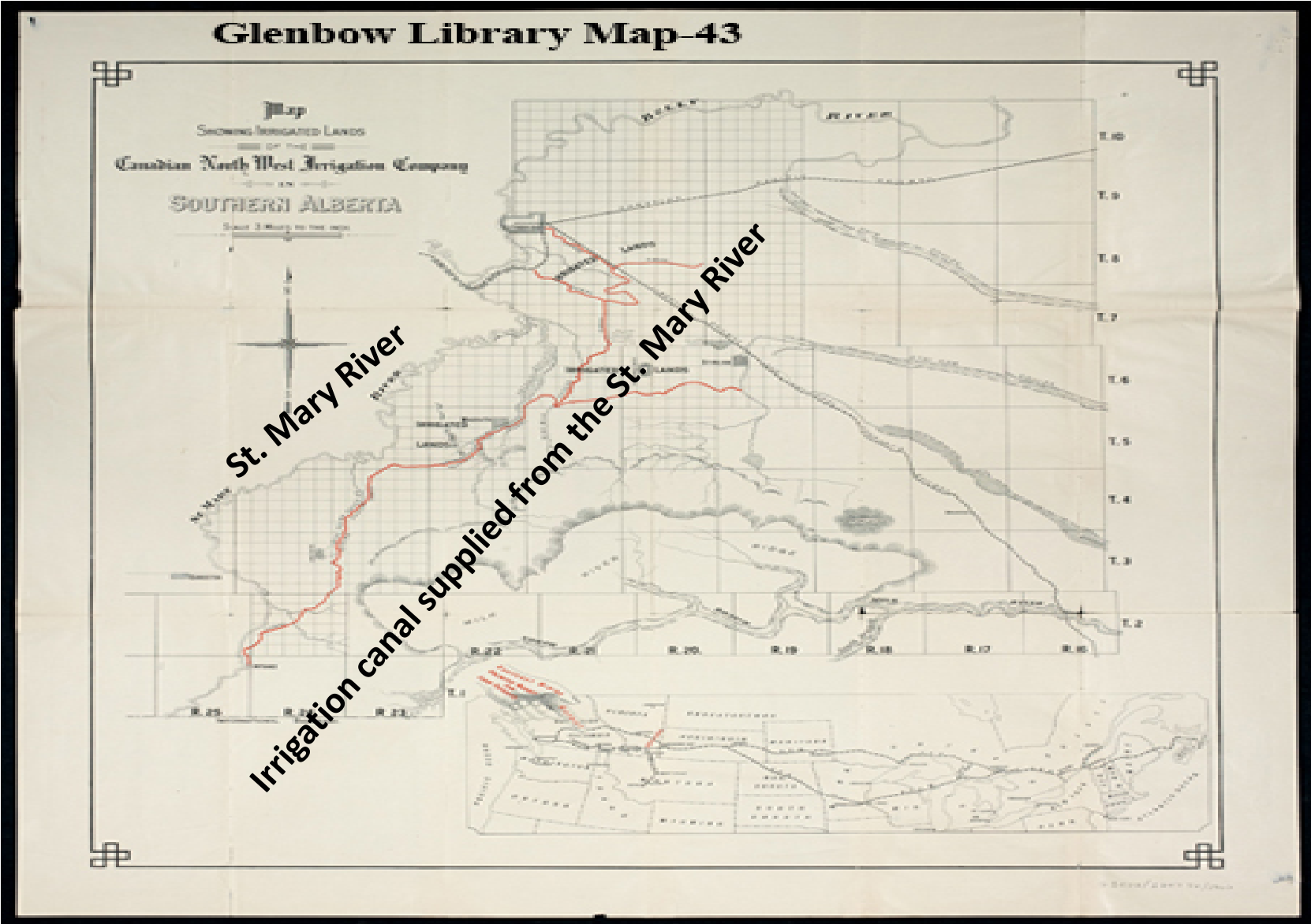


Top 5th Percentile for Variability in Annual Discharge

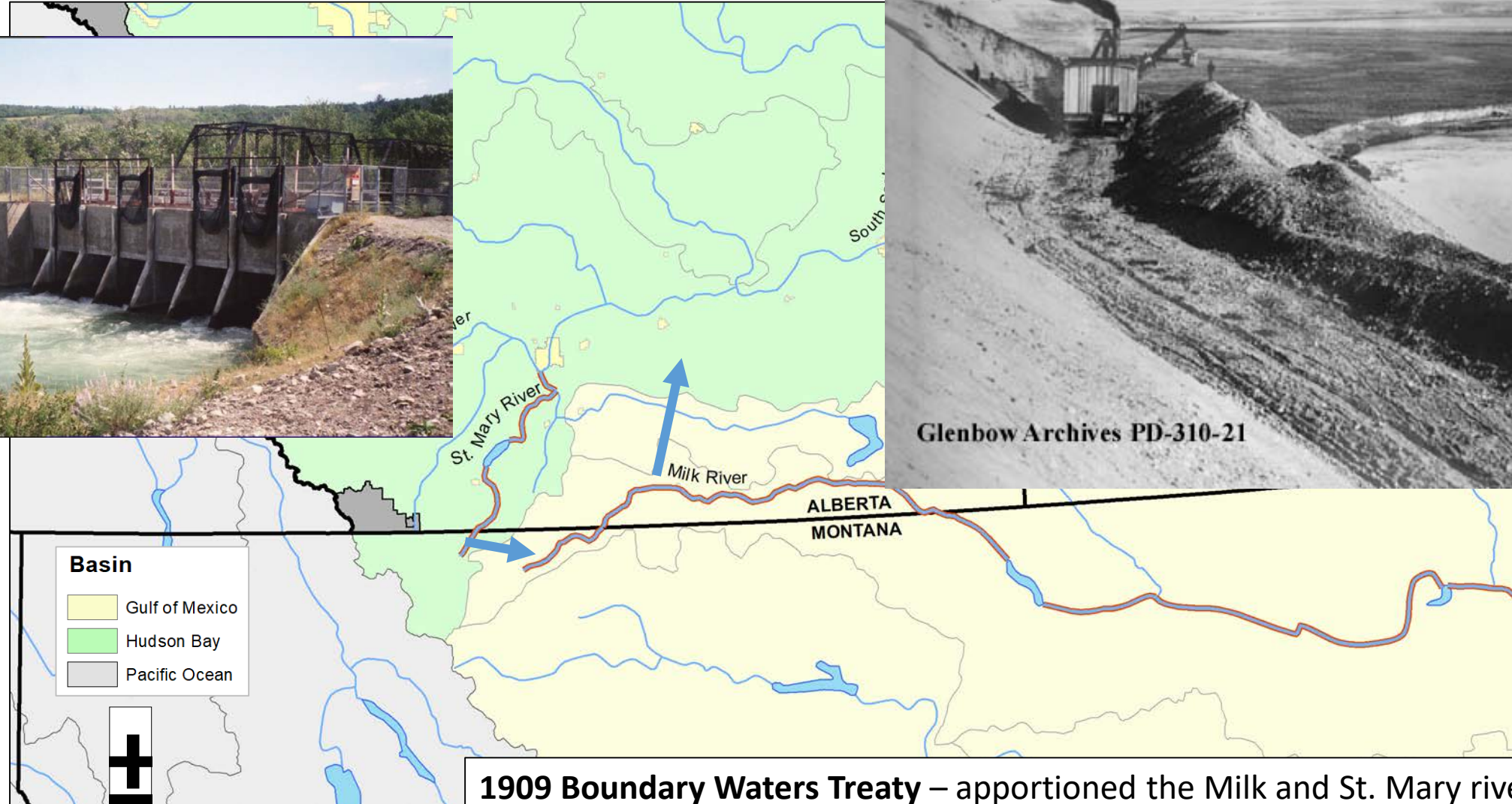


Variability measured as the coefficient of variation (standard deviation / mean)

Irrigated lands of the Canadian North West Irrigation Company 1900



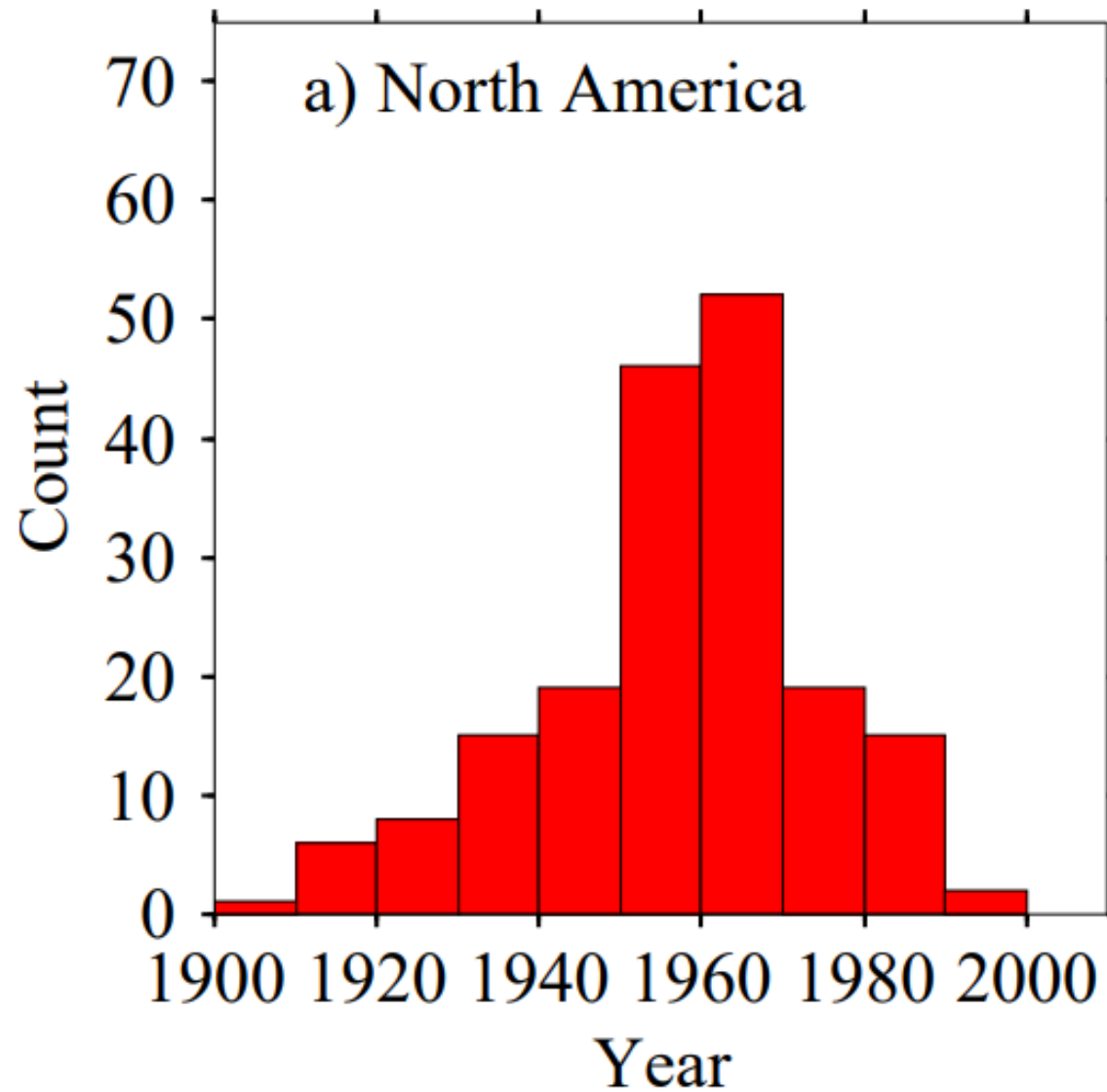
“Spite” Canal



Glenbow Archives PD-310-21

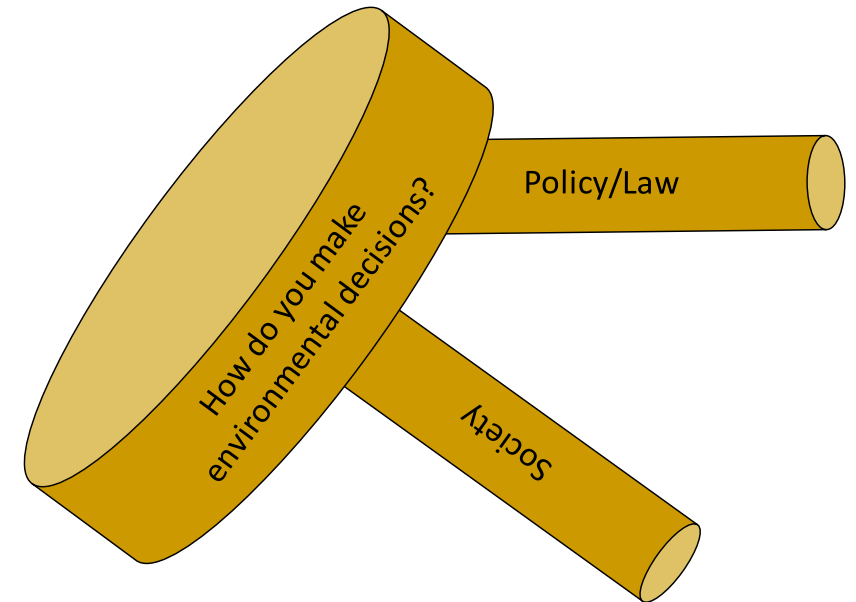
1909 Boundary Waters Treaty – apportioned the Milk and St. Mary rivers between the United States and Canada and outlined how future water disputes would be settled.

Number of Large Dams Built by Decade



Definition of a large dam:

- $\geq 15\text{m}$ dam height; or,
- 5-15m dam height and $\geq 3 \text{ Mm}^3$ impounded



Tennant Method - 1975

"...it is a crime against nature to rob a stream of that last portion of water so vital to the life forms of the aquatic environment that developed there over eons of time."

Sets standards based on a percentage of mean annual discharge

Narrative Description of Flows ^{1/}	Fisheries Classification ^{2/}	Recommended Base Flow Regimens	
		Oct.-Mar.	: Apr.-Sept.
Flushing or Maximum	--	200% of the average flow ^{3/}	
Optimum Range	--	60%-100% of the average flow ^{4/}	
Outstanding	I	40%	60%
Excellent	II	30%	50%
Good	III	20%	40%
Fair or Degrading	IV	10%	30%
Poor or Minimum	--	10%	10%
Severe Degradation	--	10% of average flow to zero flow	

Tessmann - 1979

“Living components of stream ecosystems are adapted to the natural flow regime and depend both on high flows and periods of low or even zero flow... The best minimum flow model is one that mimics nature.”

