Using watershed geospatial data to guide aquatic ecosystem health sampling in the North Saskatchewan River basin

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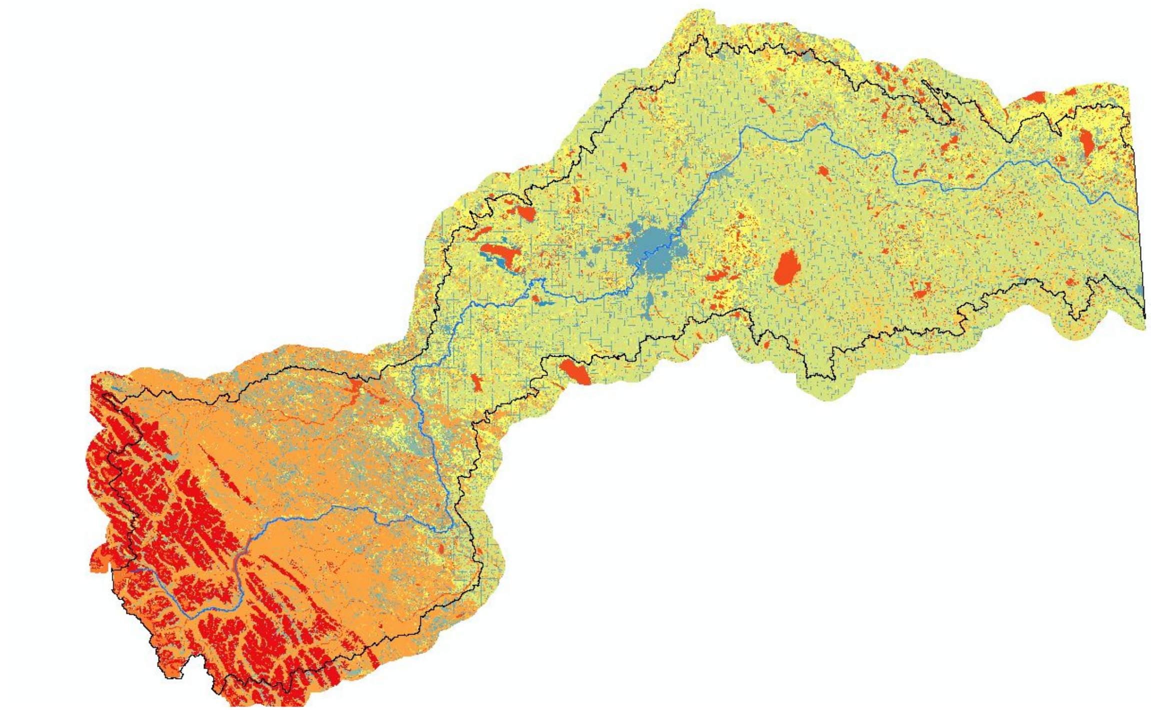
UNIVERSITY OF ALBERTA
ALBERTA INNOVATES
Alberta Environment and Parks

Classification: Protected A

UofA Watershed Integrity Project

Development of a comprehensive geospatial tool for assessing watershed integrity and aquatic ecosystem health in the North Saskatchewan River basin

Watershed integrity (geospatial)



Untested and assumed stressor-response relationships

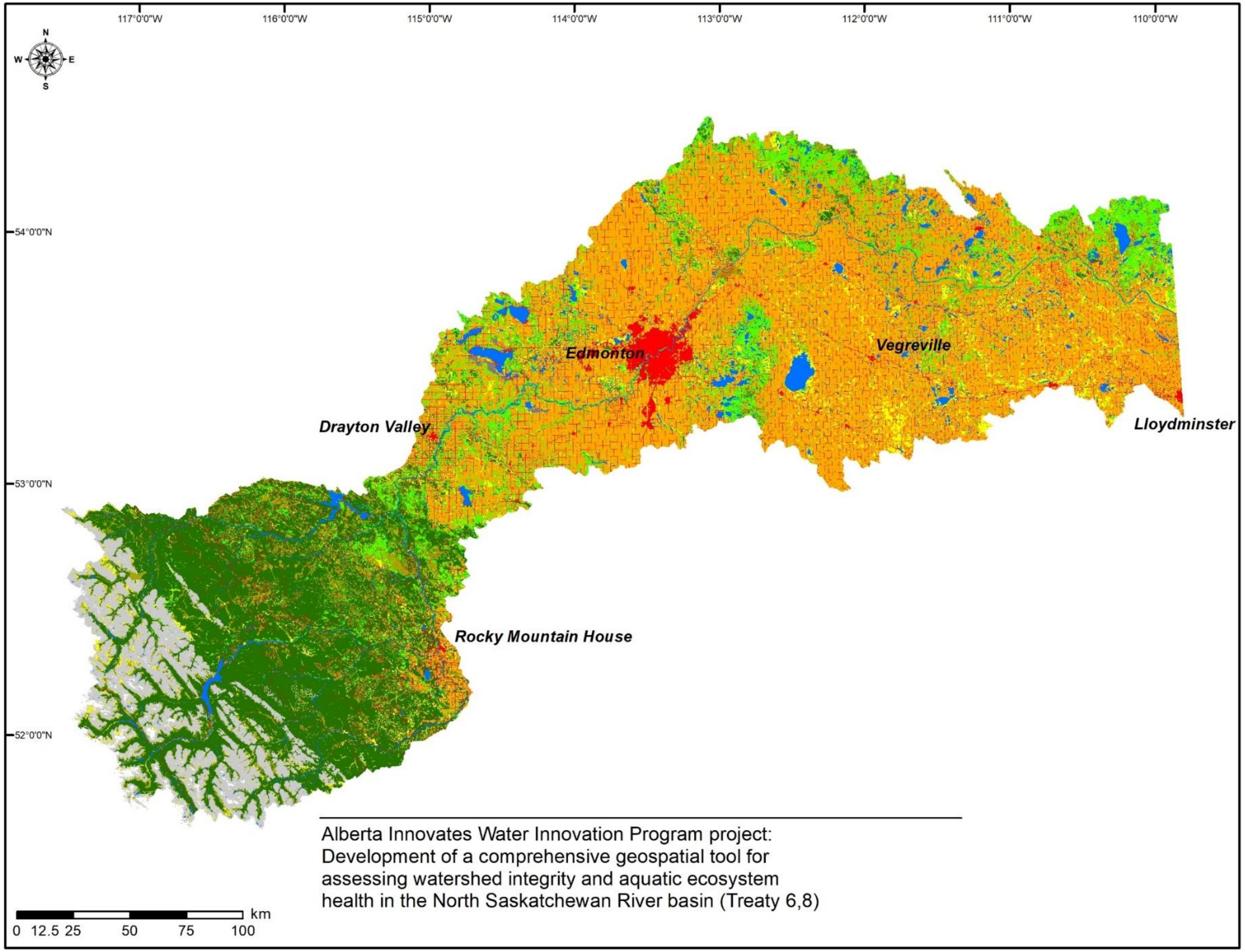
Aquatic ecosystem health (field)

Can we develop a geospatial model of watershed integrity that can accurately predict AEH in the North Saskatchewan River Basin?

