Performance Measures and Flooding Regimes for Enhancing Floodplain, Riparian and Wetland Ecosystems within the Drawdown Zones of Columbia River Treaty Reservoirs

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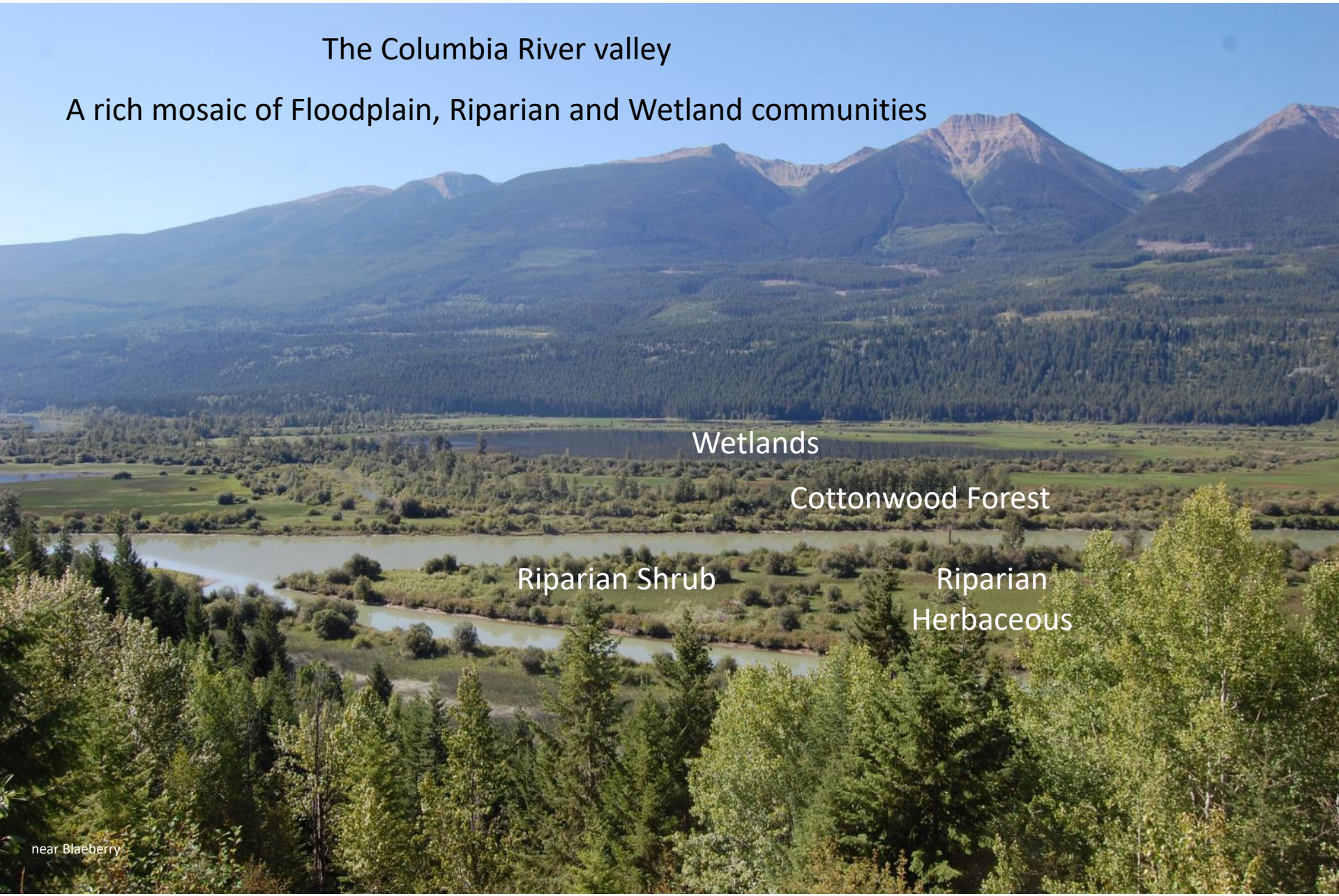
Columbia River Treaty