Sets standards based on percentages of mean annual and mean monthly discharge

<u>Situation</u>	<u>Minimum Monthly Flow</u>
1. mean MF <40% mean AF	mean MF
2. mean MF >40% mean AF and 40% mean MF <40% mean AF	40% mean AF
3. 40% mean MF >40% mean AF	40% mean MF

MF = Monthly Flow

AF = Annual Flow

Instream Flow Incremental Methodology (IFIM)

- Standard setting methods (e.g., Tennant or Tessmann) did not address trade offs (too rigid).
- Irrigators and power companies could report the loss or gain in arable acres, power production or revenue from incremental changes to water availability.
- A comparable tool was needed to understand incremental affects on instream ecosystem services (e.g., fish production, effluent dilution, navigation, etc.).

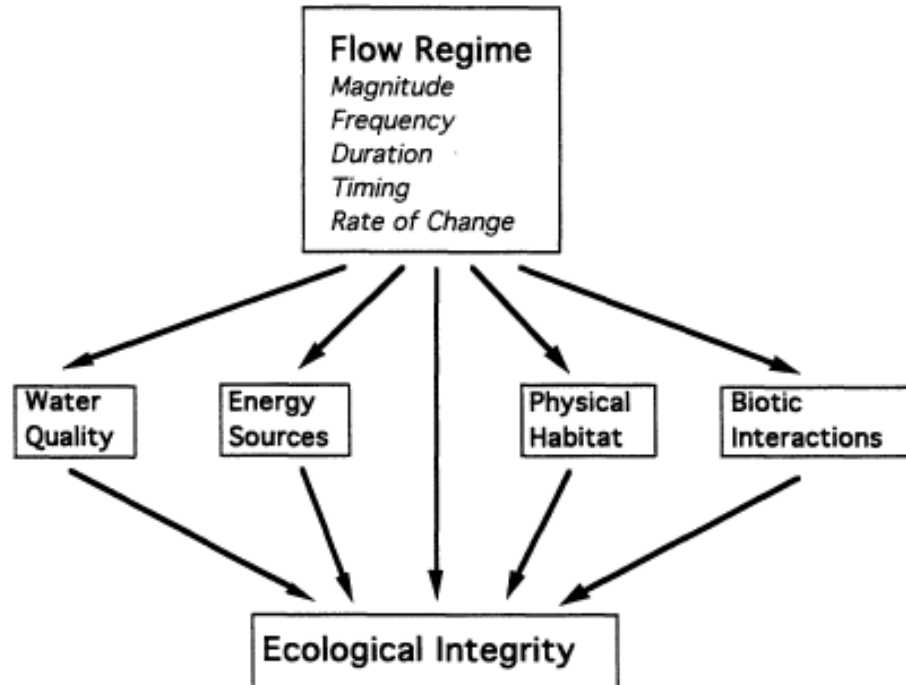
Instream Flow Incremental Methodology (IFIM)

- IFIM is a multifaceted decision support system that looks at riverine ecology for the purpose of making water management decisions.
- Significant development through the 1980s but largely focused on hydraulics (depth and velocity) and fish habitat.
- Physical habitat simulation model (PHabSim).

The Natural Flow Regime

A paradigm for river conservation and restoration

N. LeRoy Poff, J. David Allan, Mark B. Bain, James R. Karr, Karen L. Prestegard,
Brian D. Richter, Richard E. Sparks, and Julie C. Stromberg



1. Magnitude
2. Frequency
3. Duration
4. Timing
5. Rate of change

Instream Flows

*for Riverine Resource
Stewardship*
Revised Edition

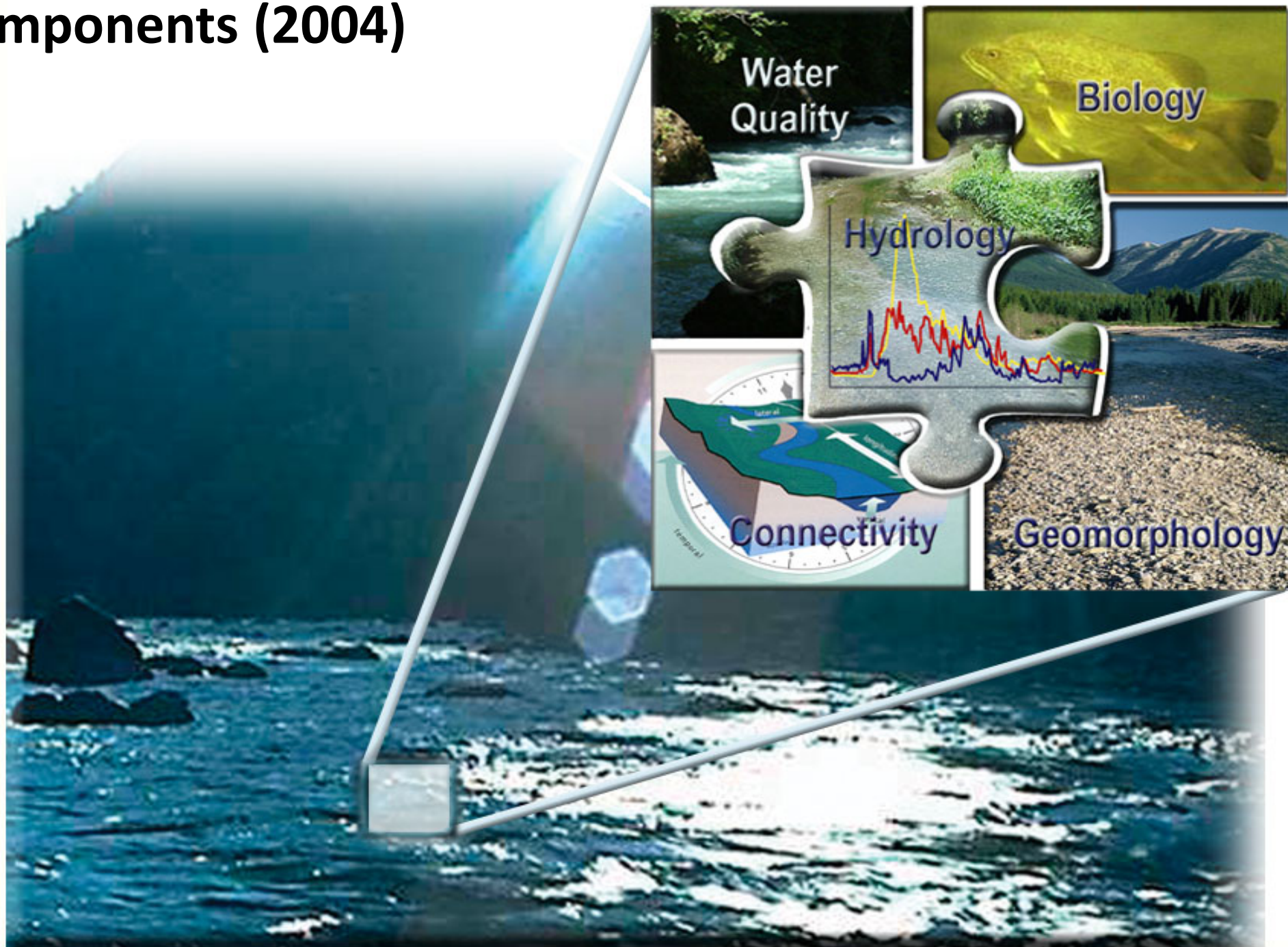
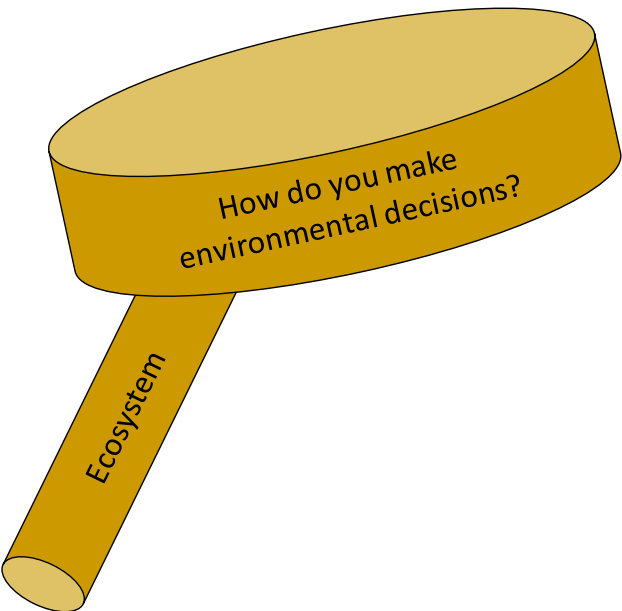


- Allan Locke, retired from Alberta Environment and Parks
- Co-author of the IFC book

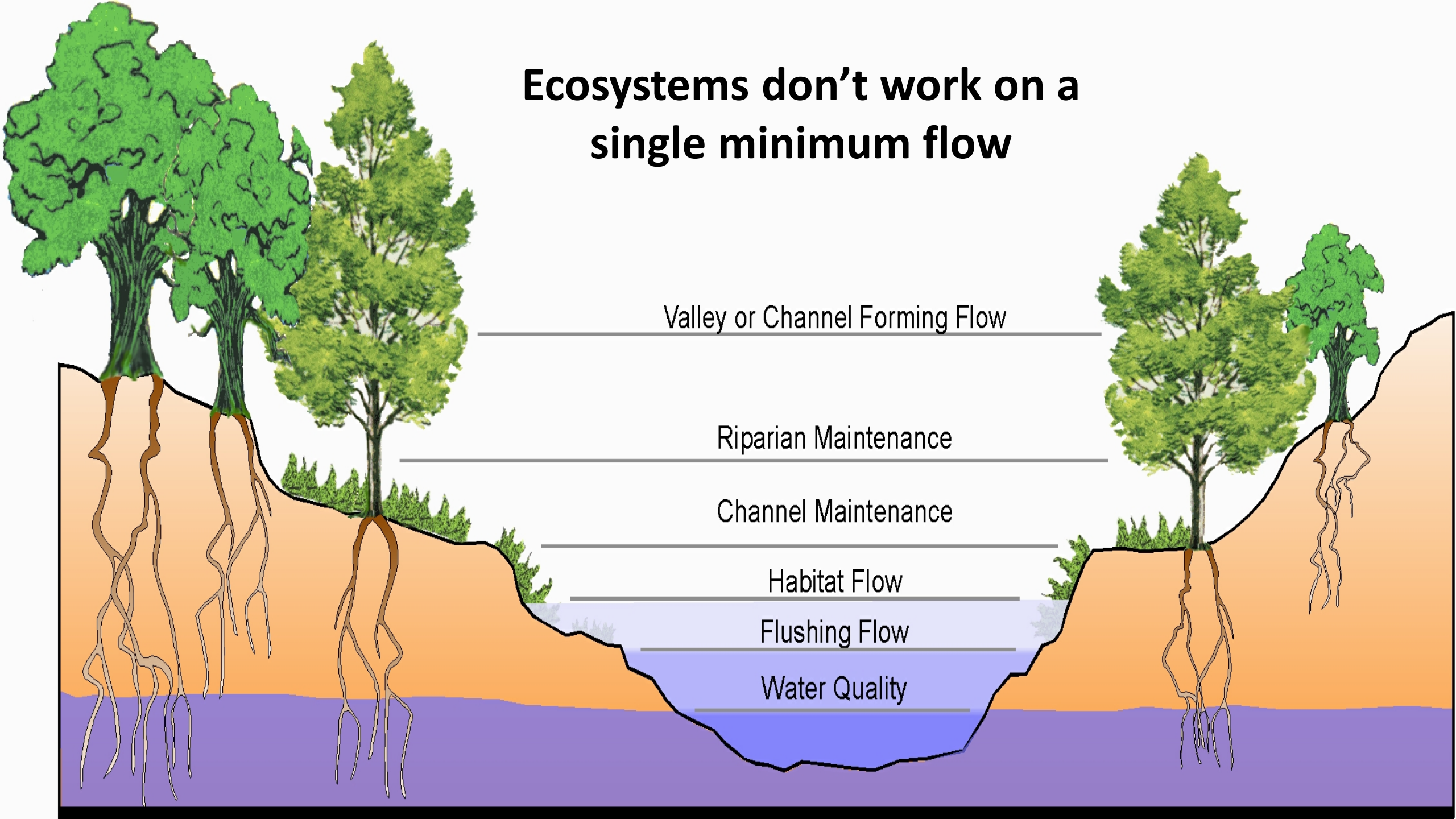


2004

Five Riverine Components (2004)



Ecosystems don't work on a single minimum flow



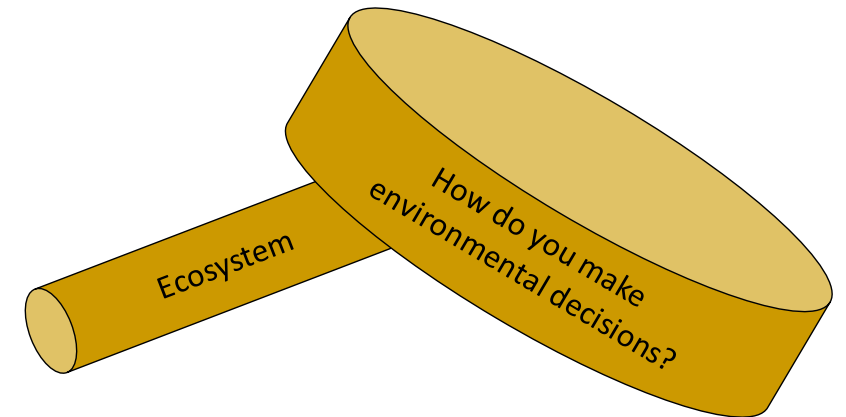


Instream Flow Needs Determinations for the South Saskatchewan River Basin, Alberta, Canada