Major project objectives

1. Review published geospatial models of watershed integrity and indices of AEH
2. Assess AEH of representative tributaries of the NSR using field-based approaches and traditionally used indices (water quality, microbial communities, periphyton, benthic invertebrates and fish)
3. Develop and test the performance of relationships between indices of AEH with geospatial data
4. Implement the best-performing geospatial model of watershed integrity
5. Disseminate the results to the scientific community and the general public

AEH site selection



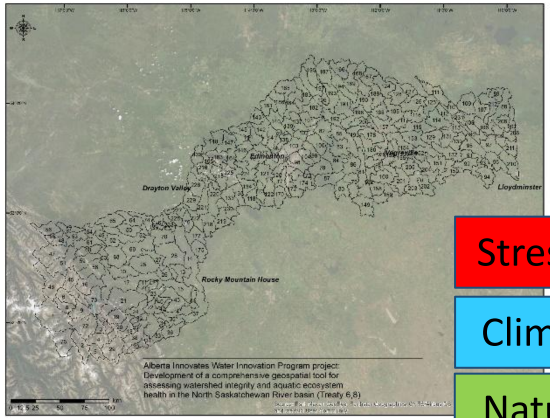
AEH site selection objectives

1. Maximize indicator variability across the basin, but capture smaller-scale variability.
2. Trade-off between # distinct areas of interest and site replication
3. Accessibility




AEH: Site Selection workflow

1.

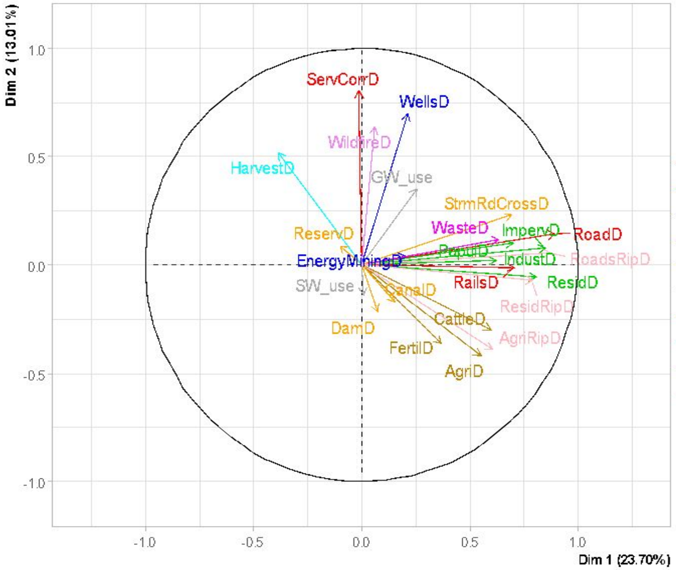


Stressor indicators

Climate indicators

Natural indicators

2.



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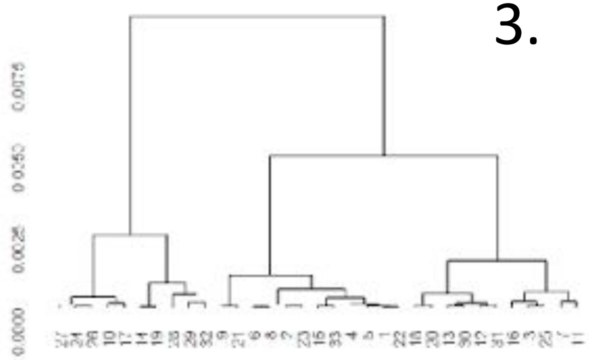

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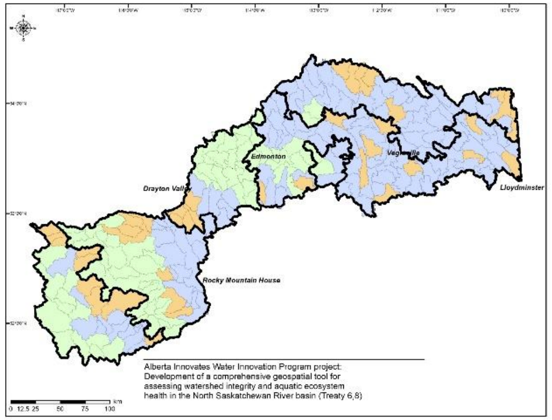

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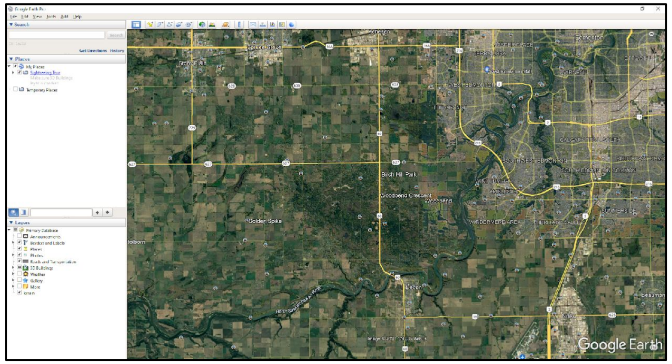
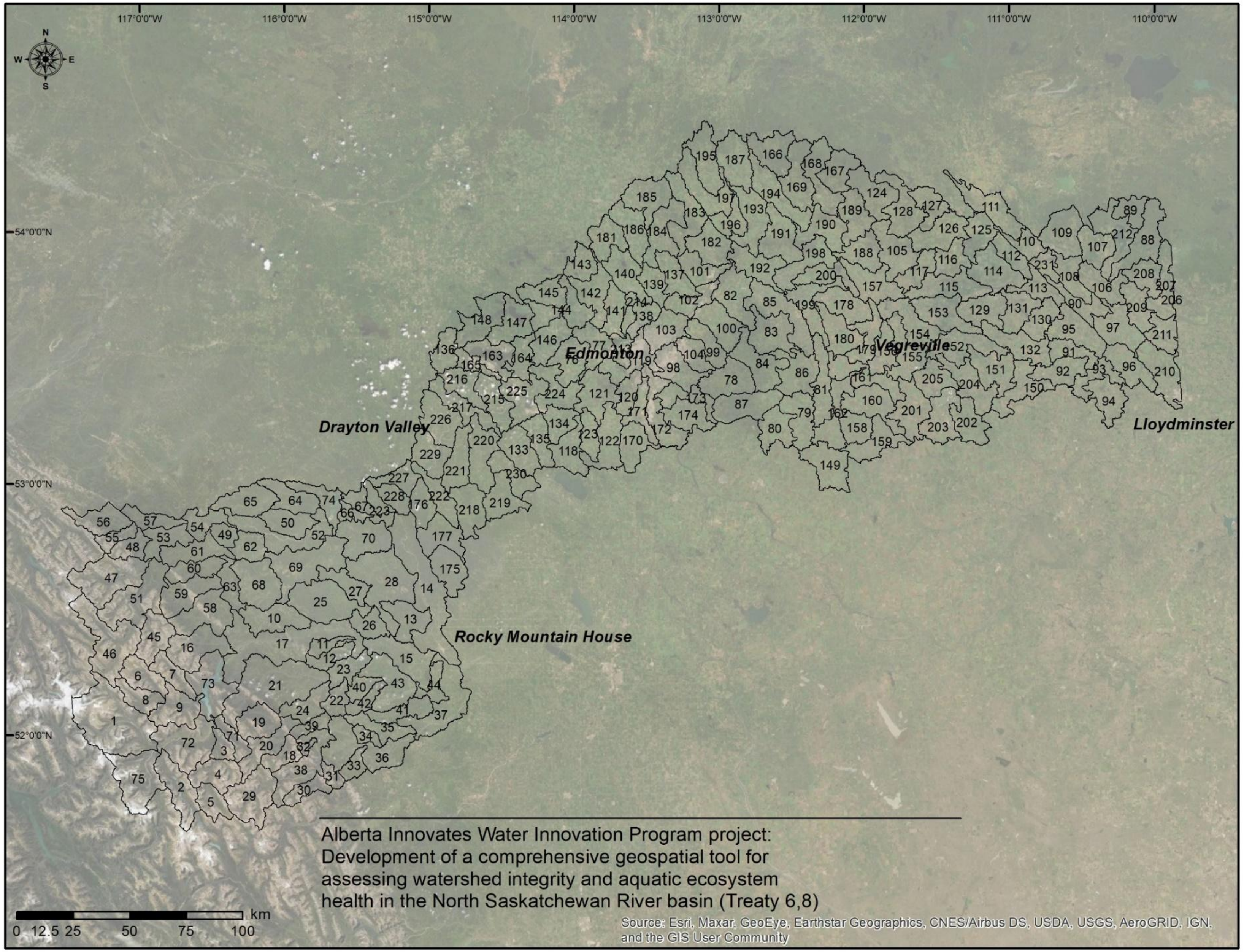


