



Integrated Water Resources Management of the Saskatchewan River Basin using WEAP

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Challenges to Canadian Water Resources



Integrated Modelling
Program for Canada
Global Water Futures

- Increasing extreme events (e.g. floods and droughts)



1999–2004 Canadian Prairies
Drought

Source: <http://www.farmfutures.com/weather/drought-worsens-canadas-southern-prairie>

- Water scarcity and quality degradation



Algal Blooms in Lake Erie

Source: <https://freshwaterfuturecanada.ca/2018/02/canada-ontario-action-plan-to-address-lake-erie-algal-blooms-falls-short/>

What Are the Drivers?



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- Climate change
- Population growth
- Increasing development
- **Fragmented governance**

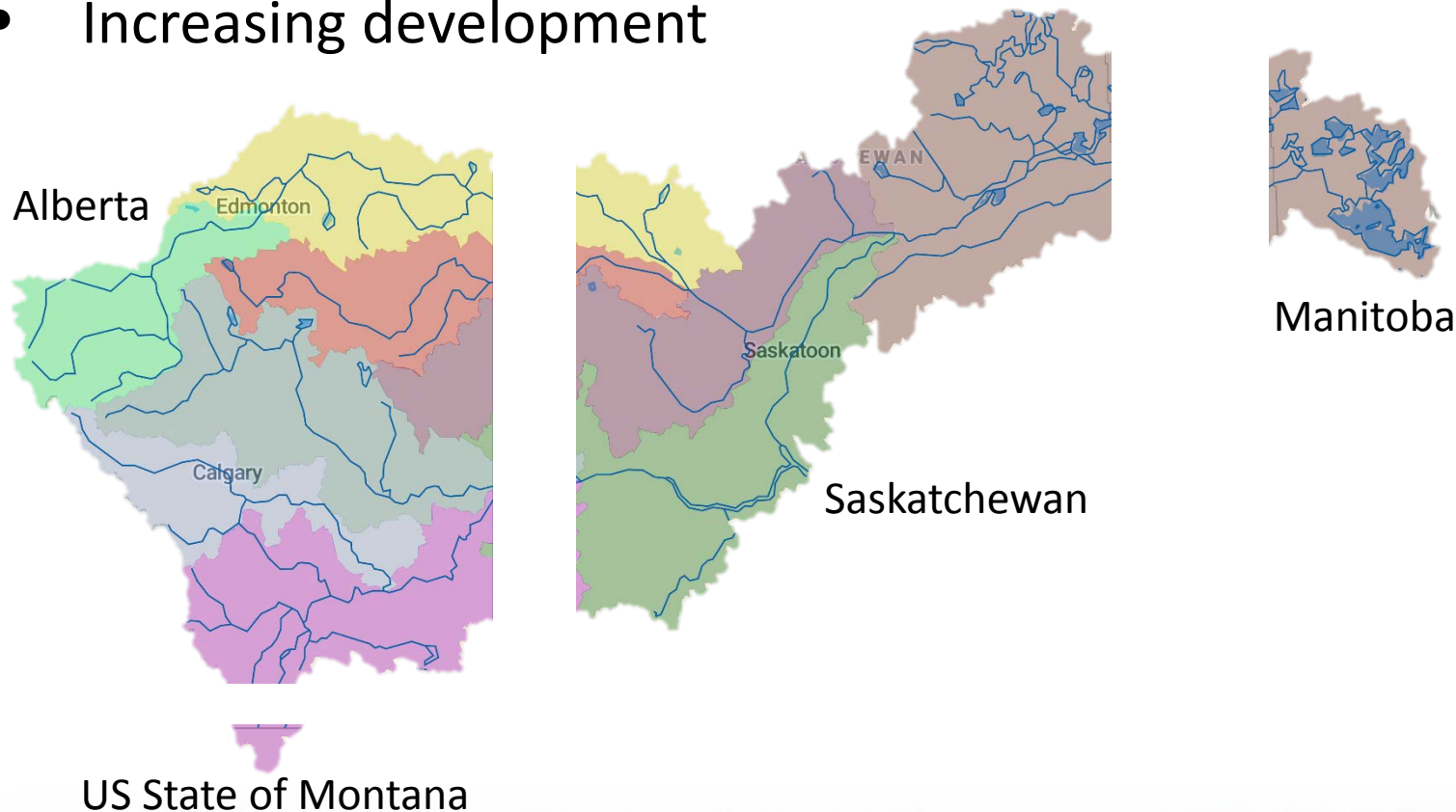


Figure 5. The transboundary Saskatchewan River Basin located in Western Canada



Integrated Modelling Program for Canada



THEME A:

Integrated
Earth Systems
Modelling

THEME B:

Water Management
Modelling, Coupling
Human-driven and
Natural Systems

THEME C:

Decision Making
under Uncertainty
and Non-stationarity

THEME D:

User Engagement
and Knowledge Mobilization

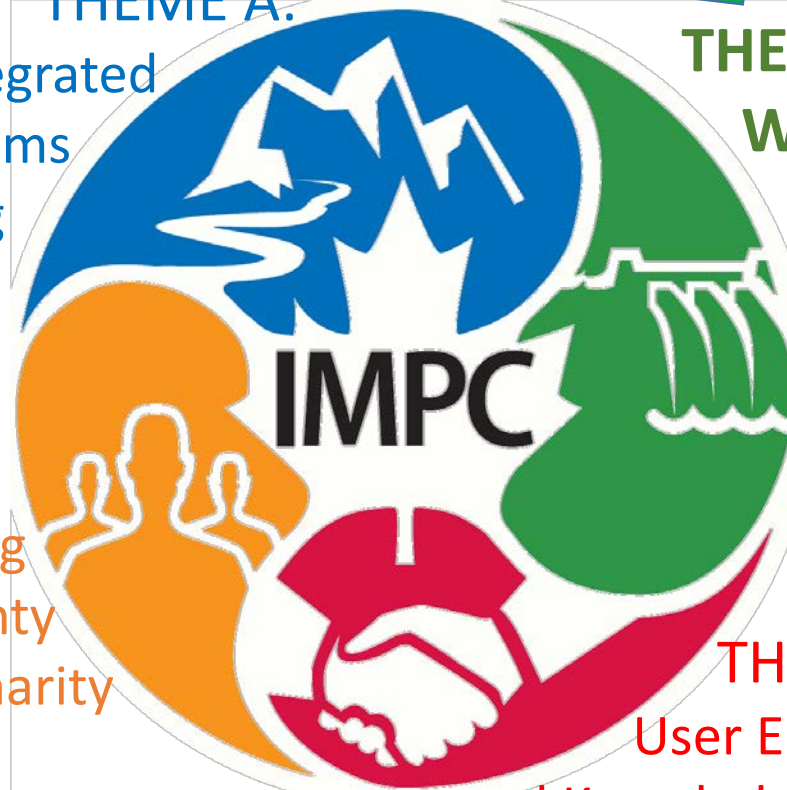


Figure 6. The Integrated Modelling Program for Canada (IMPC) structure

Source: Published with permission from Dr. Amin Haghnegahdar – IMPC Project Manager



Water Resources Modelling of the SaskRB in WEAP

- **Bow**, **Red Deer** and **Oldman** sub-basins have been modelled in WEAP so far.