- 1964
- 4 dams ◯
- Flood control
- Hydroelectric power

- Modernization ~2024

River	Dam	Reservoir
Columbia	Mica	Kinbasket
Columbia	Keenleyside	Arrow
Duncan	Duncan	Duncan
Kootenay	Libby	Koocanusa


The Columbia River valley
A rich mosaic of Floodplain, Riparian and Wetland communities
Wetlands
Cottonwood Forest
Riparian Shrub
Riparian Herbaceous
near Blaeberry

In contrast:

The valley downstream has been dramatically altered

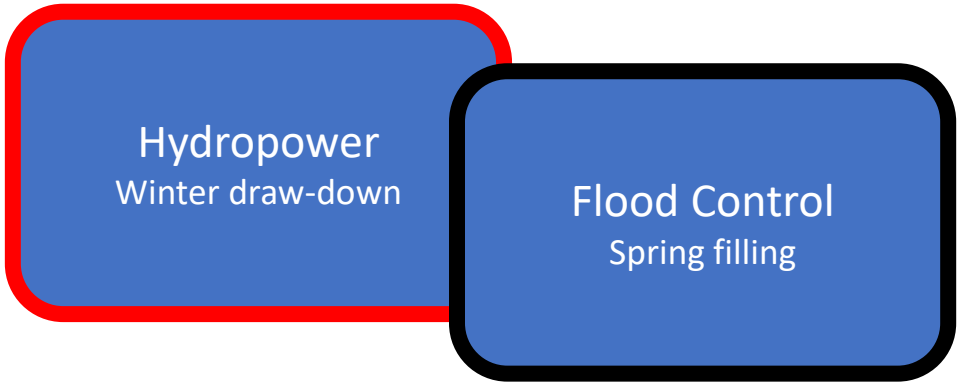
Another example:

Duncan Reservoir

The alternating inundation and exposure is lethal to all plants.

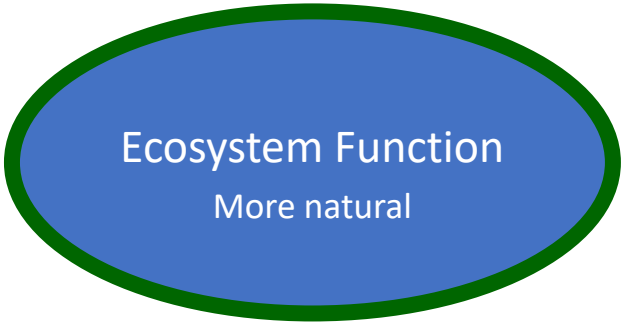
The drawdown zones are ecologically barren.

Columbia River Treaty Objectives (1964)



Treaty Modernization

A Third Objective



Reservoirs?

Our study

What plants are where, and why?