Class

1: Subcatchments & indicators



Climate indicators (n=3)

Natural indicators (n=33)

Stressor indicators (n=26)

1: subcatchments & indicators

Natural indicators

StreamsDensity_m_km2	Min_Slope_%
Lakes_density_m2_km2	Mean_Slope_%
Conif_density_m2_km2	Moraine_density_m2_km2
Conif_Decid_density_m2_km2	StMoraine_density_m2_km2
Decid_density_m2_km2	ICT_Moraine_density_m2_km2
Decid_Conif_density_m2_km2	ORGdeposit_density_m2_km2
Bog_density_m2_km2	Glaciolac_density_m2_km2
Swamp_density_m2_km2	Lacust_density_m2_km2
Fen_density_m2_km2	Bedrock_density_m2_km2
Marsh_density_m2_km2	Fluvial_density_m2_km2
OpenWater_density_m2_km2	Eolian_density_m2_km2
Protect_density_m2_km2	Colluvial_density_m2_km2
Max_Elevation_m	Riparian_density_m2_km2
Min_Elevation_m	ConifR_density_m2_km2
Mean_Elevation_m	Conif_DecidR_density_m2_km2
Max_Slope_%	DeciduousR_density_m2_km2
	Decid_ConifR_density_m2_km2

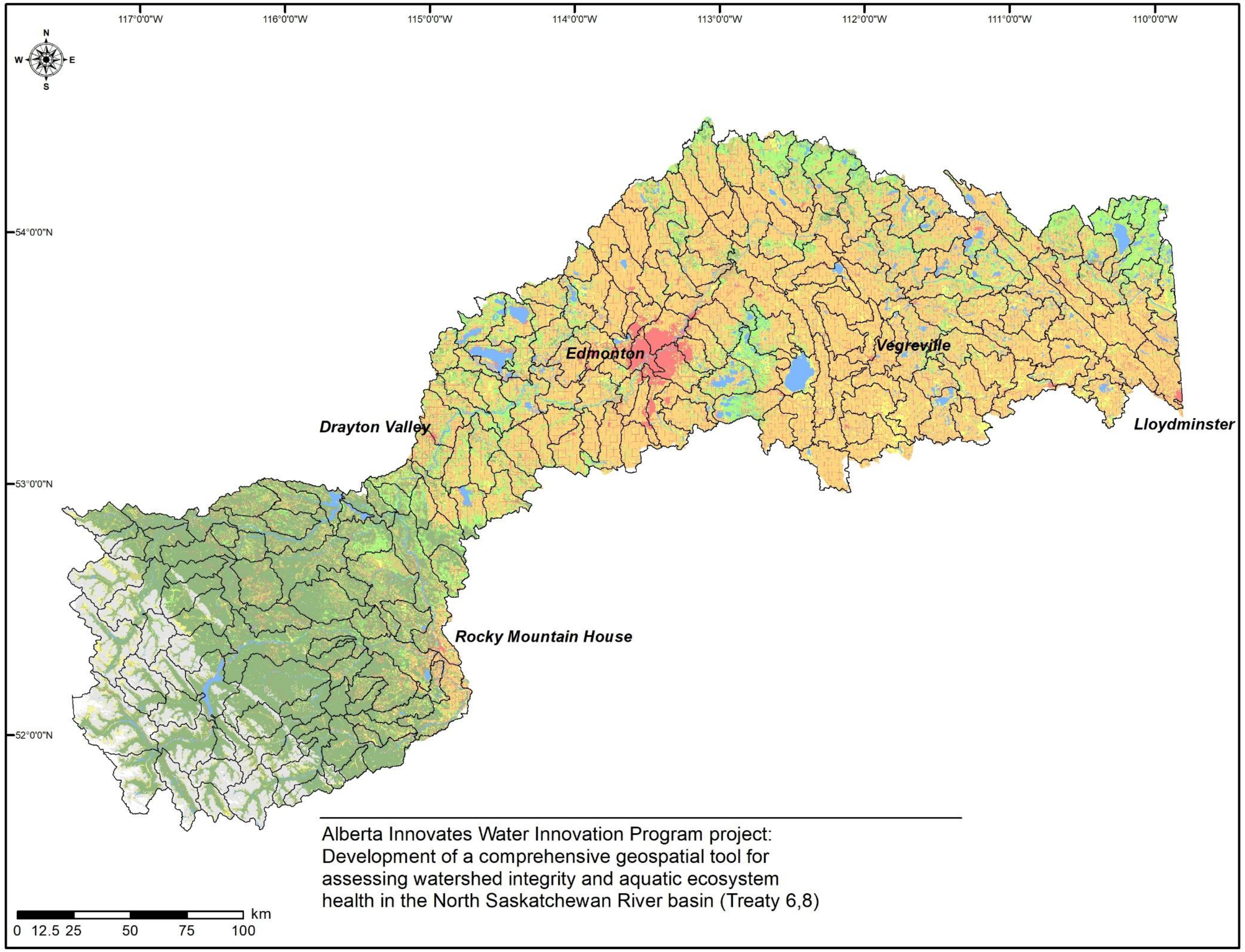
Climate indicators

TMAX_2000_19_degC
Mean_Precipitation_2000_19_mm_day
Mean_Wind_FreeIce_2000_19_m_s