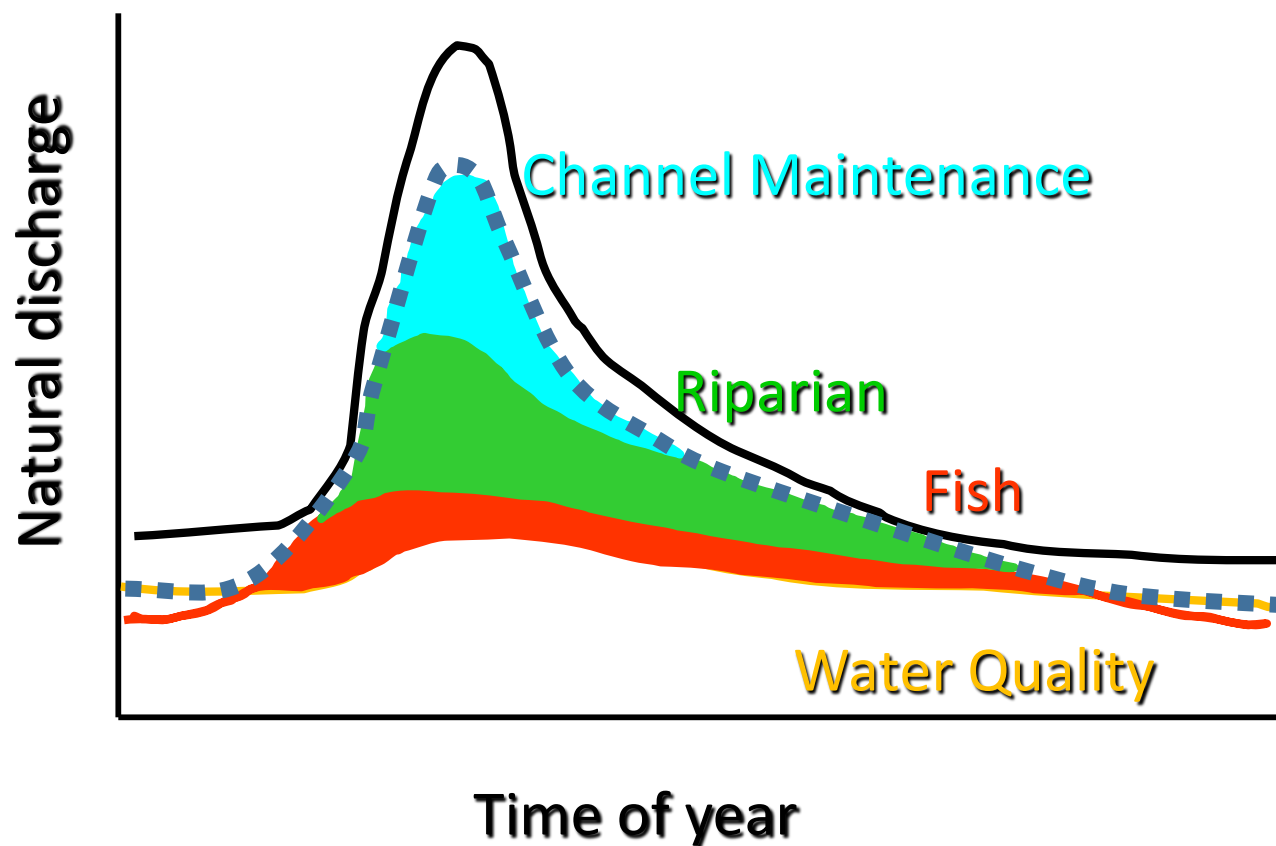
How much water does the river need so
ecosystem change is undetectable?

**G. Kasey Clipperton, C. Wendell Koning, Allan G.H. Locke
John M. Mahoney, Bob Quazi**

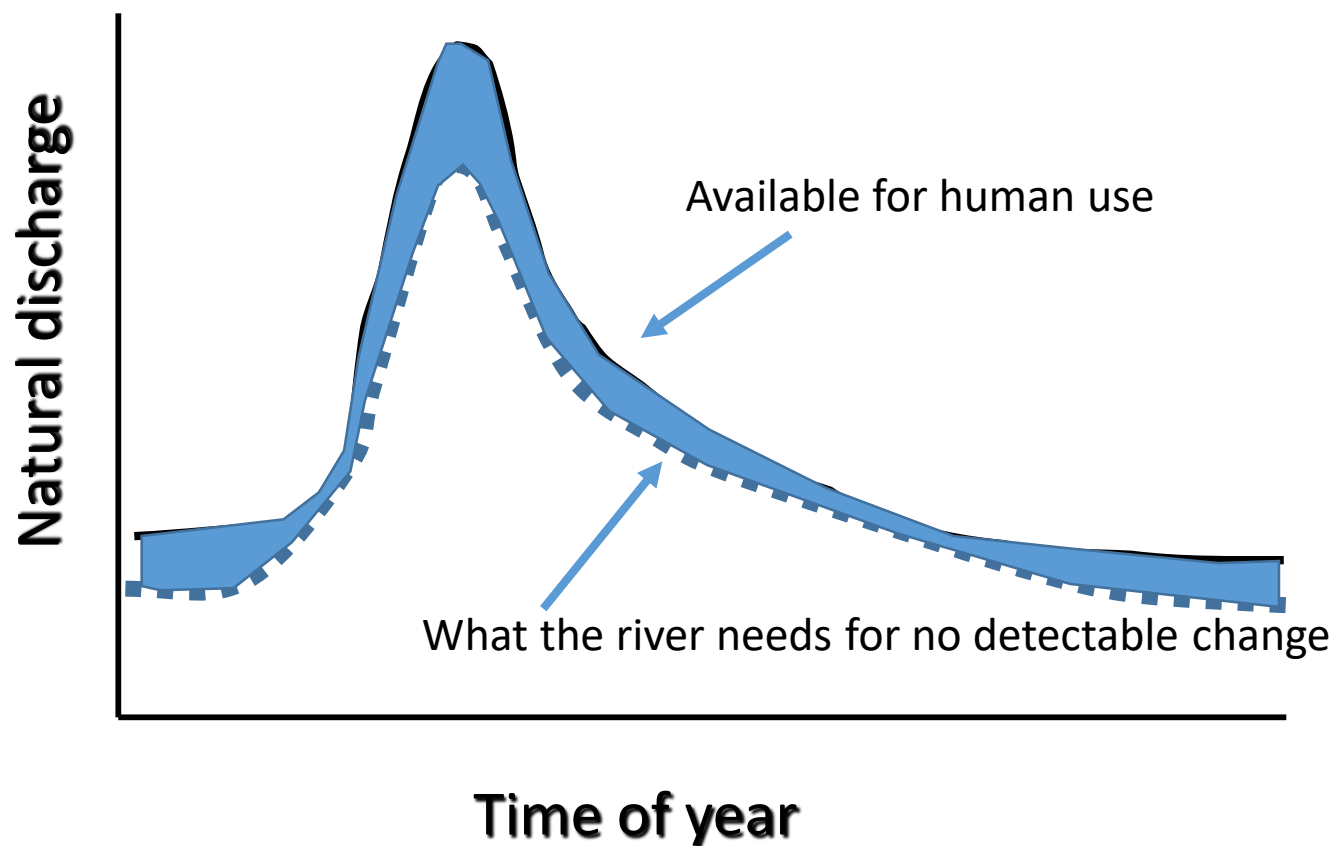
2003



Instream Flow Determination – South Saskatchewan River Basin



Instream Flow Determination – South Saskatchewan River Basin



Alberta Desktop Method (2011)

Guideline

water for life

healthy aquatic
ecosystems

» A Desk-top Method for Establishing Environmental
Flows in Alberta Rivers and Streams

Provides full protection of the aquatic
environment

Government
of Alberta

SWAD (2019)

Allocation Policy

Surface Water Allocation Directive

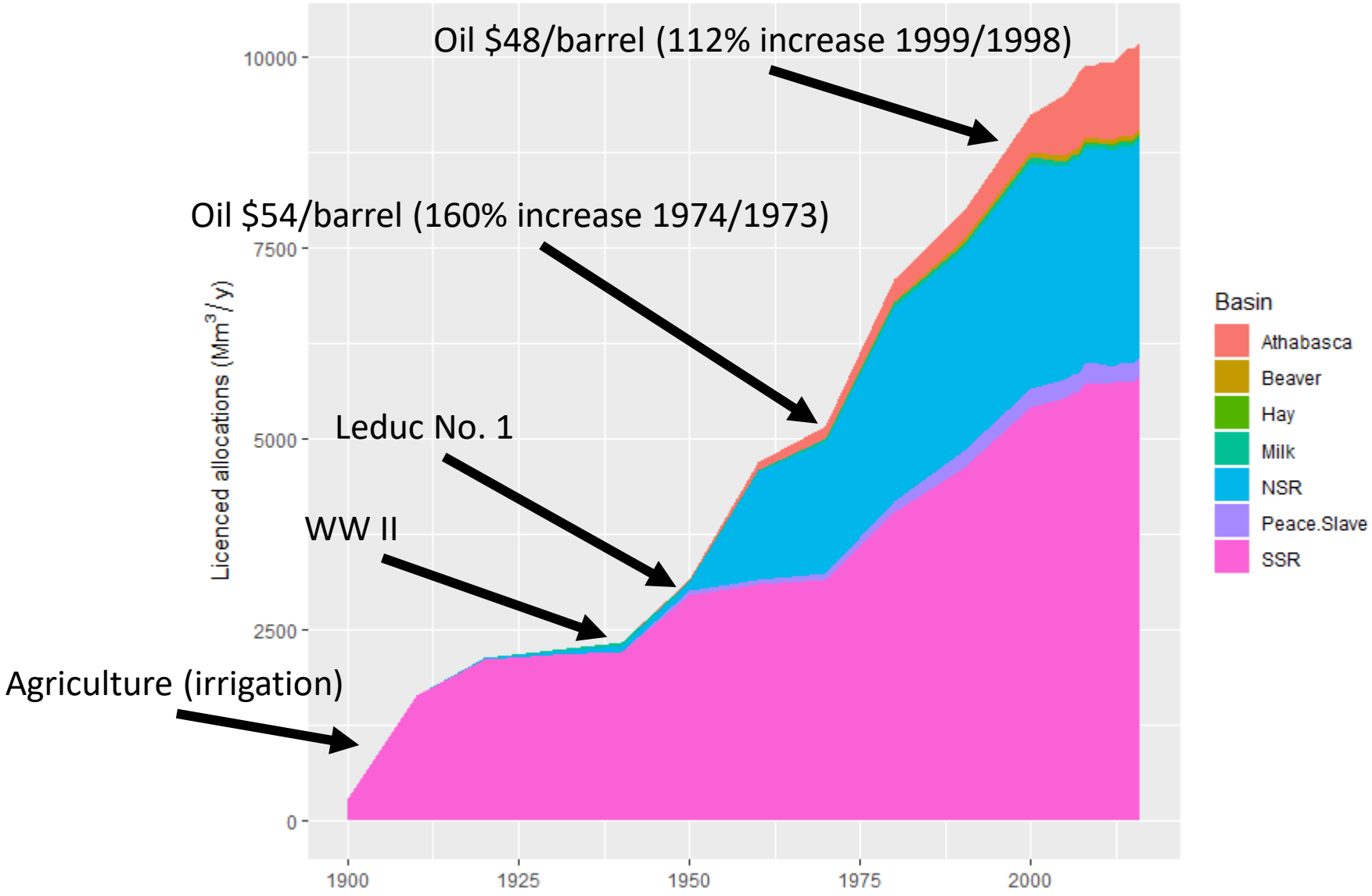


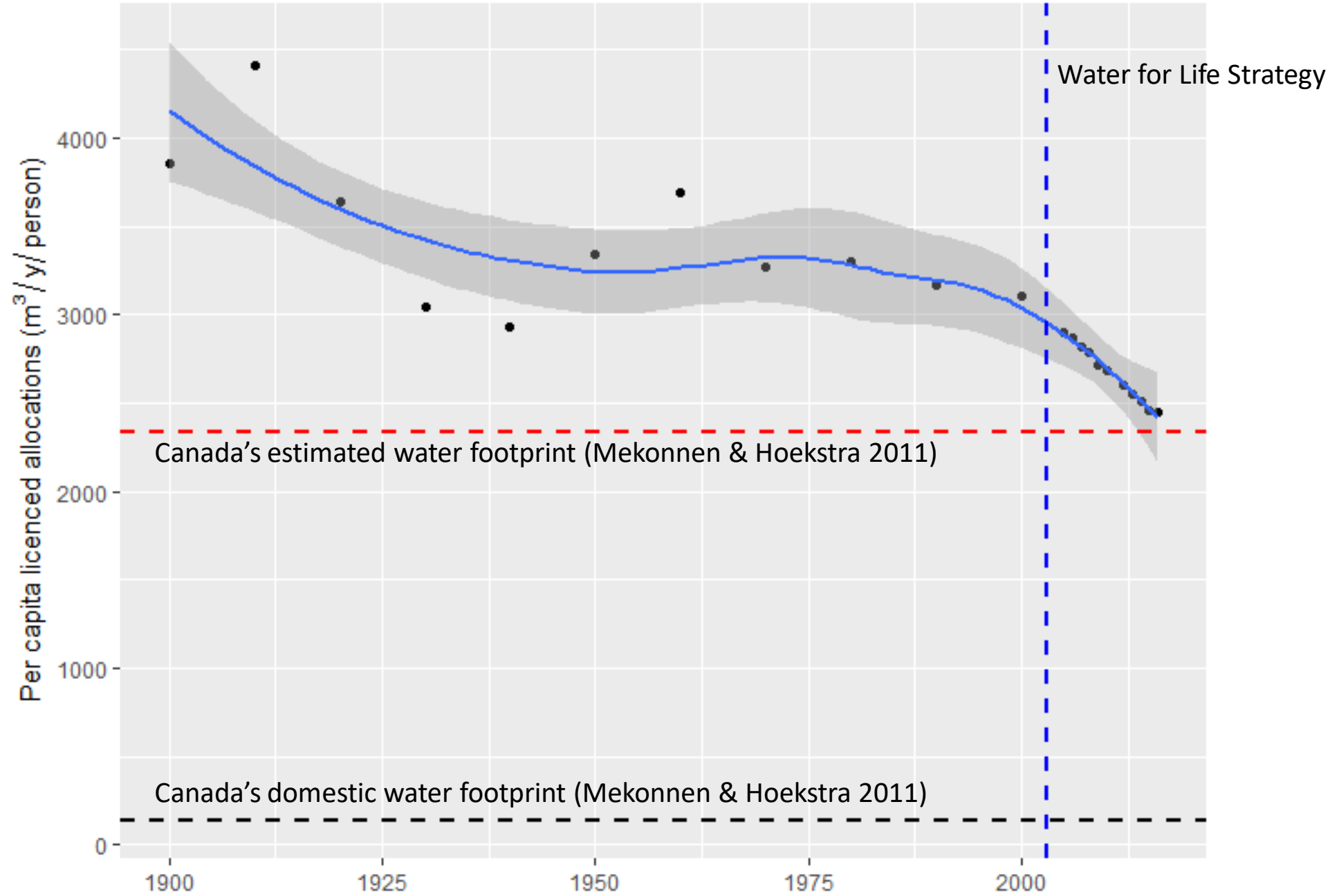
Considers both healthy environments
and human water use for a sustainable
economy