Floodplain & Riparian Vegetation Communities

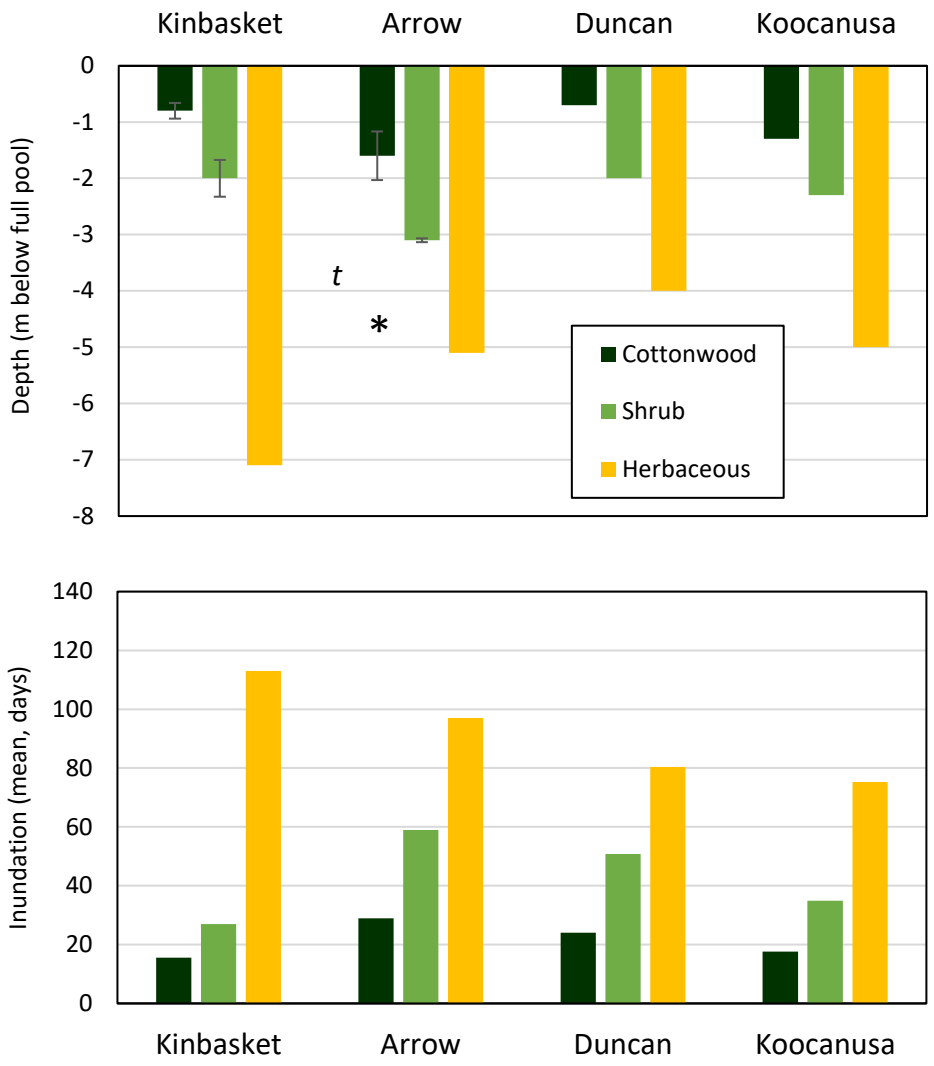
Elevational Bands

Vegetation Community Type	Descriptions	Characteristic Species
Cottonwood Forest	Cottonwood (or aspen/birch) stands or mixed stands with cottonwood	Black cottonwood, hybrid spruce, western redcedar, red-osier dogwood
Riparian Shrub	Flood tolerant shrub community.	Willows (esp. Sitka willow), mountain alder, black cottonwood, red-osier dogwood
Riparian Herbaceous	Perennial herbaceous communities with non-native grasses and native sedges. Inundation-driven communities maintained by reservoir operations.	Reed canarygrass, bluejoint, Kellogg's sedge, Columbia sedge, wool-grass, horsetails, rushes

General Consistency

Elevations

Inundation durations

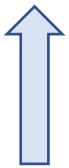


Performance measures

Recruitment is occasional and vulnerable

Exposure is essential and varies across the reservoirs

Vegetation Community Type	Description	Seedling Recruitment		Community Maintenance		
				Inundation Tolerance		
		Recruitment Period No or < 4 wks inundation	Frequency of Recruitment	Average Inundation	Occasional Inundation 1-in-4 years	Exposure Requirement
Floodplain/Riparian Habitats		Years	#/30yrs	Days/Growing season		
Cottonwood Forest	Cottonwood stands, often mixed	**3 + 2**	**2**	**25**	**35**	110
Riparian Shrub	Flood-tolerant shrub community, commonly with willows	**3 + 1**	**2**	**45**	**60**	95
Riparian Herbaceous	Graminoid dominated communities with forbs and few woody plants	2 + 1	4	110	125	75
Ruderals	Weedy communities on dry disturbed sites	*Inhospitable substrates*				
Wetland Habitats						
Fens, Swamps, Marshes	Sedge, shrub or graminoid dominated wetlands or shallow ponds or fringes	1/2 + 2	3	15-55	25-80	100