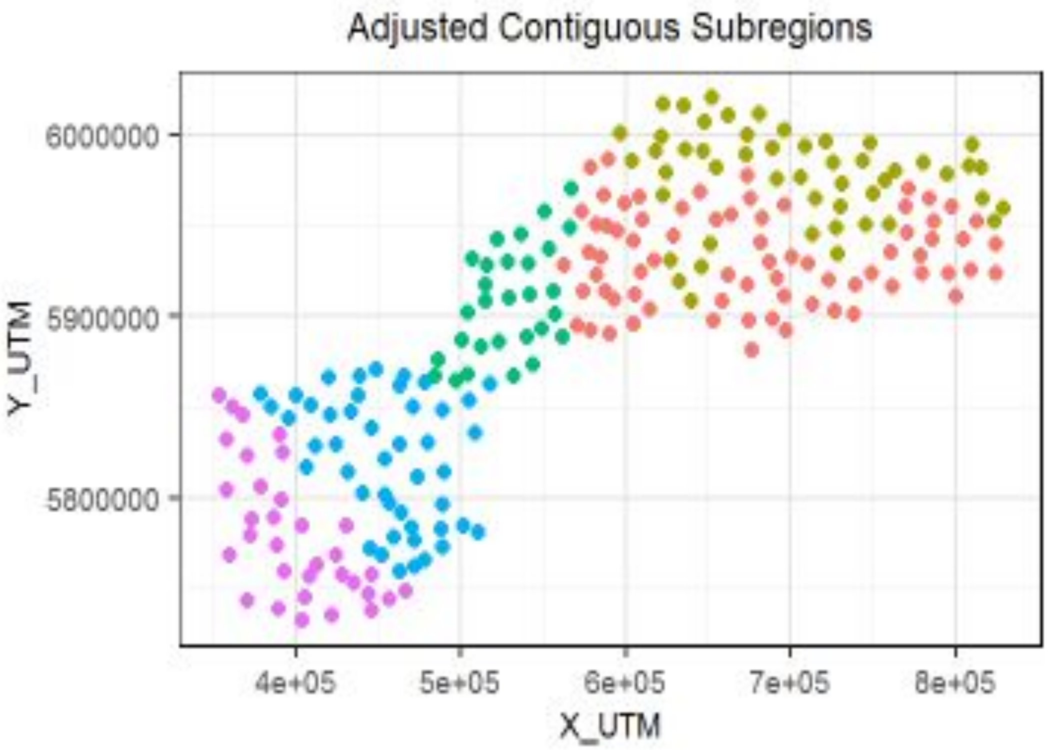
Stressor indicators

RoadsDensity_m_km2	SW_use_m3_km2
RailsDensity_m_km2	GW_use_m3_km2
Trans_Density_m_km2	Canal_density_m2_km2
ServCorridor_Density_m_km2	Res_density_m2_km2
Indust_density_m2_km2	Dam_density_n_km2
Resid_density_m2_km2	StreamRoadCrossing_density_n_km2
Imperv_density_m2_km2	Pop_Density_n_km2
Agri_density_m2_km2	Harvest_density_m2_km2
Fertil_Density_ha_km2	Wildfire_density_m2_km2
Cattle_Density_n_km2	Riparian_density_km2_km2
Energy_Mining_density_m2_km2	RoadsRipDensity_m_km2
Wells_density_m2_km2	ResidRip_density_m2_km2
Waste__density_m2_km2	AgriRip_density_m2_km2

1: subcatchments & indicators



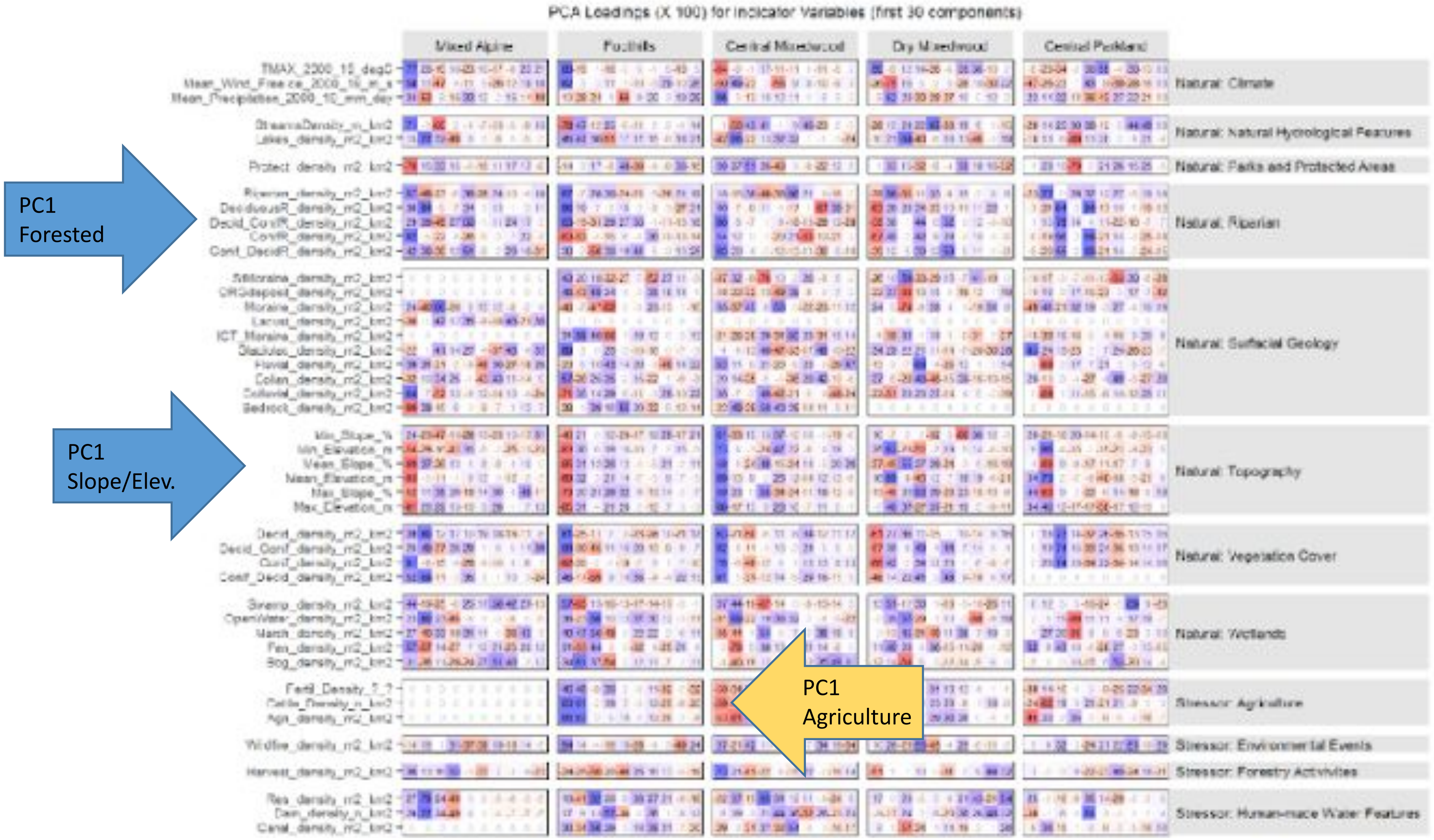
2: PCA to identify catchment variability