February 2019
Interim Directive (to be reviewed February 2020)

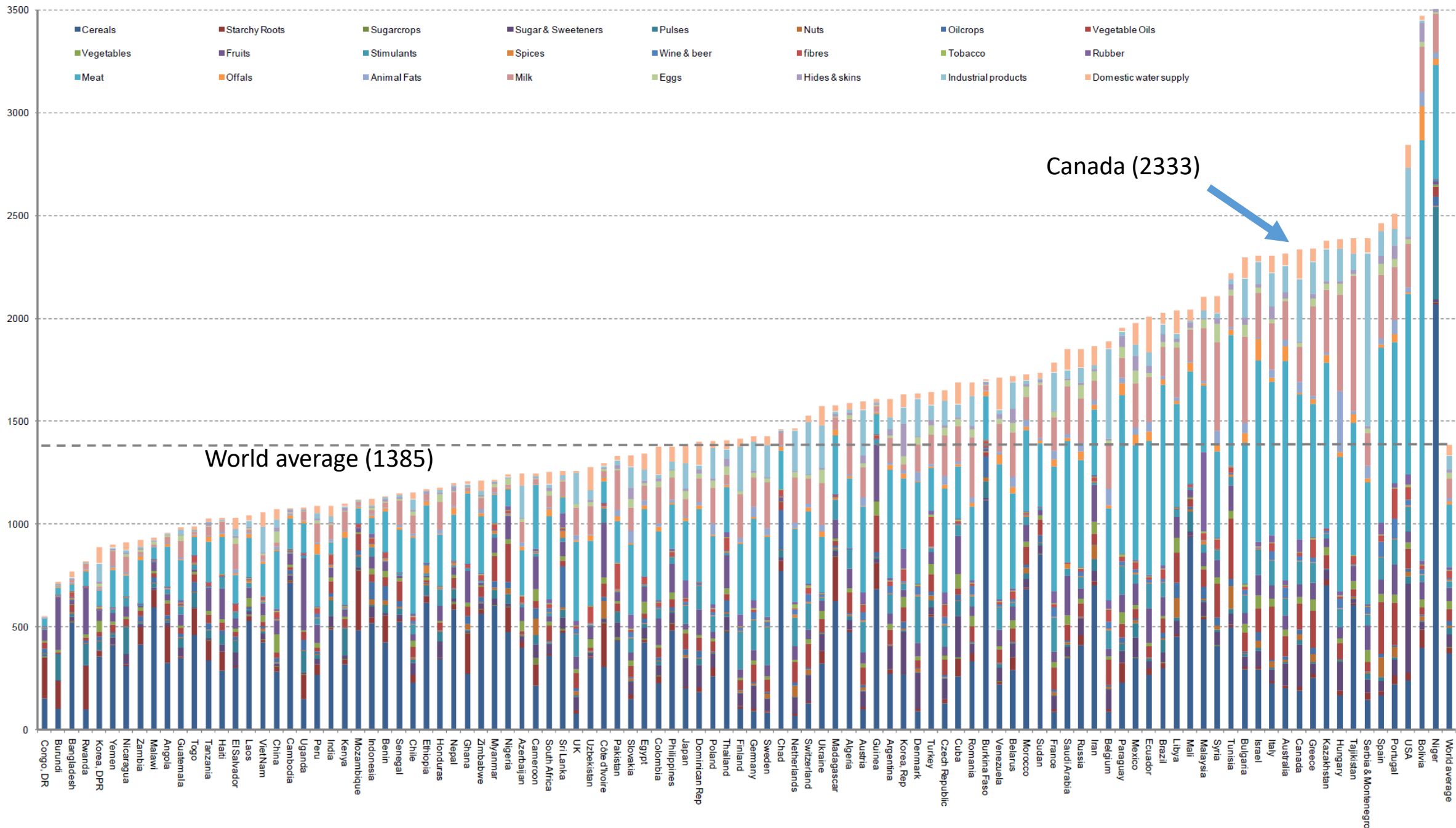
Alberta

Alberta's Licenced Allocations

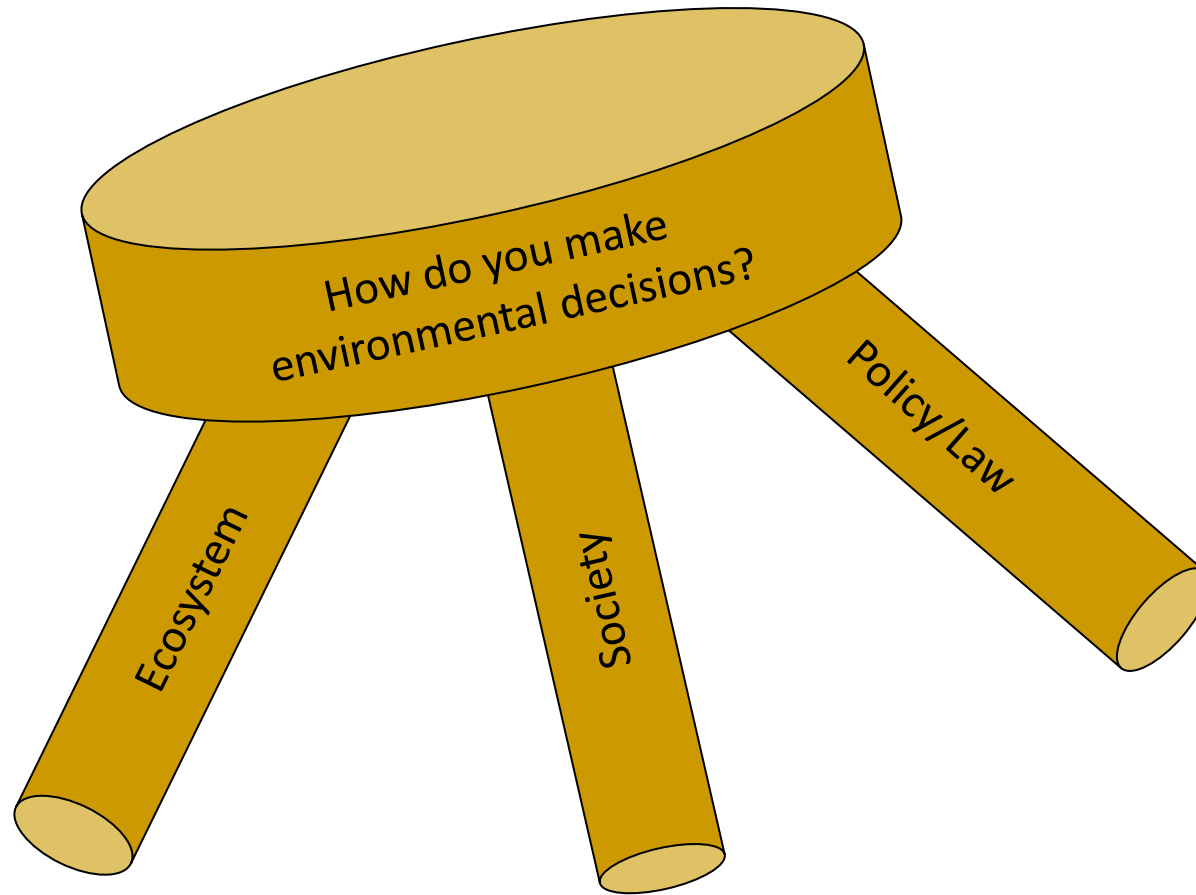




Per capita water footprint (m³/y/person)



(Mekonnen & Hoekstra 2011)

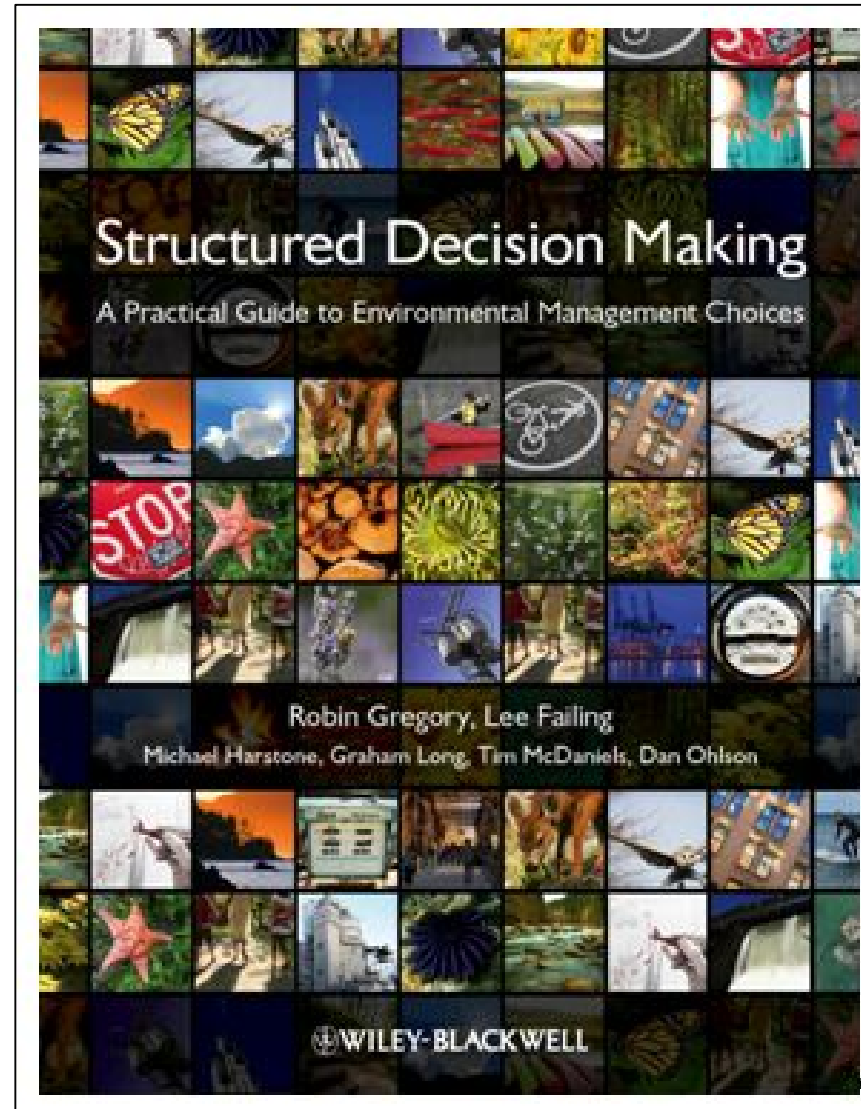


What is needed is better decisions—and science, for all its important contributions, does not deliver decisions.

Gregory et al. 2006. Journal of Risk Research. 9(7): 717-735

Structured Decision Making (SDM)

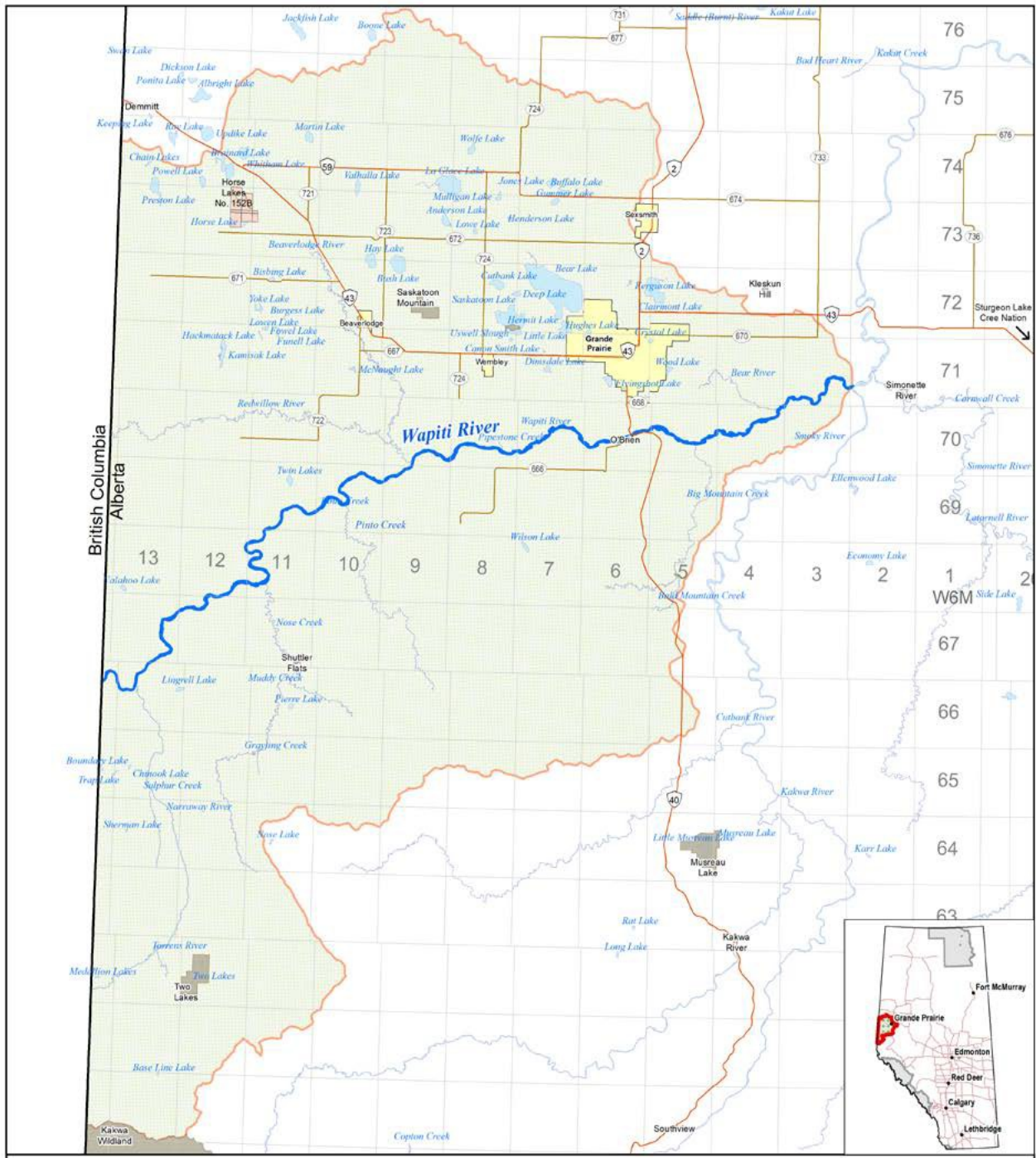
An organized framework for helping diverse groups deliberate on technically complex decisions where multiple interests are at stake.