Other factors influence establishment - Submodel

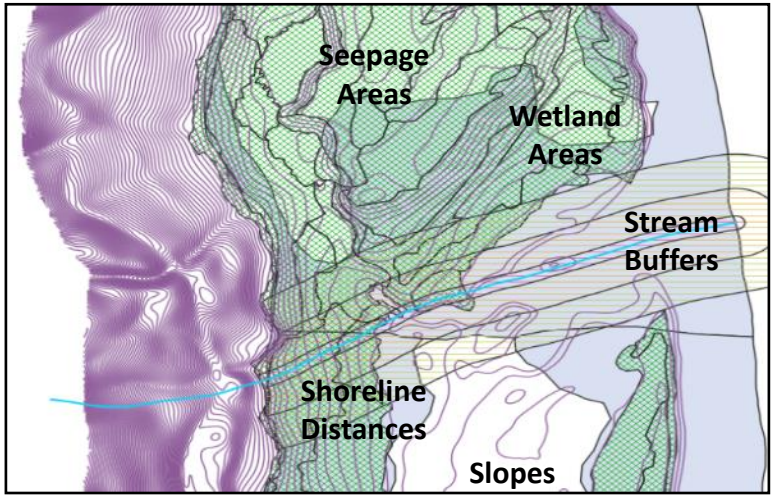
Floodplain/ Riparian Habitats

- **Slope** – analogue for substrate texture and stability
- Moisture from **riparian** position – stream buffers
- Moisture from **seepage** – pre-dam seepage locations
- **Seed source** – distance to shoreline

Wetland Habitats

- Slope – gentle to flat
- Presence of pre-dam wetlands

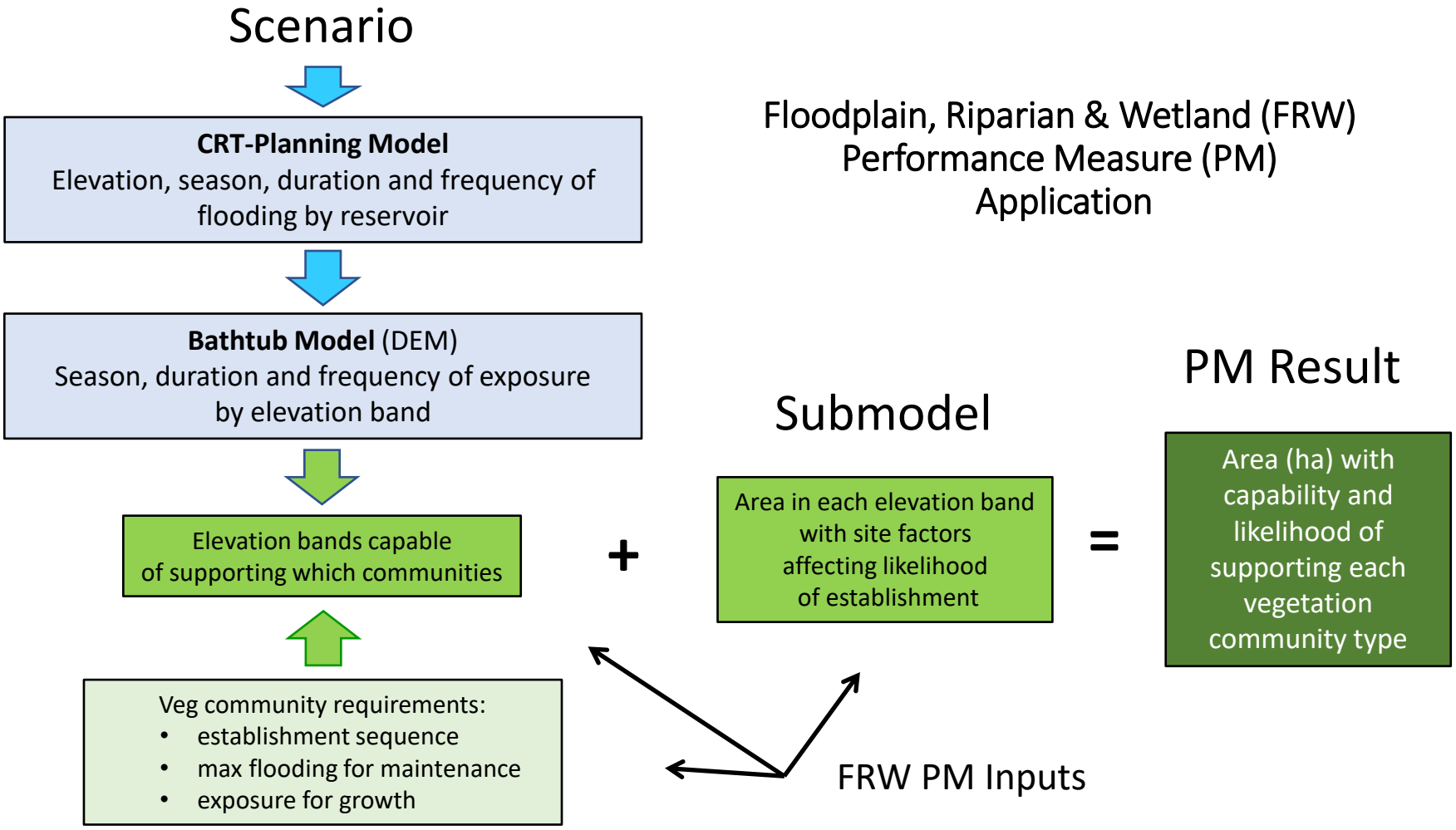
GIS Mapping and
Summary by Elevation Band