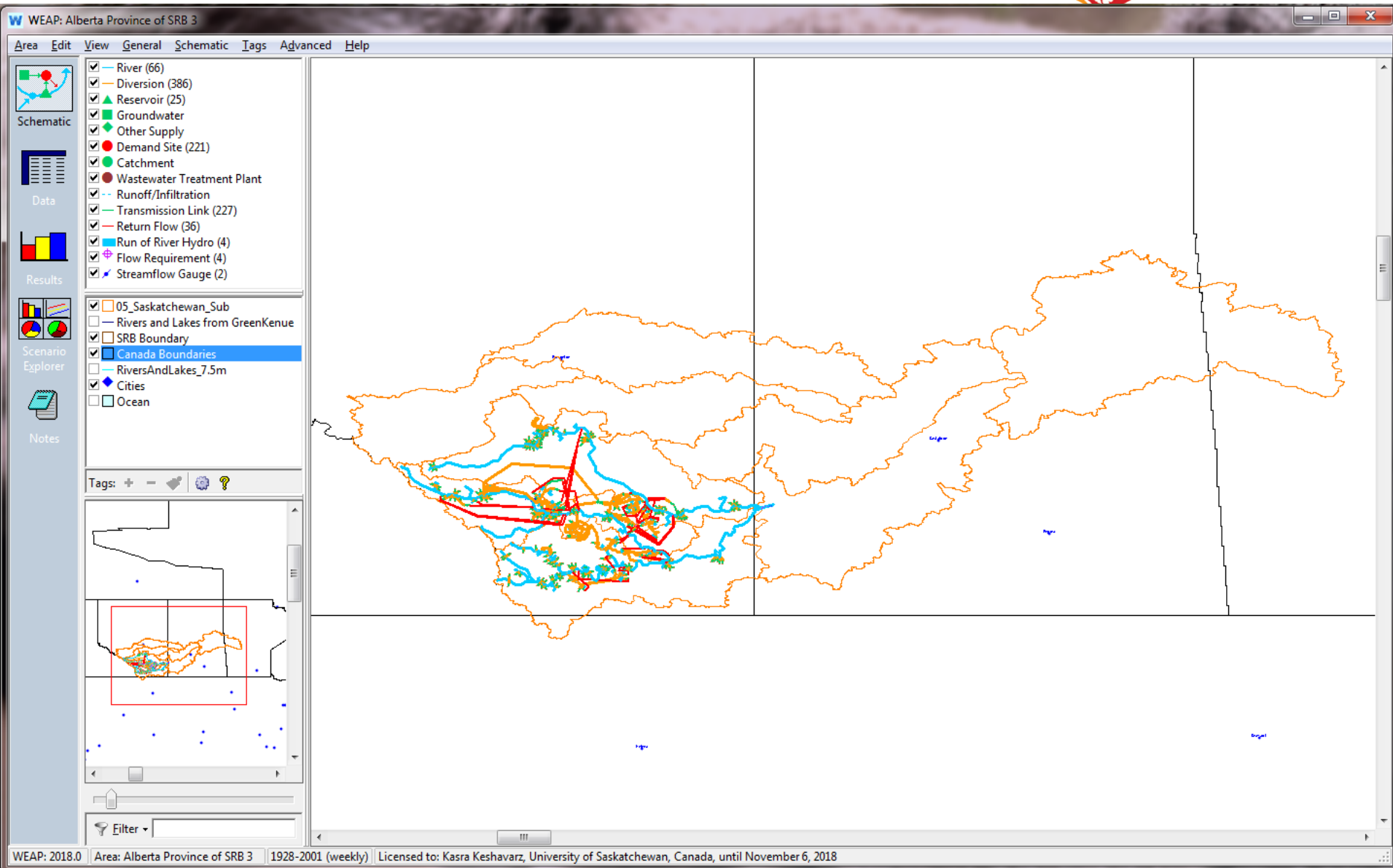
- WRMM is the model developed by Alberta Environment and Parks (AEP) for some portions of the Basin.
- For validation, WEAP results will be compared to that of WRMM.



WEAP



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Comparison



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South SaskRB Water Management Modelling



Years selected: [1990, 2000]



Filter by element type:

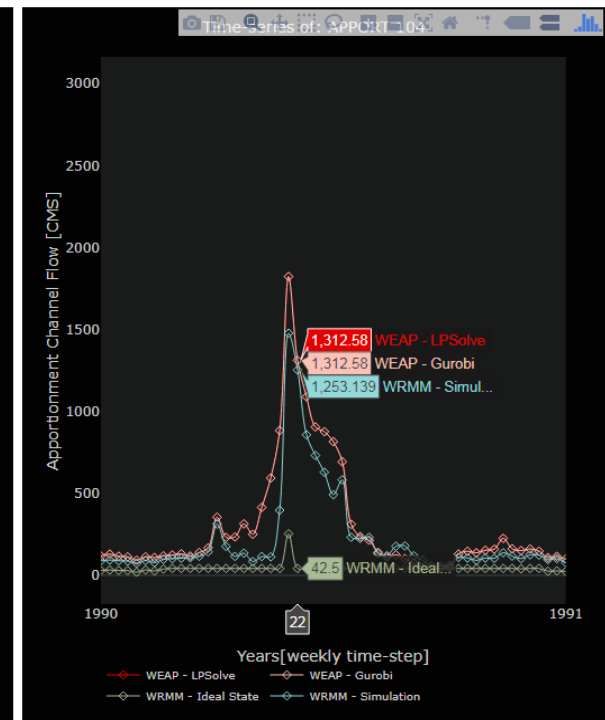
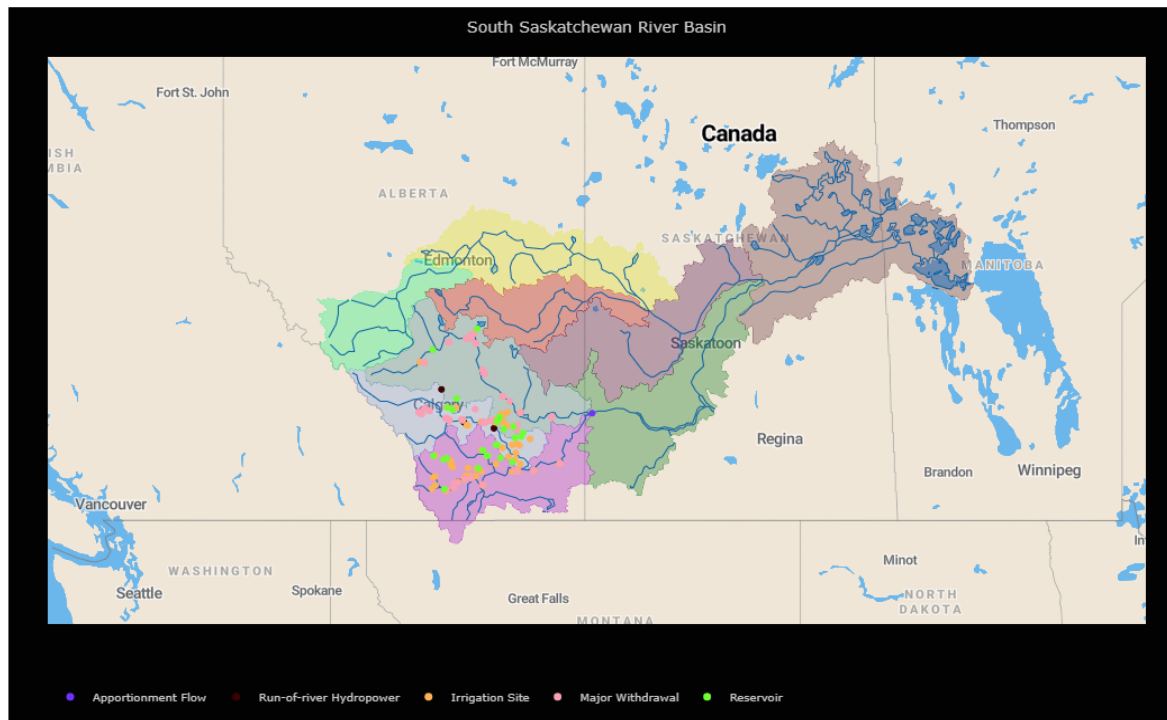
☒ All ☐ Customize

☒ Irrigation Site ☒ Major Withdrawal ☒ Reservoir ☒ Run-of-river Hydropower ☒ Apportionment Flow

Filter by model name:

☒ All ☐ Customize

☒ MODSIM ☒ WEAP - LPSolve ☒ WEAP - Gurobi ☒ WRMM - Ideal State ☒ WRMM - Simulated State
☒ WRIMS ☒ Observations



Preliminary Results



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- **1969 Master Agreement on Apportionment** maintains the minimum flow of this transboundary river.