2012

Wapiti River



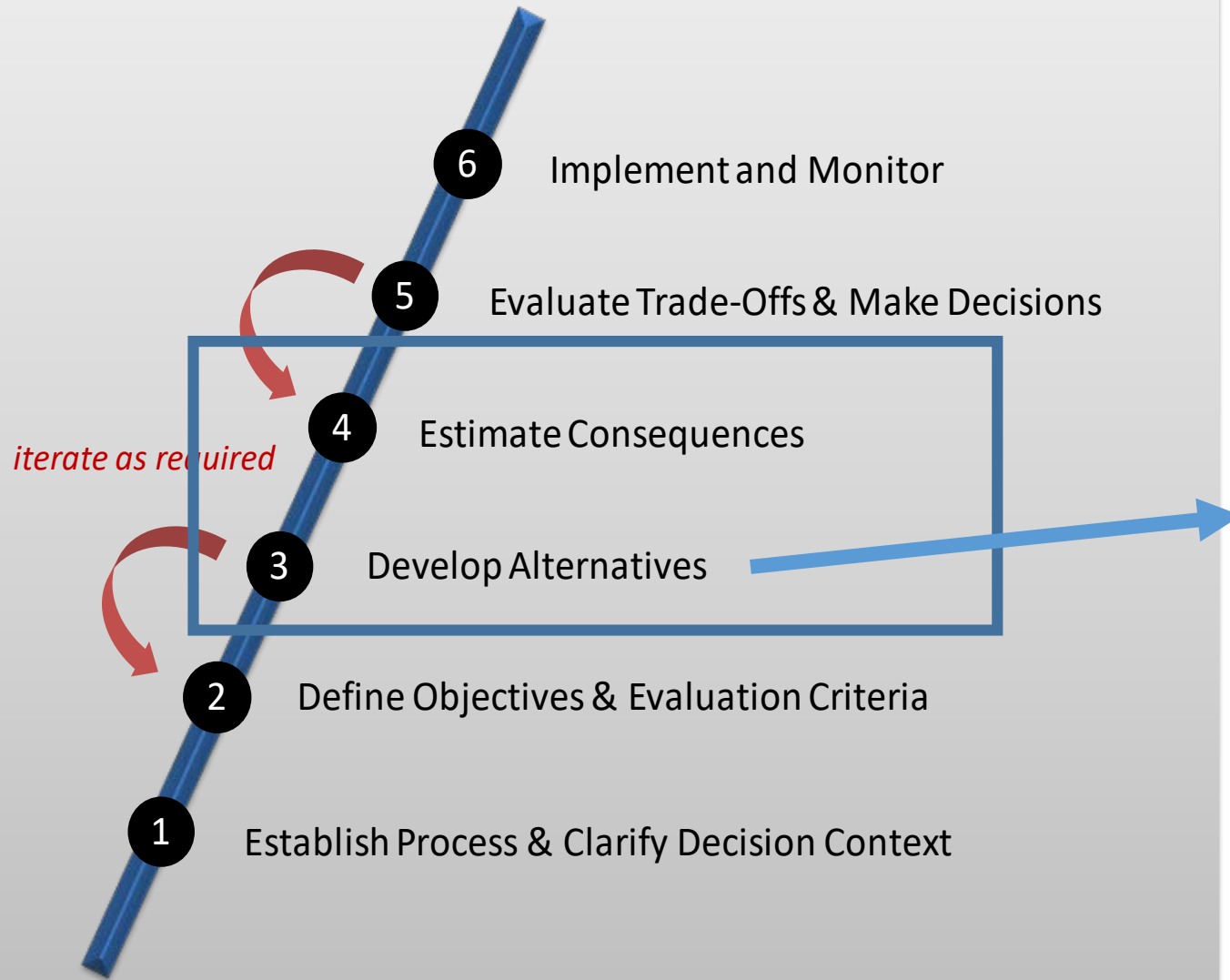


Wapiti River Water Management Plan – Steering Committee Recommendation (June 2017)



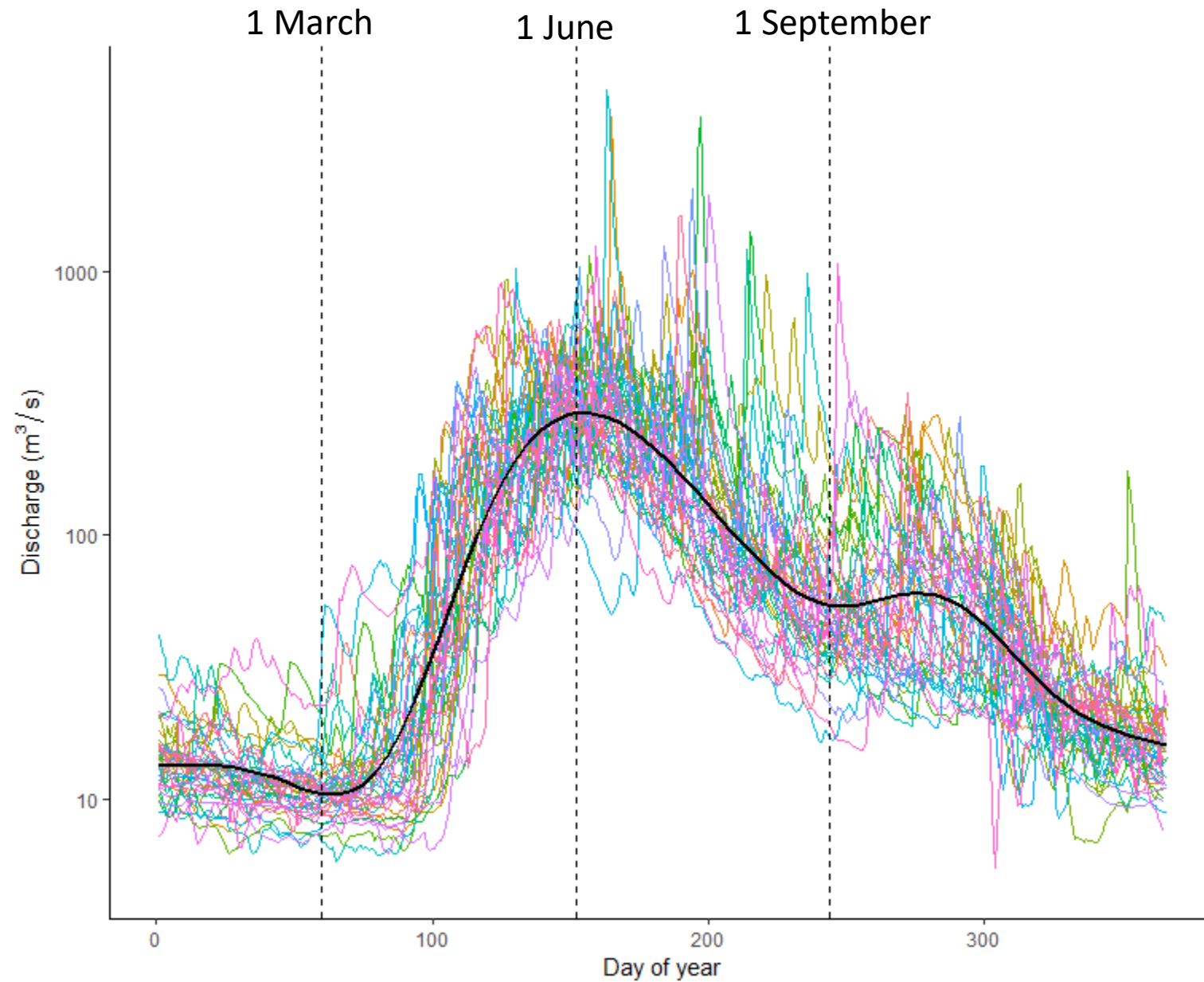
Alberta Environment and Parks
Fisheries and Oceans Canada
County of Grande Prairie
City of Grande Prairie
Aquatera Utilities Inc.
International Paper (formerly Weyerhaeuser)
Municipal District of Greenview
Mighty Peace Watershed Alliance
Town of Beaverlodge
Canadian Association of Petroleum Producers
Sturgeon Lake Cree Nation
Nitehawk Ski Hill

Structured Decision Making

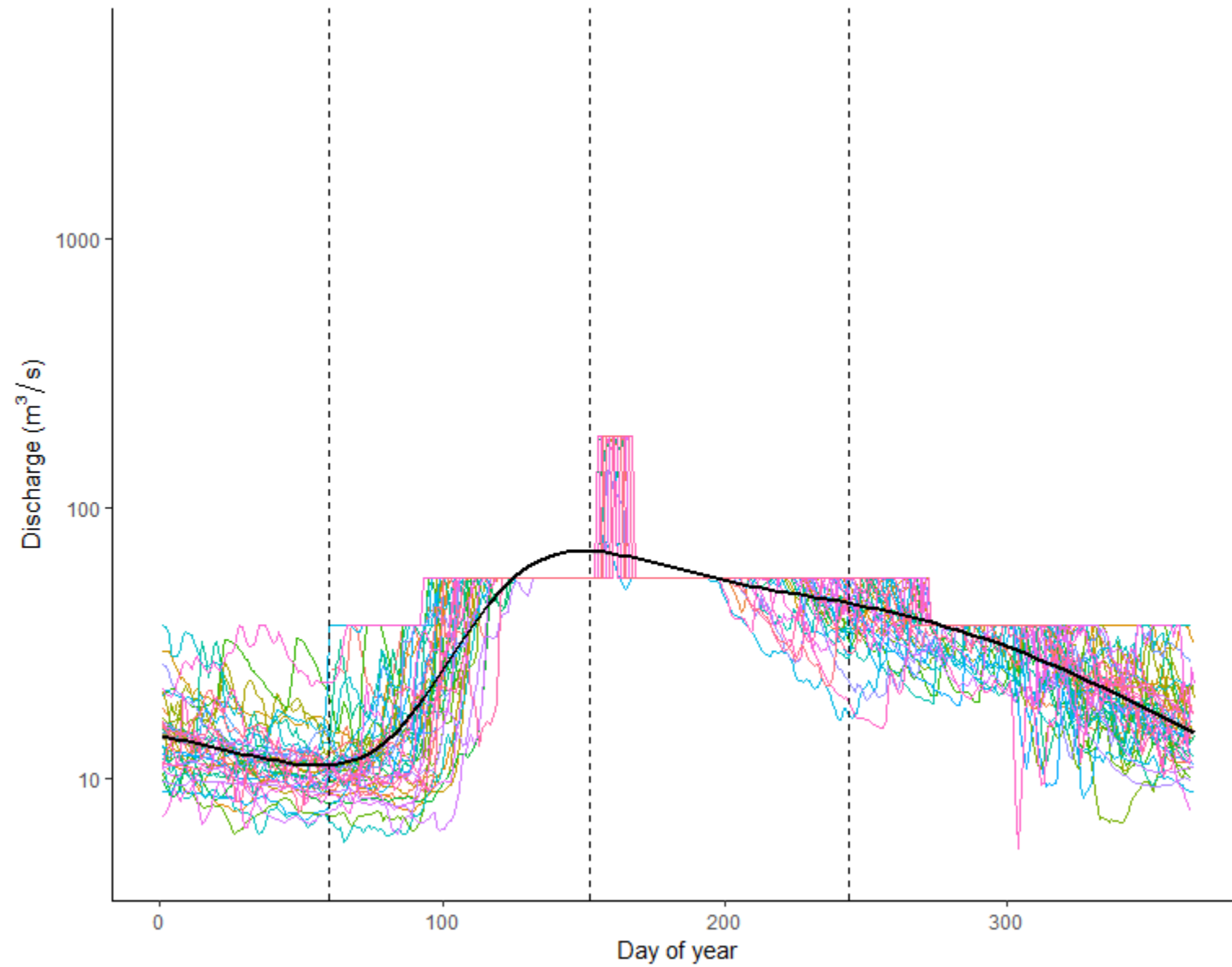


1. Tennant Method (1975)
2. Tessmann Method (1979)
3. Alberta Desktop (2011)
4. Surface Water Allocation Directive (2019)
5. Steering Committee Recommendation (2017)