Natural Subregion Count

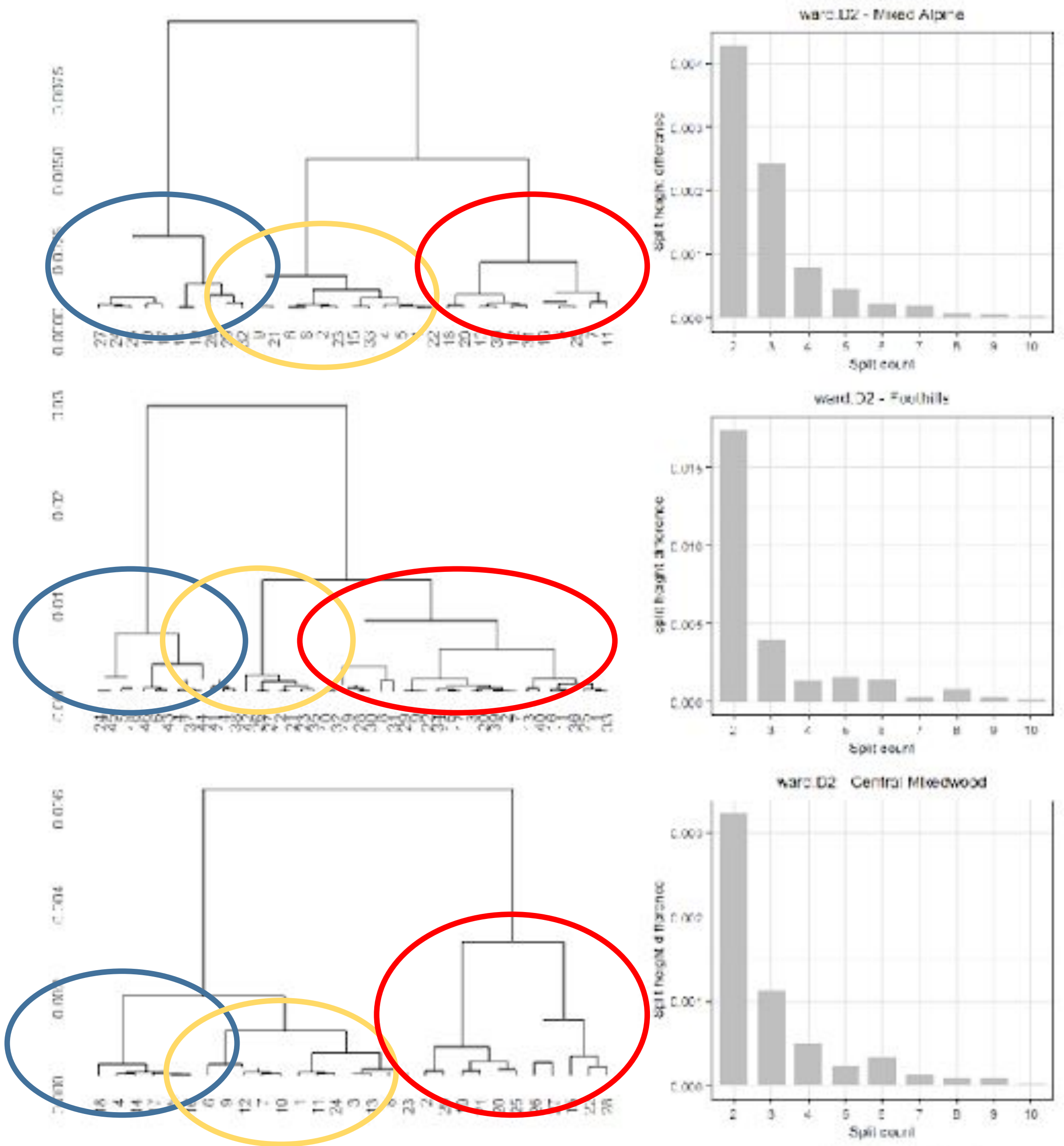
SubRegion	Freq
Mixed Alpine	33
Foothills	46
Central Mixedwood	29
Dry Mixedwood	50
Central Parkland	73