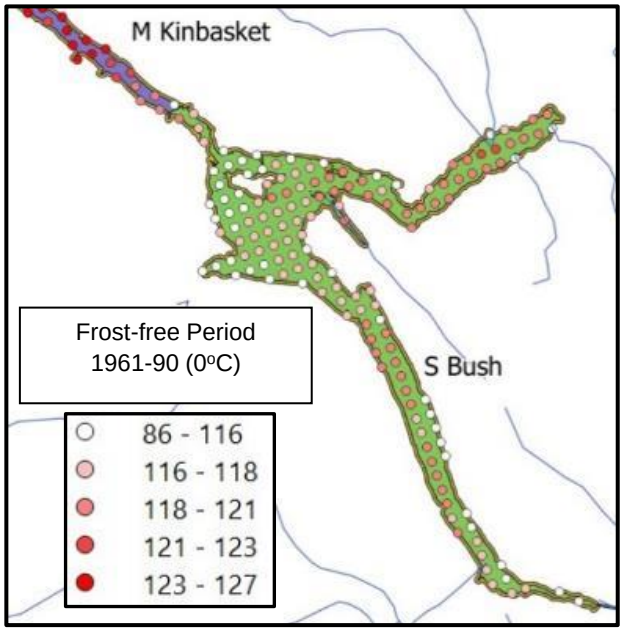
The Columbia River Treaty – Planning Model