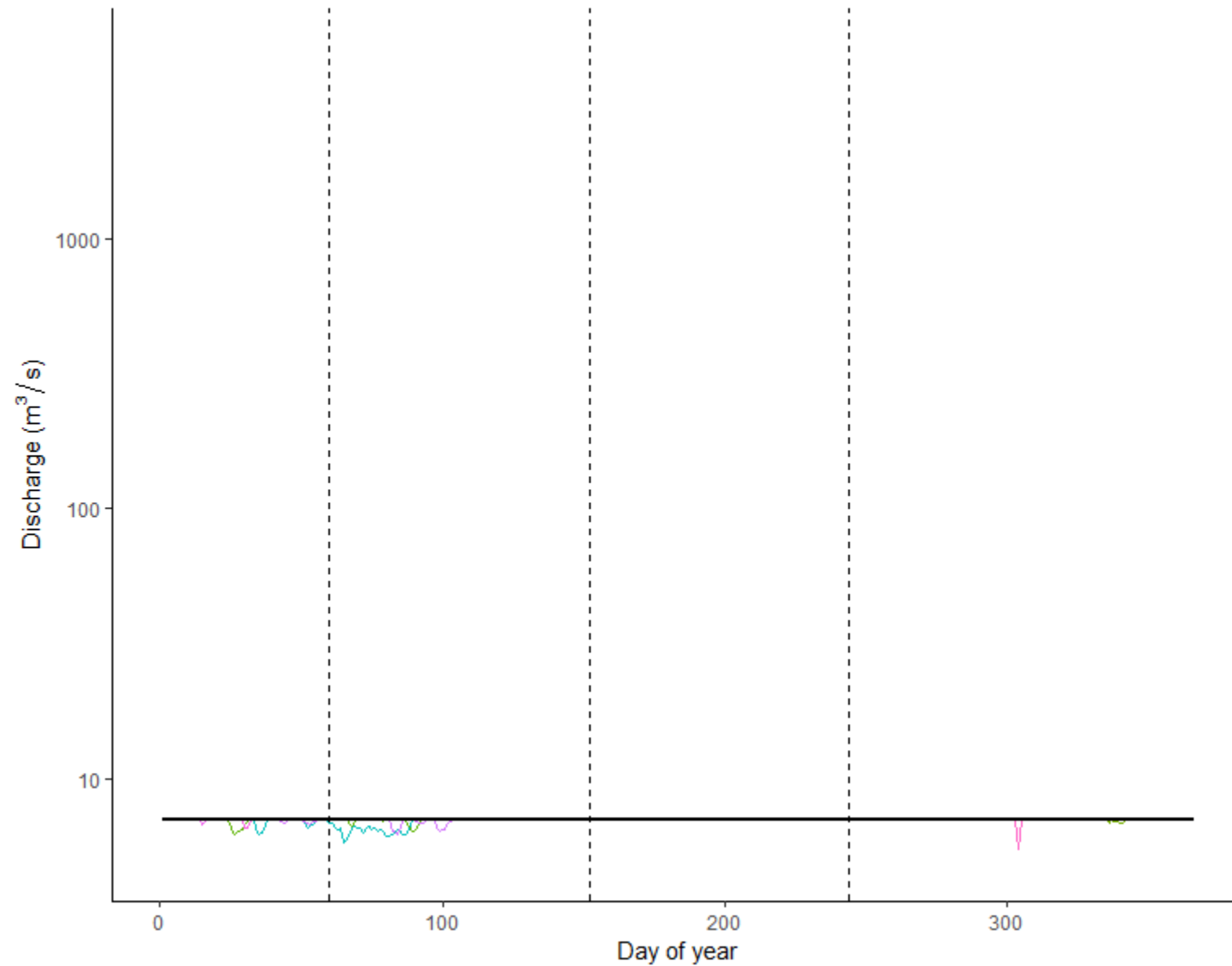
Wapiti River Flows – Natural



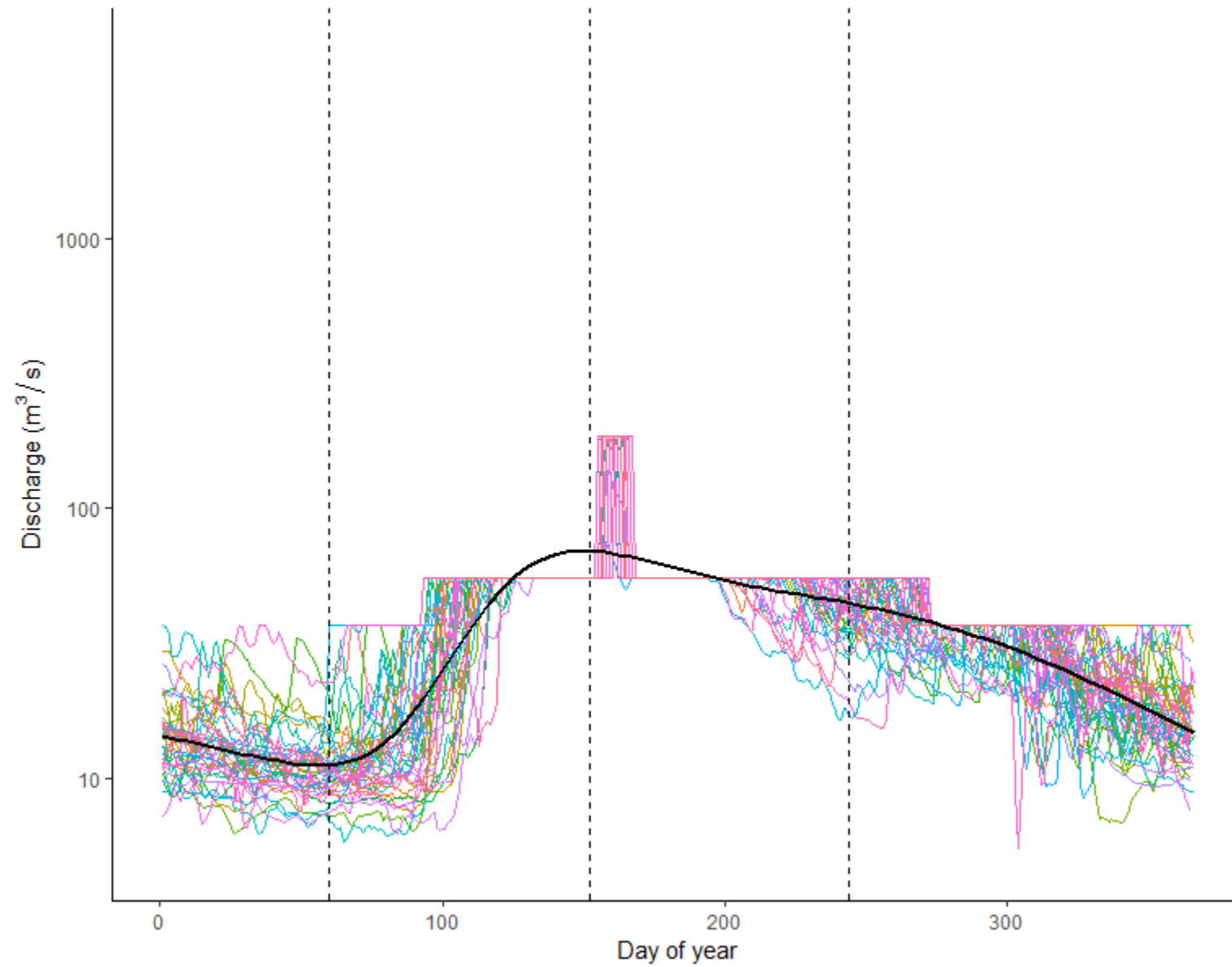
Wapiti River Flows – Tennant



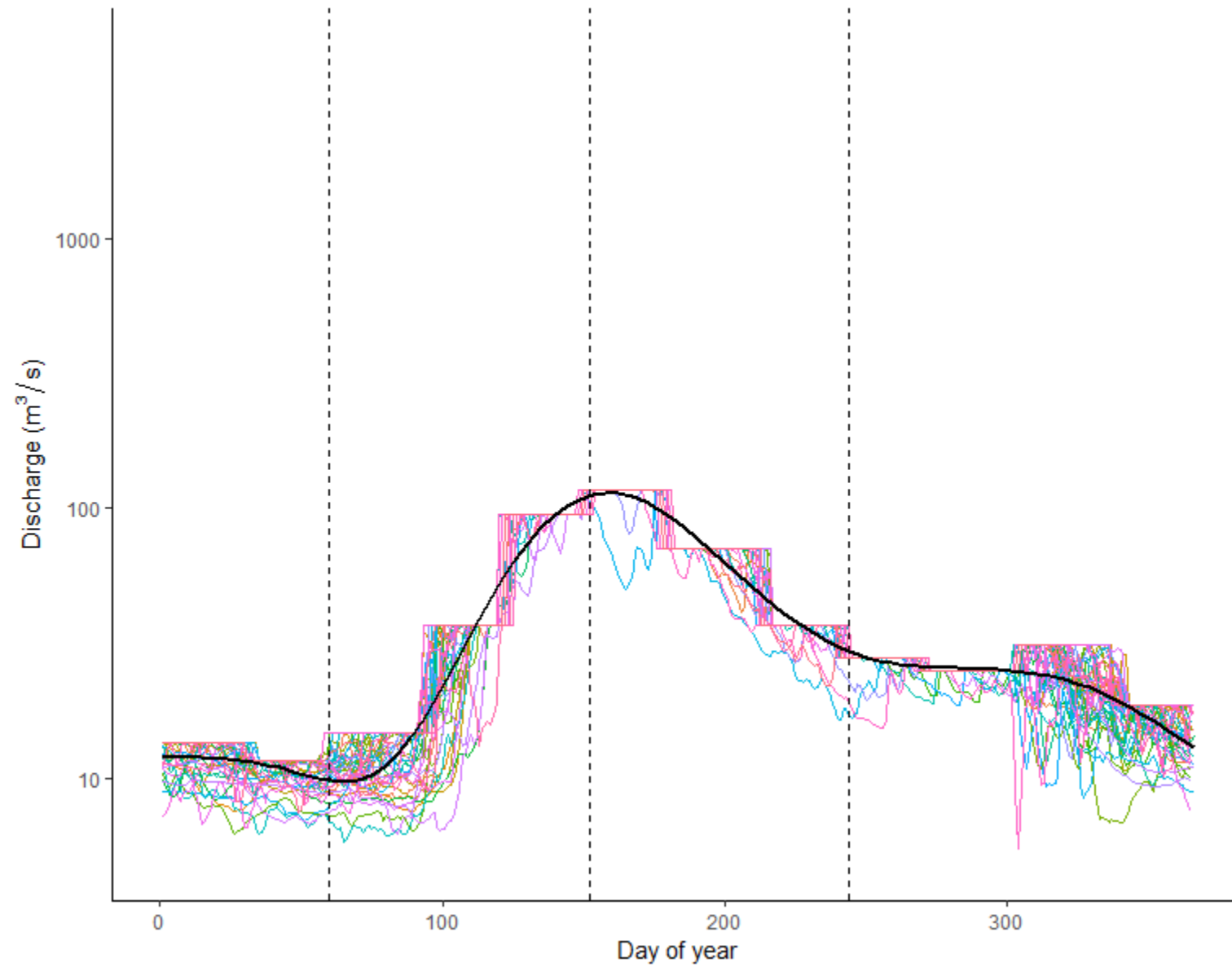
Wapiti River Flows – Water Quality Design Flow (7Q10)