2: PCA to identify catchment variability

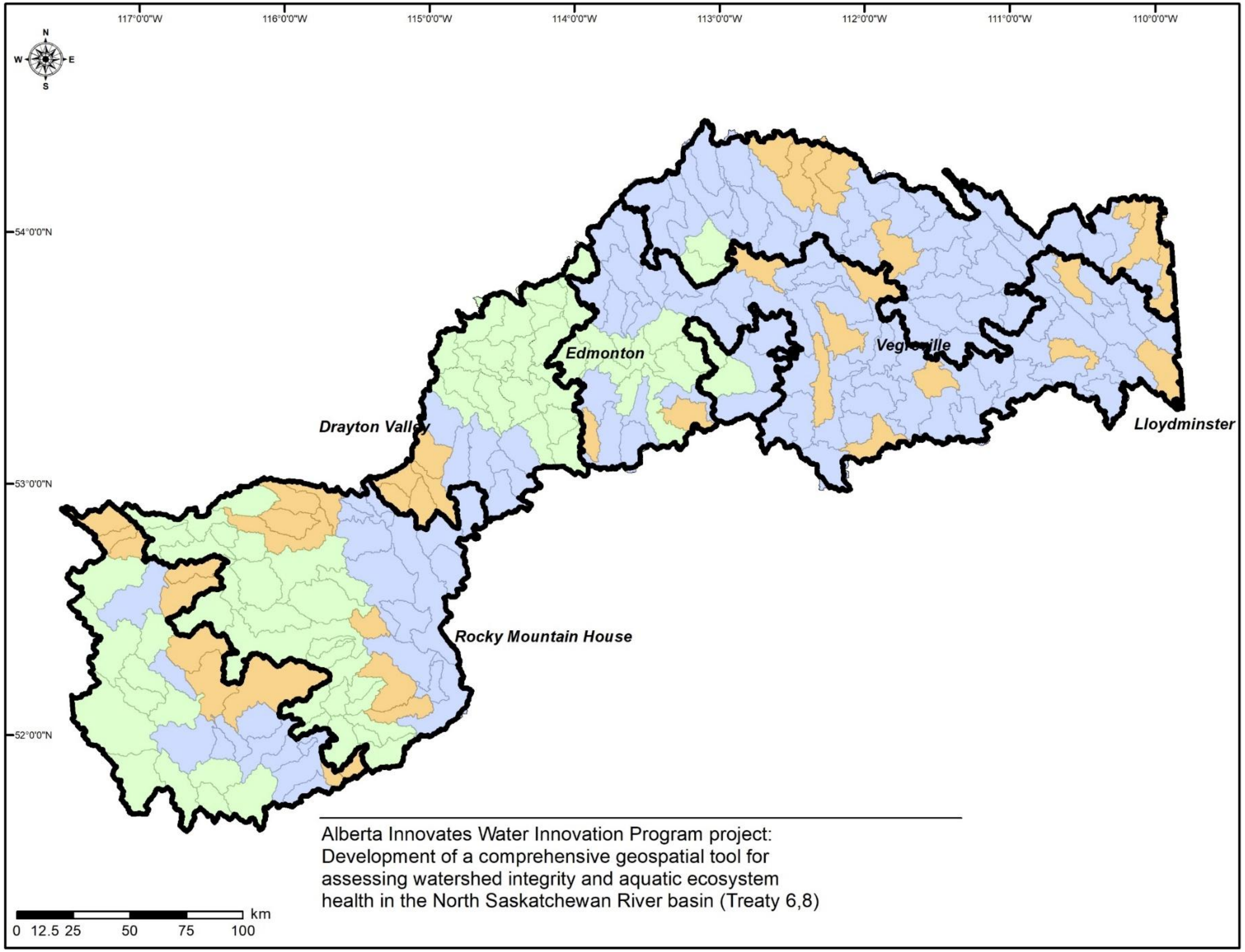


Classification: Protected A

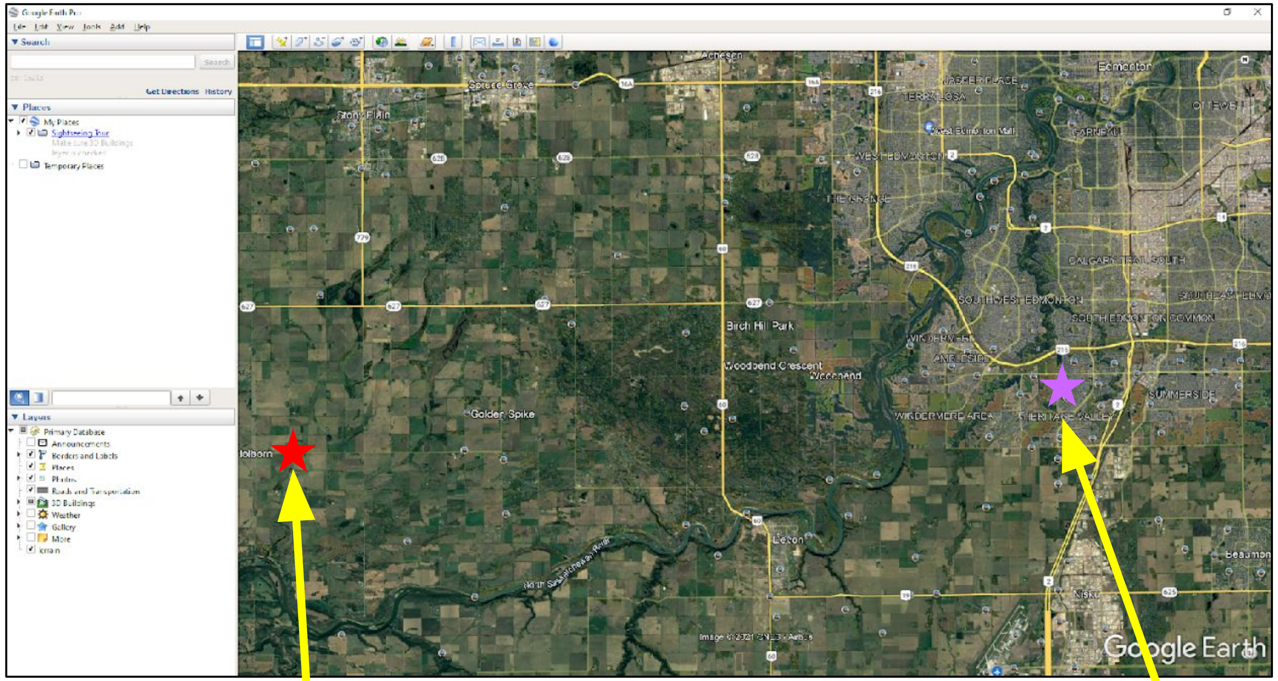
3: Clustering weighted PCA scores

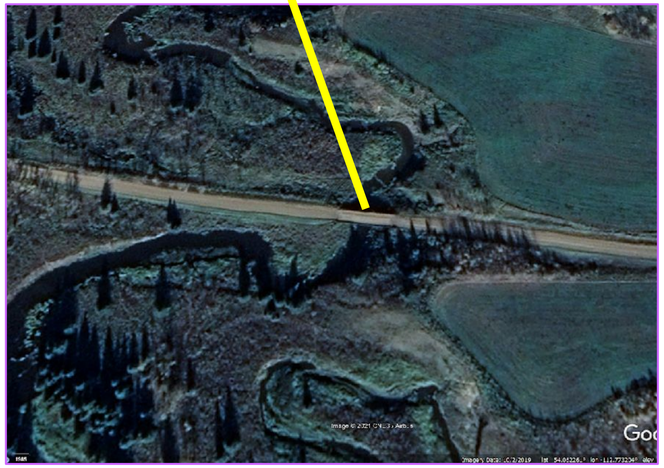


4: Clustering in space

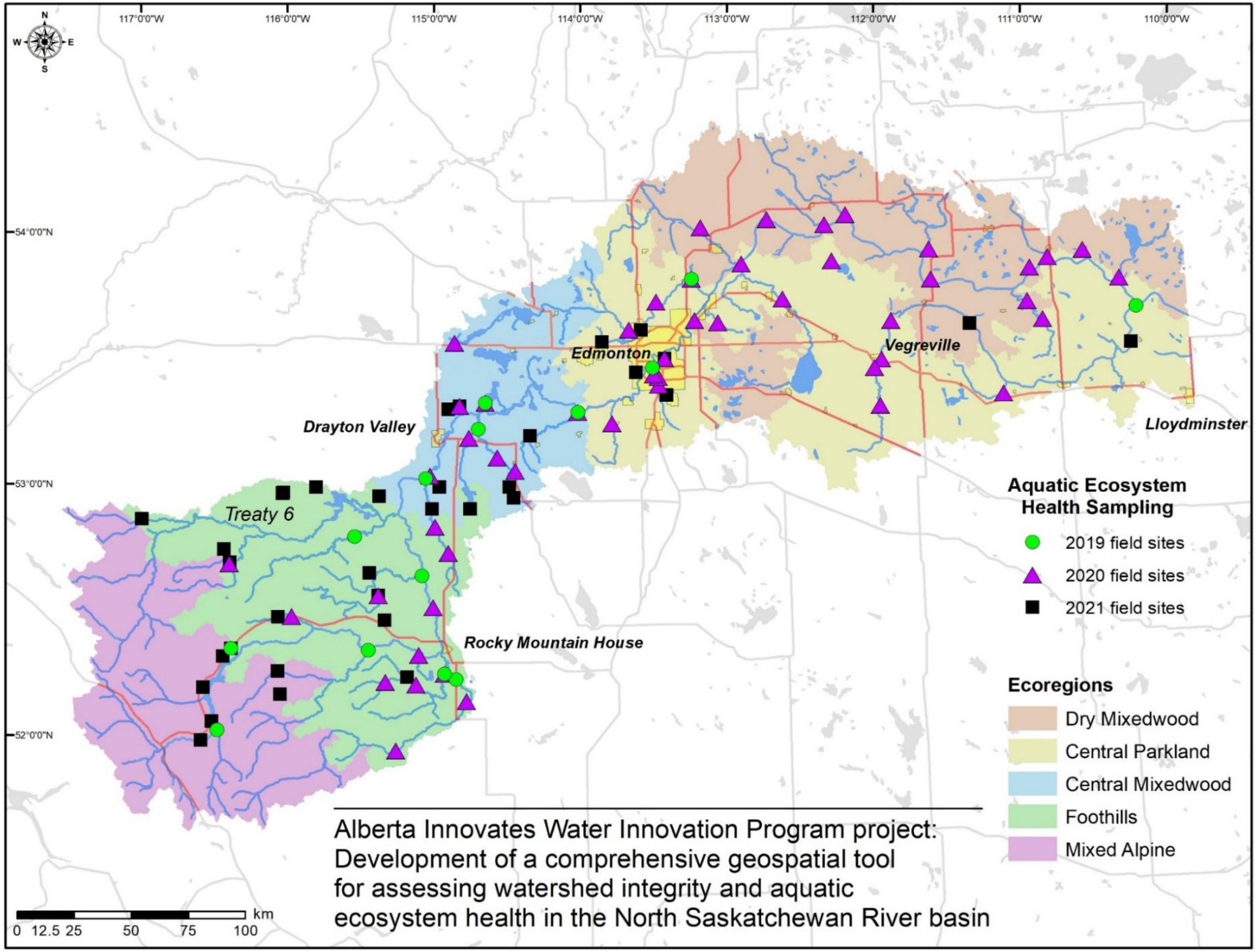


5. Site selection and reconnaissance





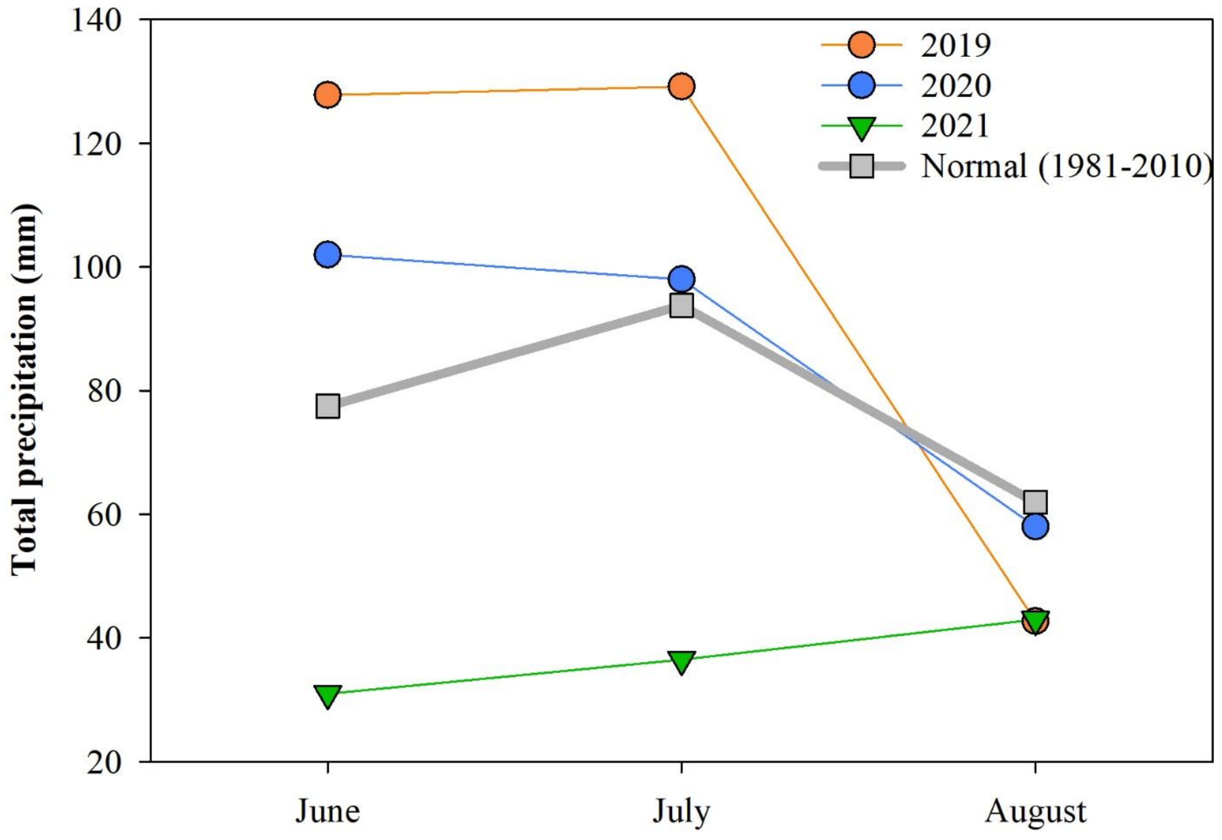
AEH sampling sites



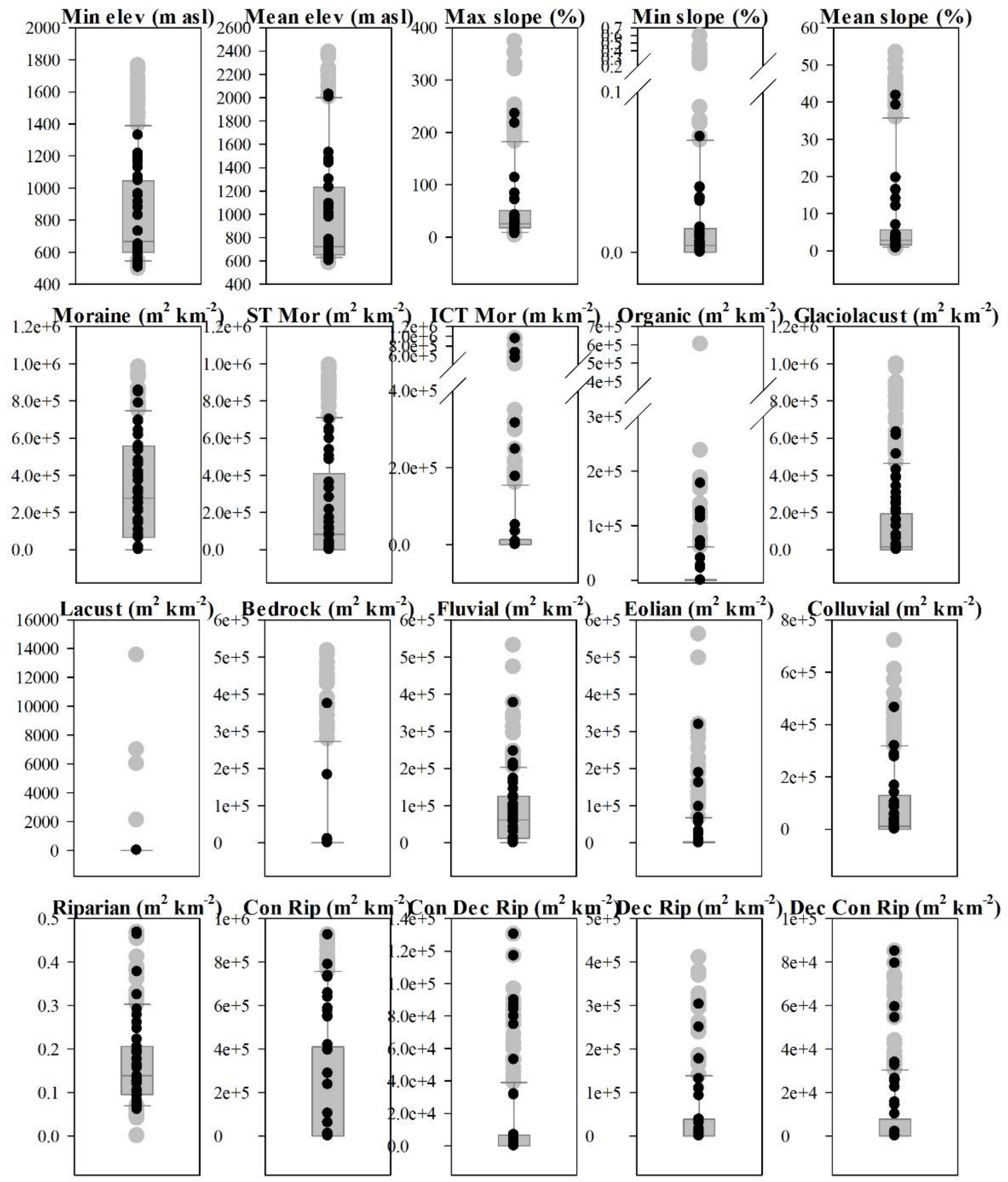