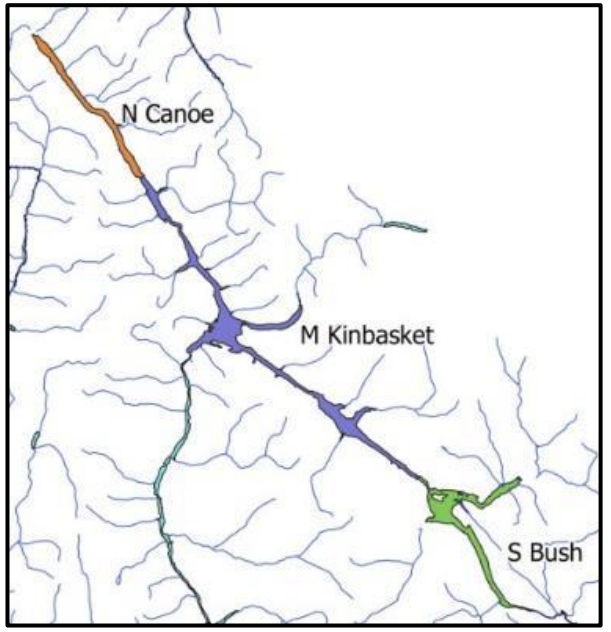
- An OASIS-based, mass balance model

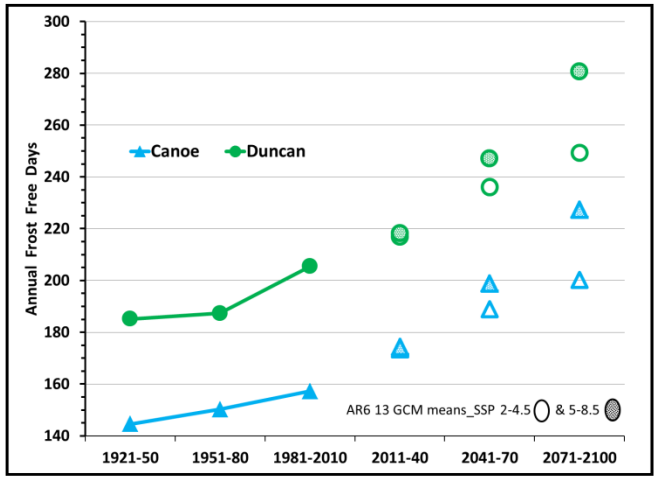
- Coupling of hydrology, ecology, and social, cultural and economic outcomes