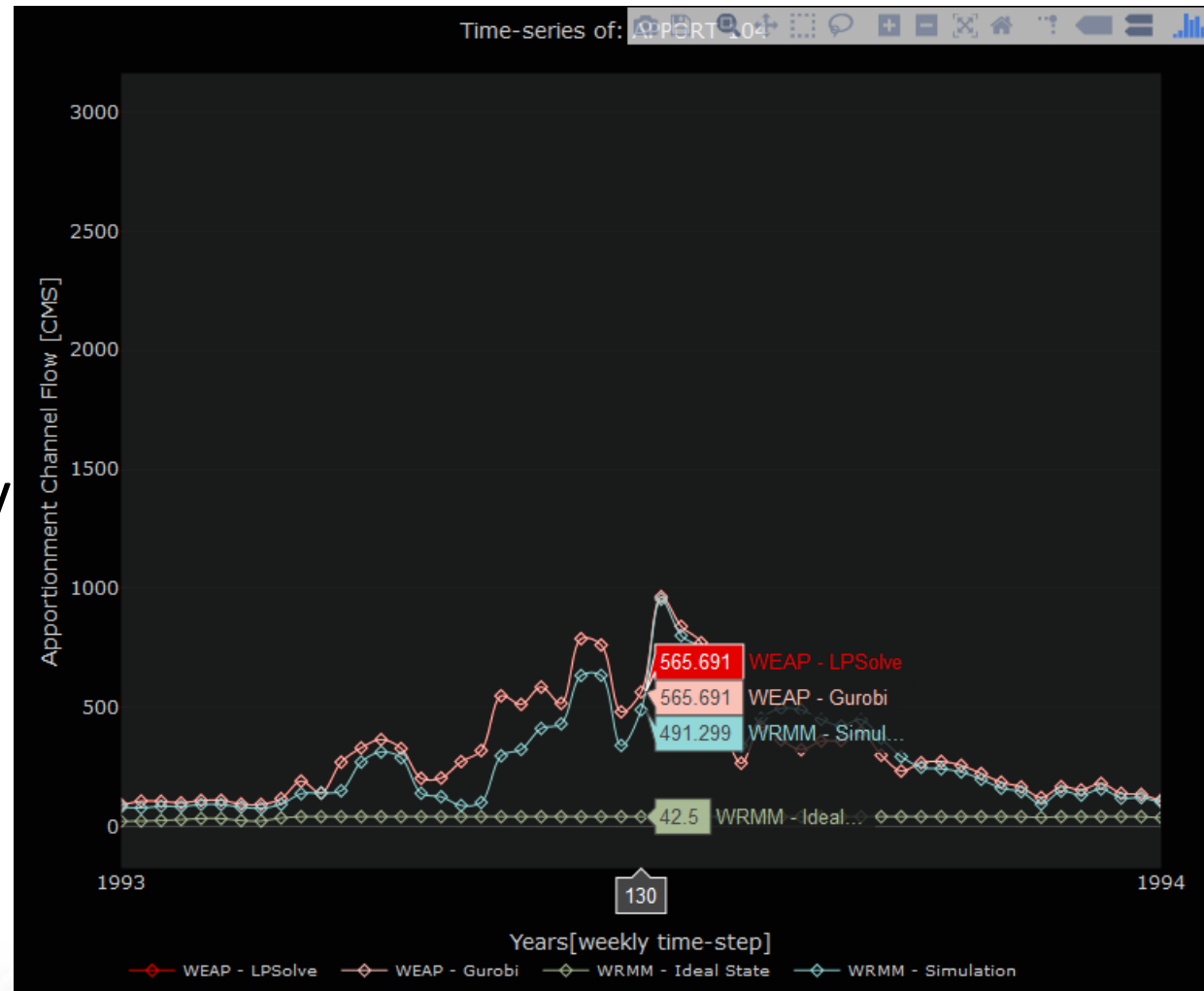


Figure 9. Time-series of the South Saskatchewan River Crossing AB-SK Border

Future Steps



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- Completing the WEAP model for the whole Saskatchewan River Basin.
- Coupling the water management model with a hydrological model.
- Assessing the viability of inter-provincial and international water allocation agreements under future climate change scenarios.





Any Questions?



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