AEH: Fieldwork

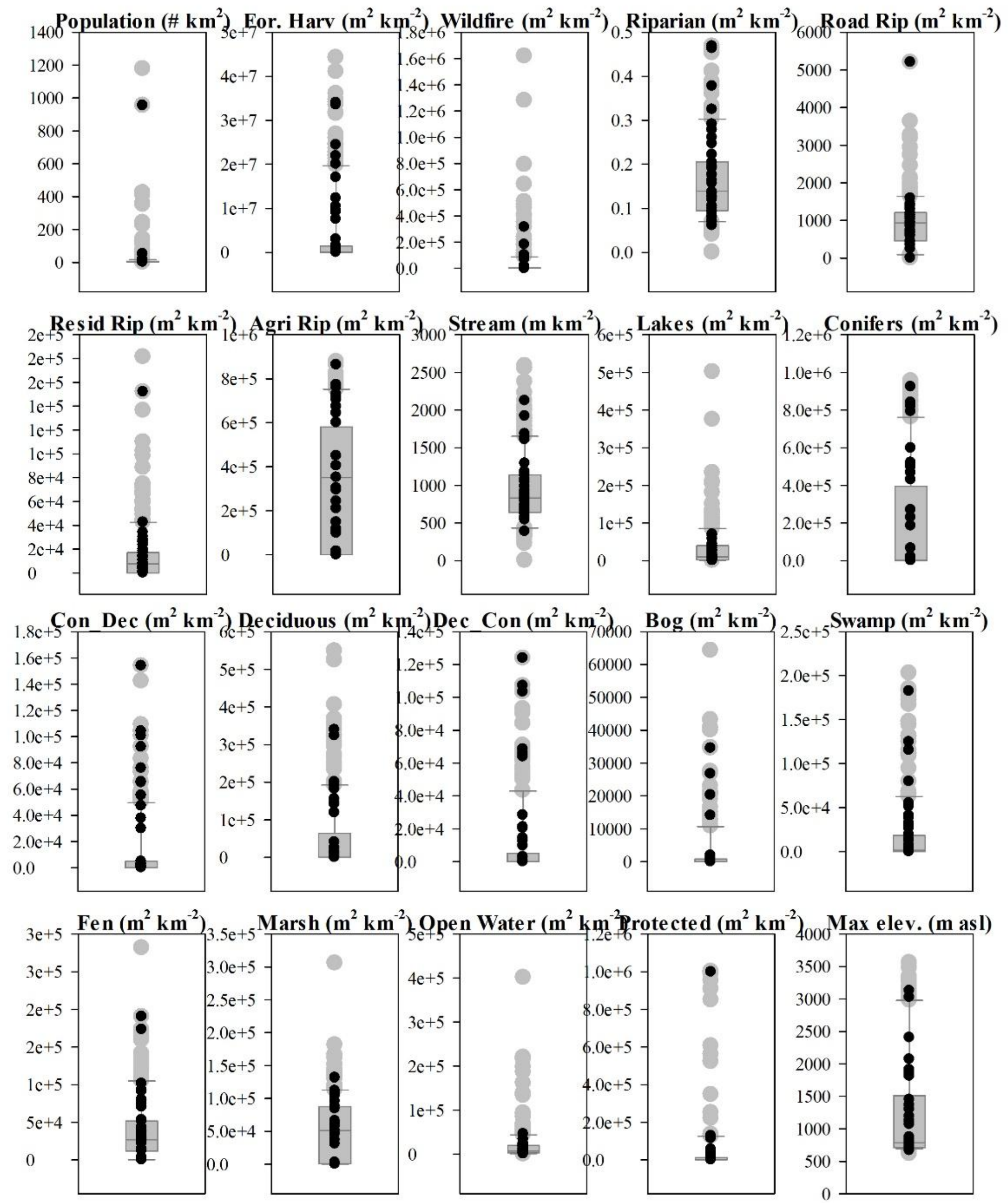
Physical habitat **Water quality** **Microbial communities**	•Substrate, river flow •Gen chemistry, nutrients, metals •Cell counts, DNA
Planktonic algae **Periphyton**	•Biomass •Pigment concentrations •Taxonomy
Benthic invertebrates	•Abundance •Taxonomy
eDNA **Crayfish** **Fish communities**	•Identified species •Biometrics •Isotopes

AEH: Fieldwork challenges



Site selection success





Acknowledgements

AEH Team

- Water quality, microbial: **M. Bhatia**, J. Lightbown, multiple field assistants
- Periphyton: **R. Vinebrooke**, S. Stenerson, multiple field assistants
- Benthic invertebrates: **R. Vinebrooke**, B. Stuparyk, multiple field assistants
- Fish: **M. Poesch, S. Greene,** V. van Mierlo, M. Cunningham, multiple field assistants

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