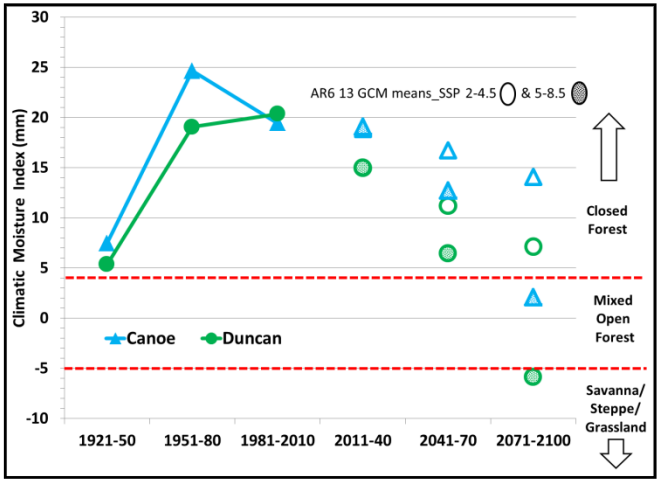


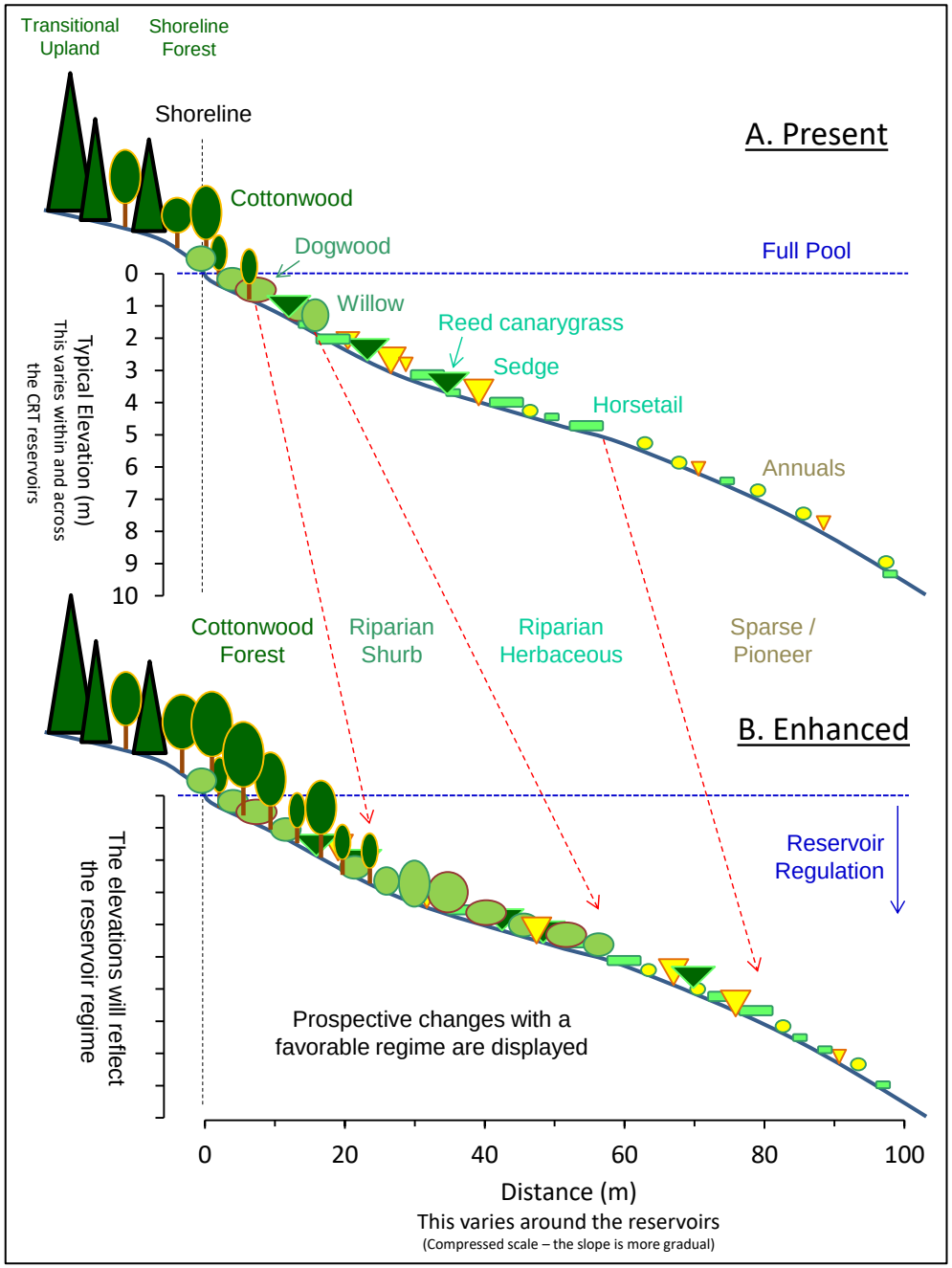
Regional climate varies across the reservoirs and climate change influences hydrology and vegetation










Transitional Upland
Shoreline Forest
Shoreline
A. Present
Cottonwood
Dogwood
Full Pool
Willow
Reed canarygrass
Sedge
Horsetail
Annuals
0
1
2
3
4
5
6
7
8
9
10
Typical Elevation (m)
This varies within and across the CRT reservoirs
Cottonwood Forest
Riparian Shurb
Riparian Herbaceous
Sparse / Pioneer
B. Enhanced
Reservoir Regulation
The elevations will reflect the reservoir regime
Prospective changes with a favorable regime are displayed
0
20
40
60
80
100
Distance (m)
This varies around the reservoirs
(Compressed scale – the slope is more gradual)