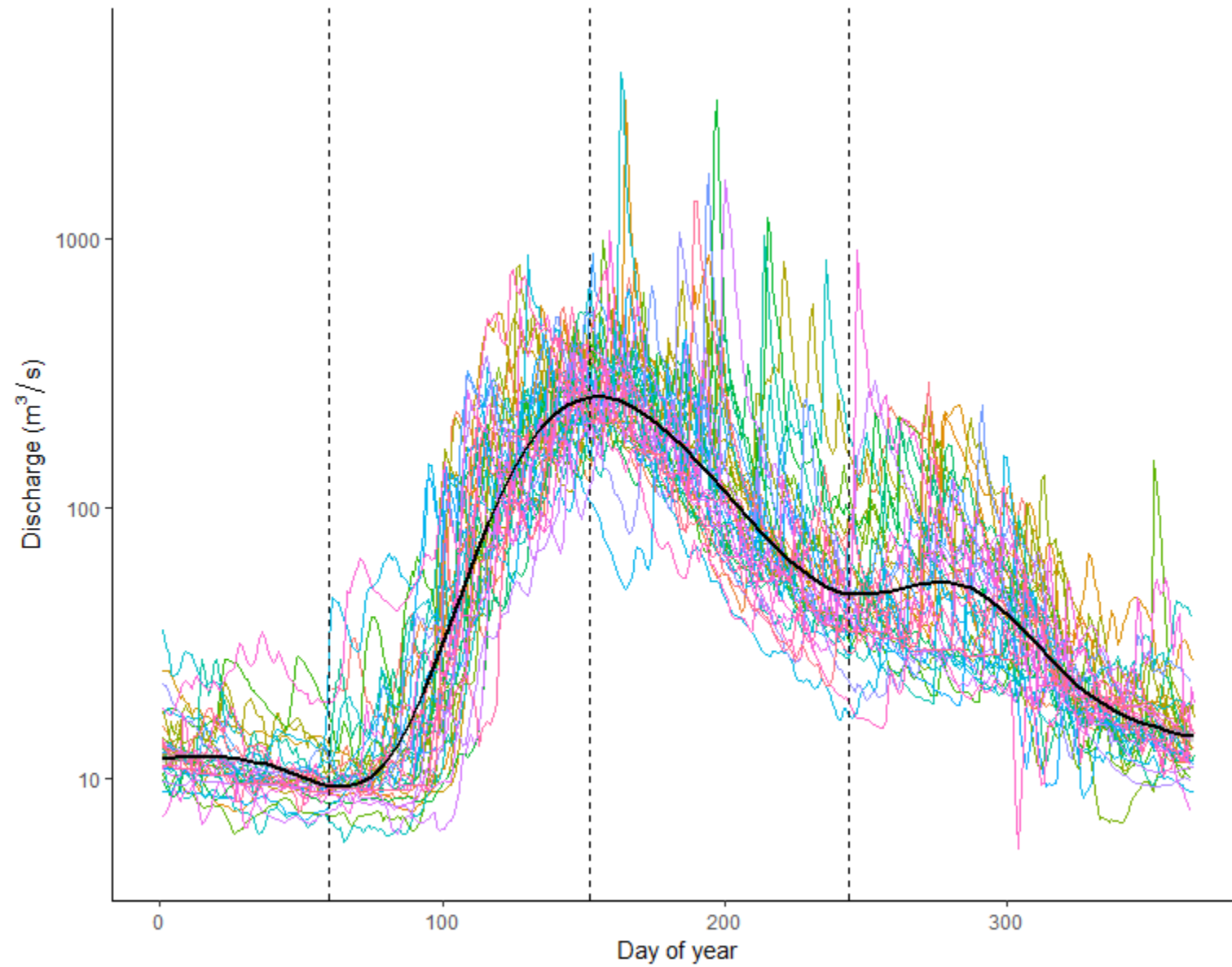
Wapiti River Flows – Tennant



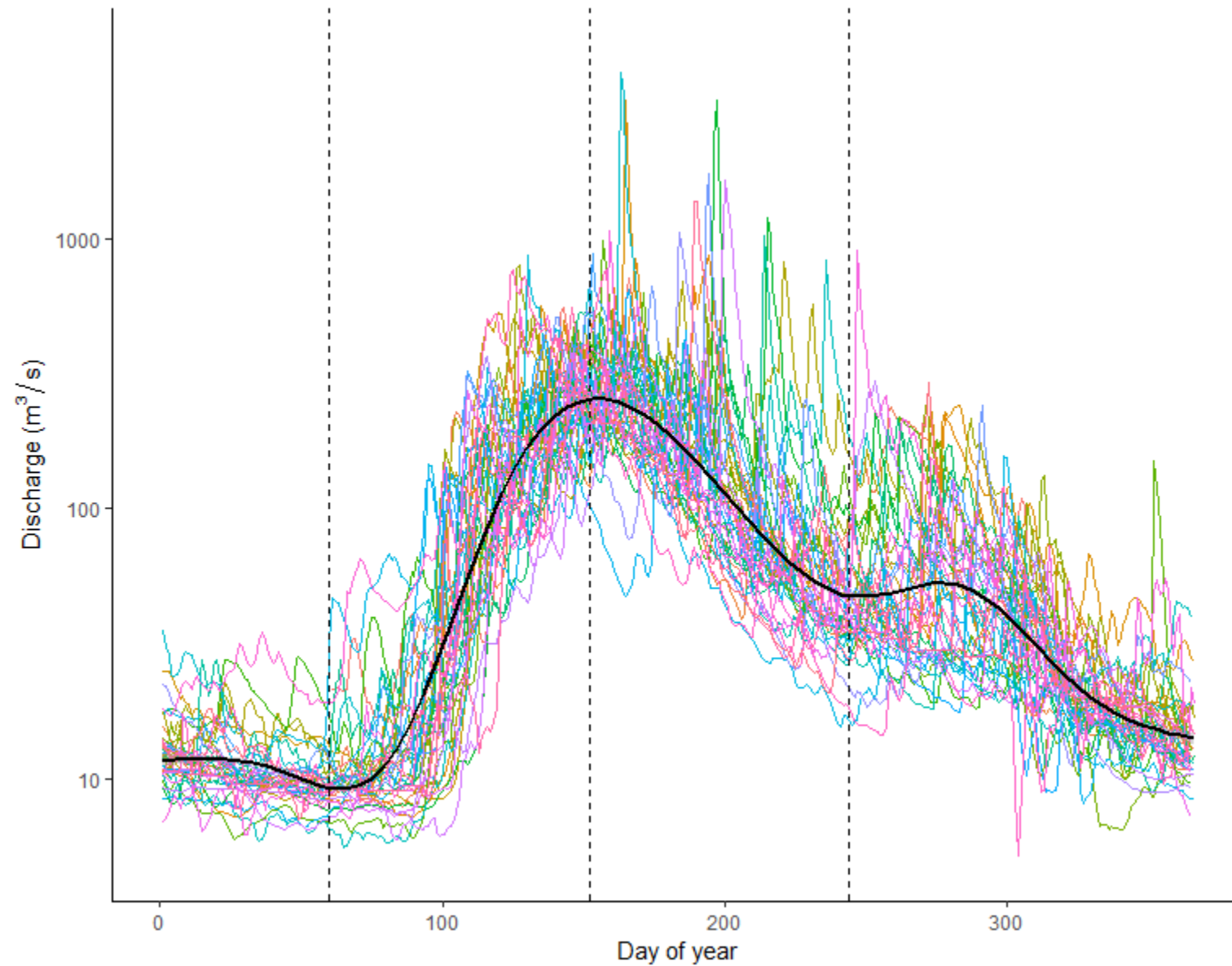
Wapiti River Flows – Tessmann



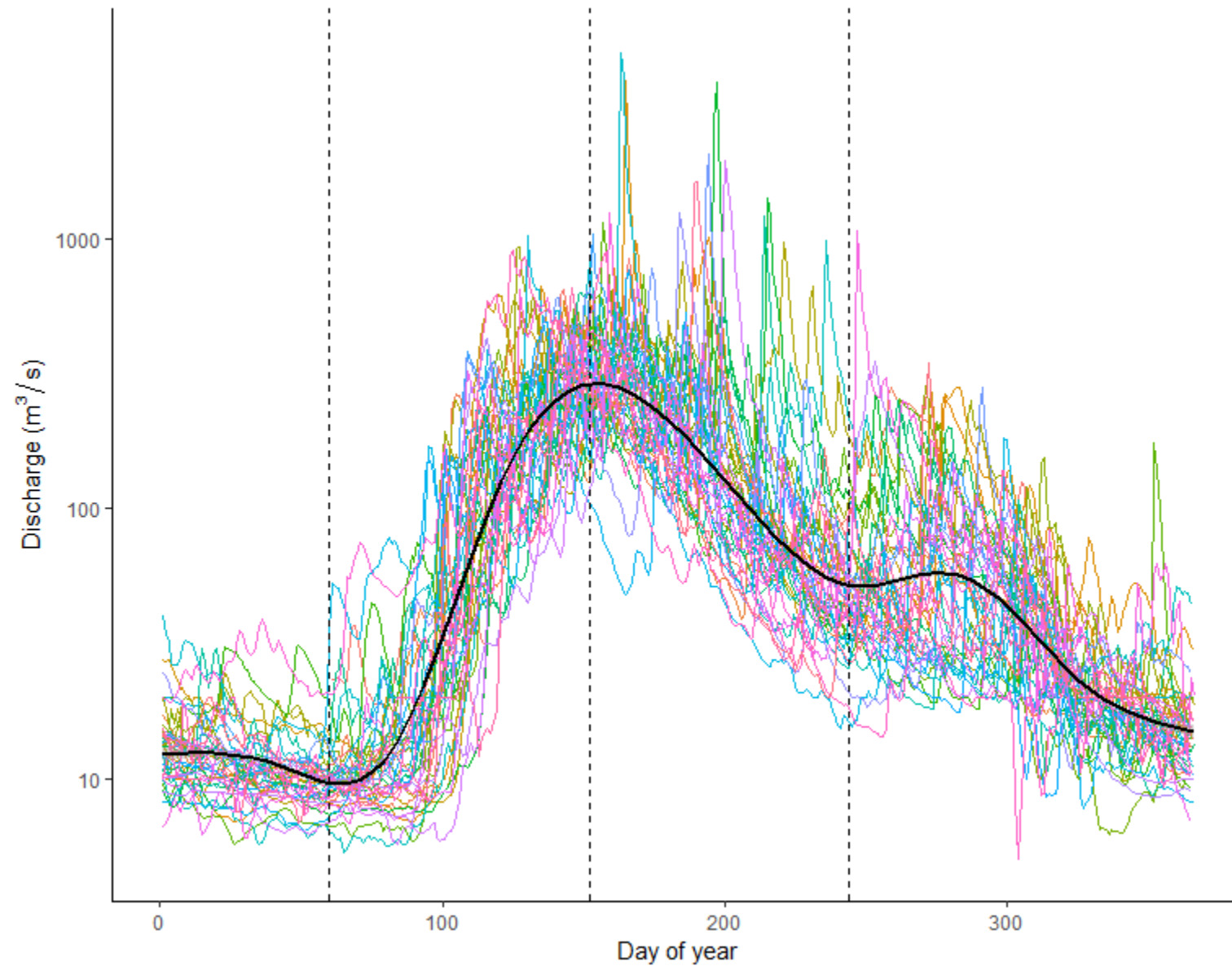
Wapiti River Flows – Alberta Desktop



Wapiti River Flows – Surface Water Allocation Directive

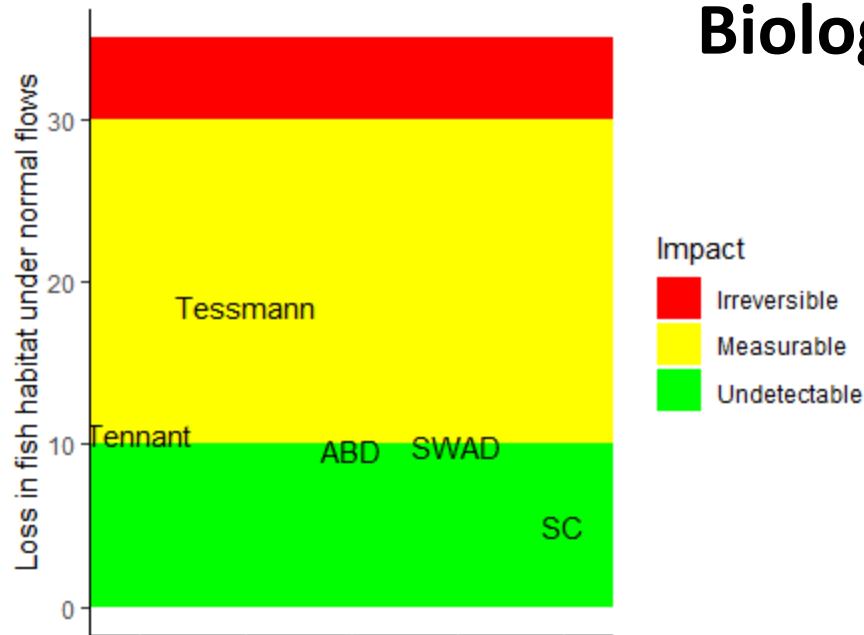


Wapiti River Flows – Steering Committee Recommendation

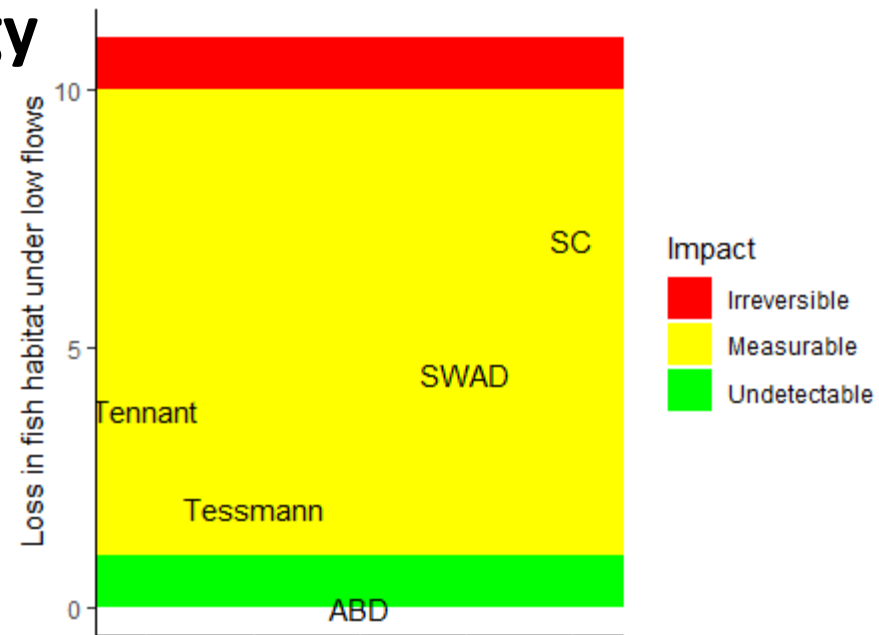


Wapiti River – Predicted Environmental Consequences

Fish habitat loss normal flows



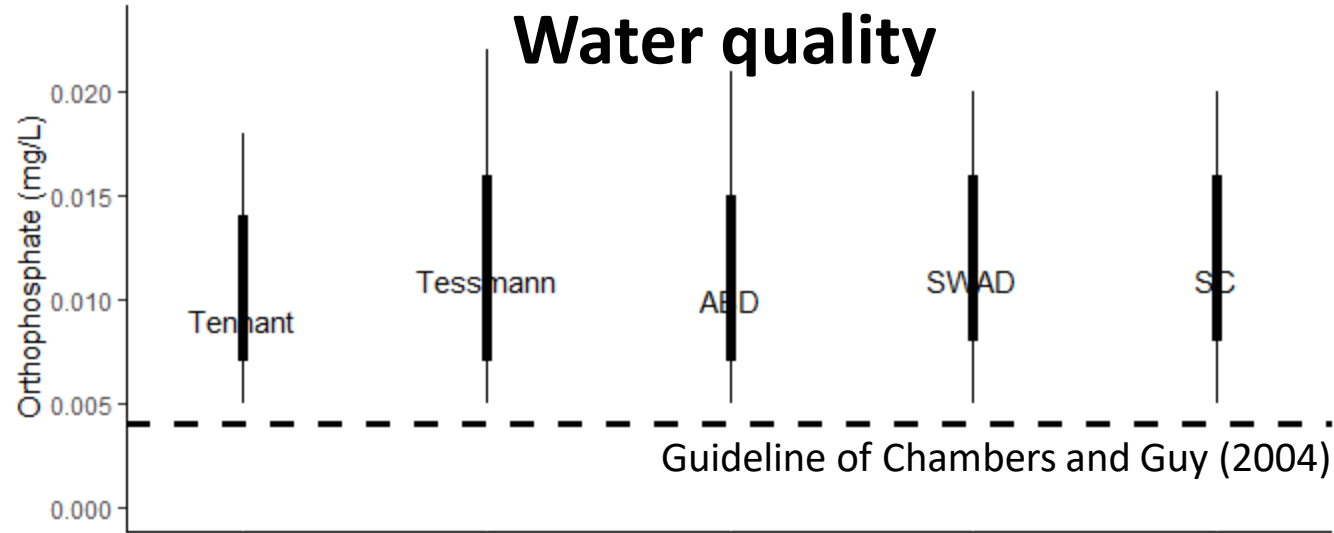
Fish habitat loss low flows



Geomorphology/Riparian



Water quality



Wapiti River – Predicted Water Use Consequences

Estimated shortages (existing licences) – Tennant Method

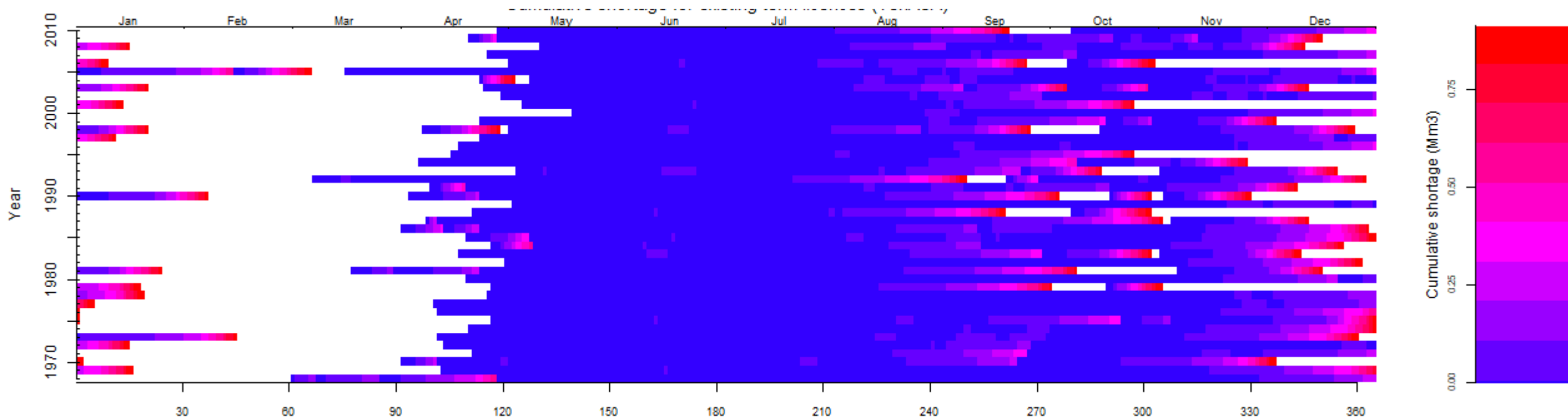


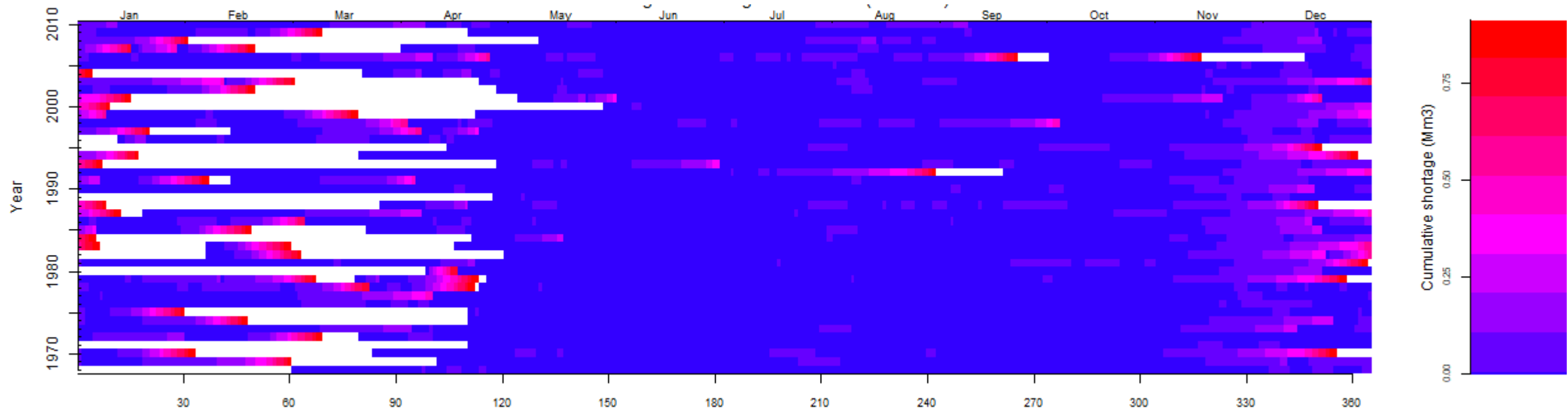
Figure Eight Lake – 1.12 Mm³ (Mitchell & Prepas 1990)



04/14/2016 09:06

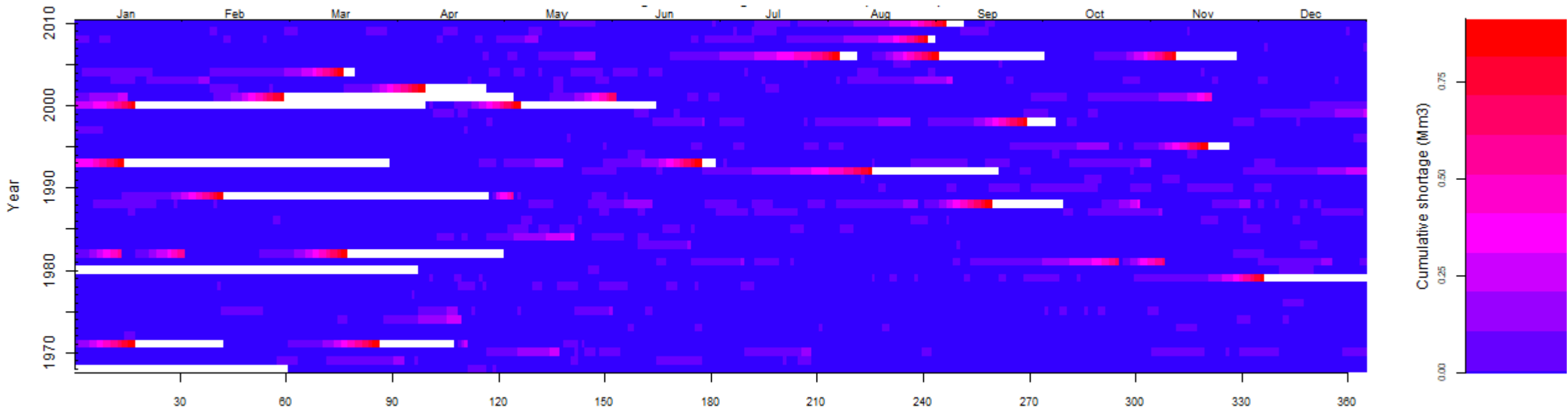
Wapiti River – Predicted Water Use Consequences

Estimated shortages (existing licences) – Tessmann Method



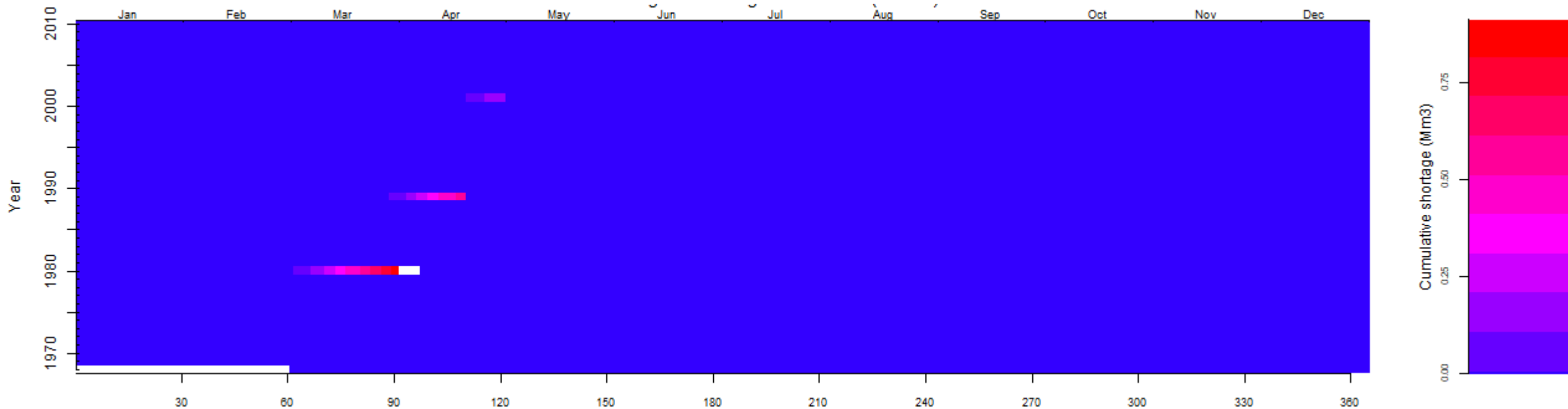
Wapiti River – Predicted Water Use Consequences

Estimated shortages (existing licences) – Alberta Desktop



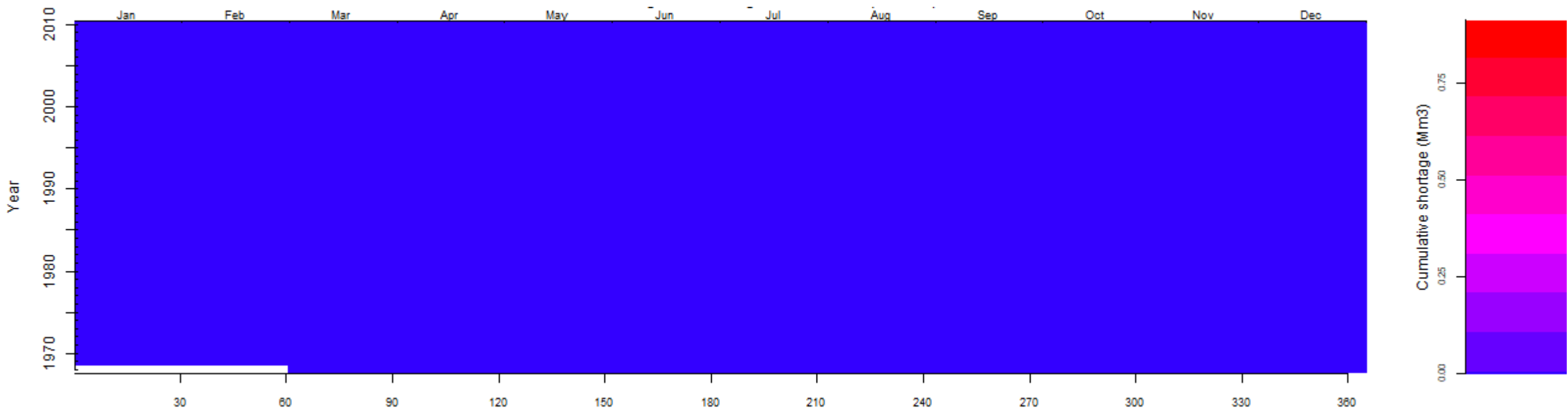
Wapiti River – Predicted Water Use Consequences

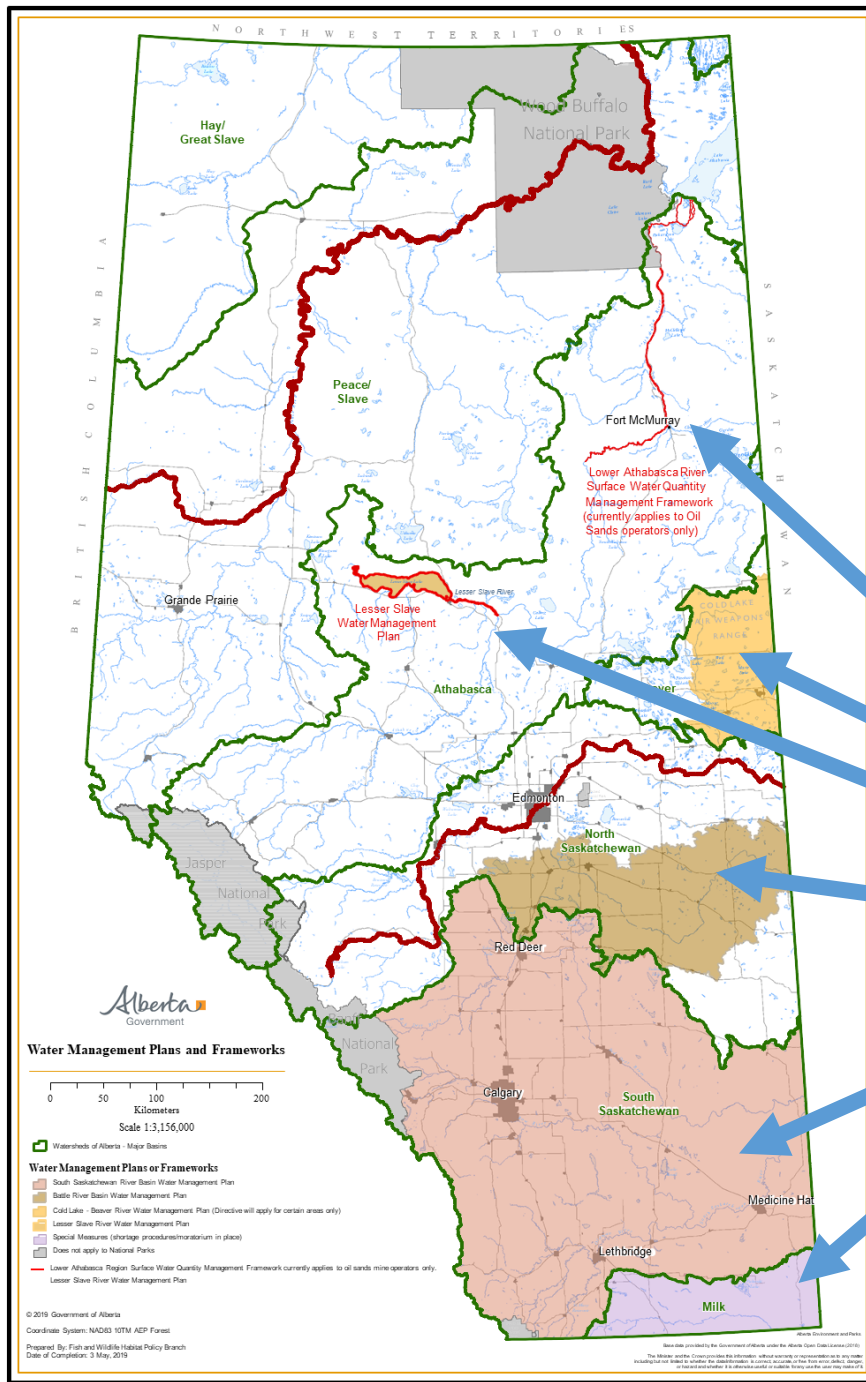
Estimated shortages (existing licences) – Surface Water Allocation Directive



Wapiti River – Predicted Water Use Consequences

Estimated shortages (existing licences) – Steering Committee





Surface water allocation directive is the “default” in the white areas

Coloured areas have water management plans or frameworks

How much water can I take out of the river?

Water Management Plans/Frameworks should determine the answer.