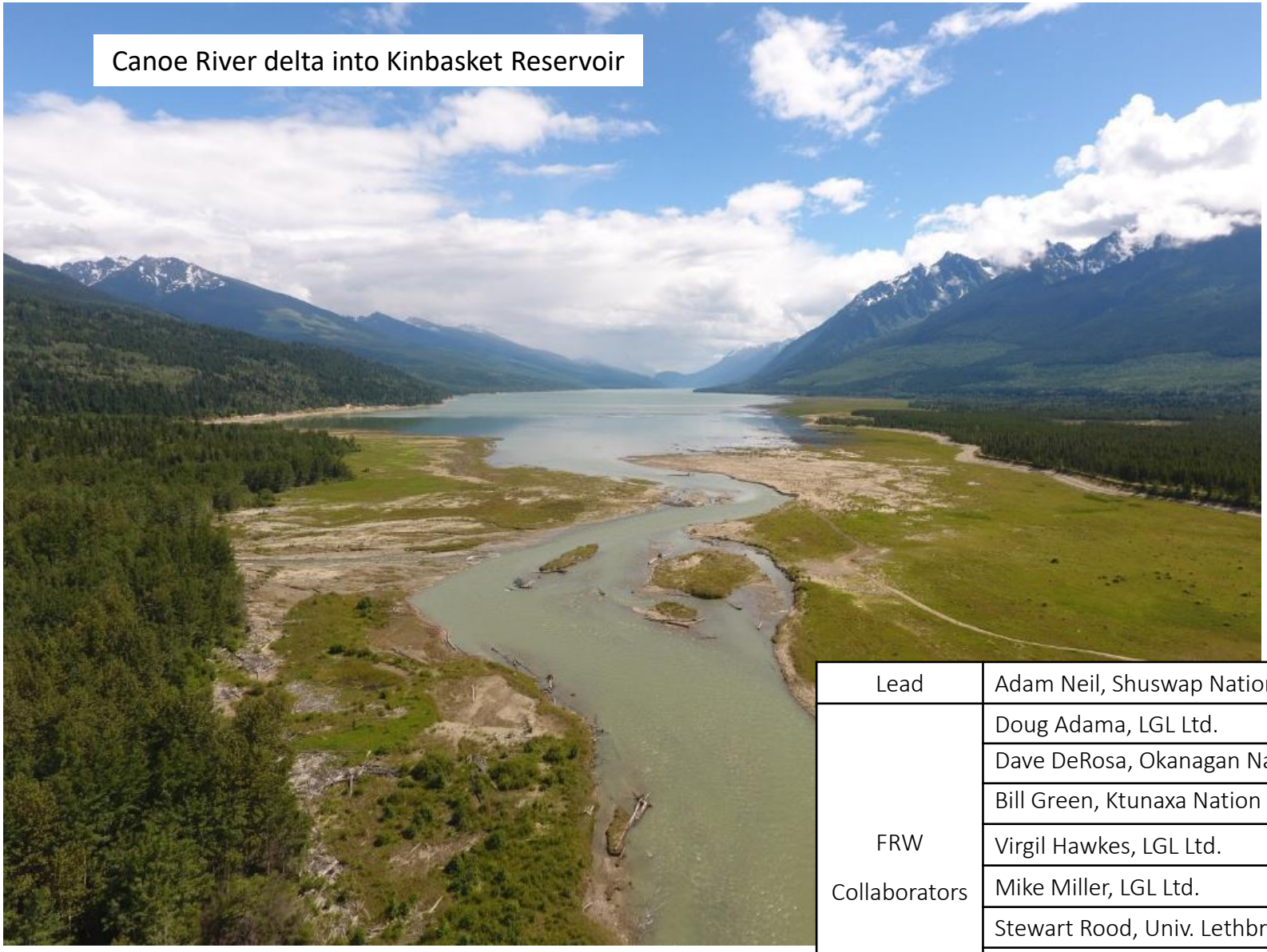
Ongoing Challenges

- Limited mapping of ecosystems
- Elevation data for improvement bands
- Koocanusa Reservoir
- Active Adaptive Management - Monitoring

Need for Balance

- Hydropower, Flood Control & Ecological Function
- Reservoir & River Reaches
- Shared Opportunities Between Reservoirs

Kootenay River
Koocanusa Reservoir



Canoe River delta into Kinbasket Reservoir

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	Alan Thomson, Mtn. Stn. Consultants
	Greg Utzig, Kutenai Nature Investigations

A team effort