The Slow Water Movement: Watershed Restoration and Regenerative Agriculture

There is a rising need for watershed restoration through regenerative agriculture at the landscape scale. Human wastewater, fossil fuel emissions, deforestation and agricultural intensification for crops and livestock have vastly increased nutrient flows between terrestrial and aquatic ecosystems, often exacerbated by climate change that can drive extreme rainfall events at key nutrient movement times (Fig. 1). Because homogenized agricultural landscapes lack the extended storage capacity formerly provided by extensive networks of wetlands, nutrients flow rapidly from crop fields, often equipped with tile drainage, to channelized streams before reaching rivers, lakes, and oceans. Collectively, these landscape modifications increase and accelerate the movement of nutrients and toxins across the land and water.

These flows are now understood to be responsible for massive algal blooms resulting in ecosystem dead zones accompanied by significant reductions in biodiversity, both striking examples of regional ecological degradation. These global patterns are mirrored in the Lake Erie watershed where large amounts of important agricultural food are produced. Here, through the development of strong interactive ties between University of Guelph researchers, farmer communities (ALUS), conservation authorities and Indigenous partners, we will create an unprecedented large-scale regionally orchestrated set of restored wetlands. While wetland restoration is not new, through our strong tie to ALUS (with experienced wetland restoration teams), we seek for the first time to create an entire watershed wetland ecosystem restoration capable of naturally slowing down movement in the watershed thereby increasing nutrient retention, carbon storage and biodiversity. Further, by monitoring a reference (fast water watershed) simultaneously we will demonstrate the efficacy of a coordinated, community agricultural restoration. Our monitoring will use simple yet affordable scientific technologies (e.g., DNA barcoding), allowing for the first time a major watershed scale natural "restoration and efficacy" experiment.

Success on the Lake Erie landscape sets up the conditions for further implementation and engineering of watershed-level solutions to nutrient, contaminants, carbon and biodiversity sustainability while yielding the food we need for a still growing population. Additionally, it promises to be an internationally leading initiative for a globe that requires novel sustainability achievements. The watershed scale organizational capabilities of ALUS will facilitate this large-scale natural watershed restoration experiment, as well as an expert scientific team that can monitor and assay biodiversity at the whole food web scale.

The multi-agency/organization initiative will team farmers, managers, researchers, and community together to produce a world leading food sustainability restoration program that can serve as a globally leading icon for "slowing water", reducing landscape nutrients, increasing carbon storage, and simultaneously creating habitat heterogeneity that ignites the maintenance and growth of local biodiversity (Fig. 1). All areas of massive concern for the Lake Erie watershed.

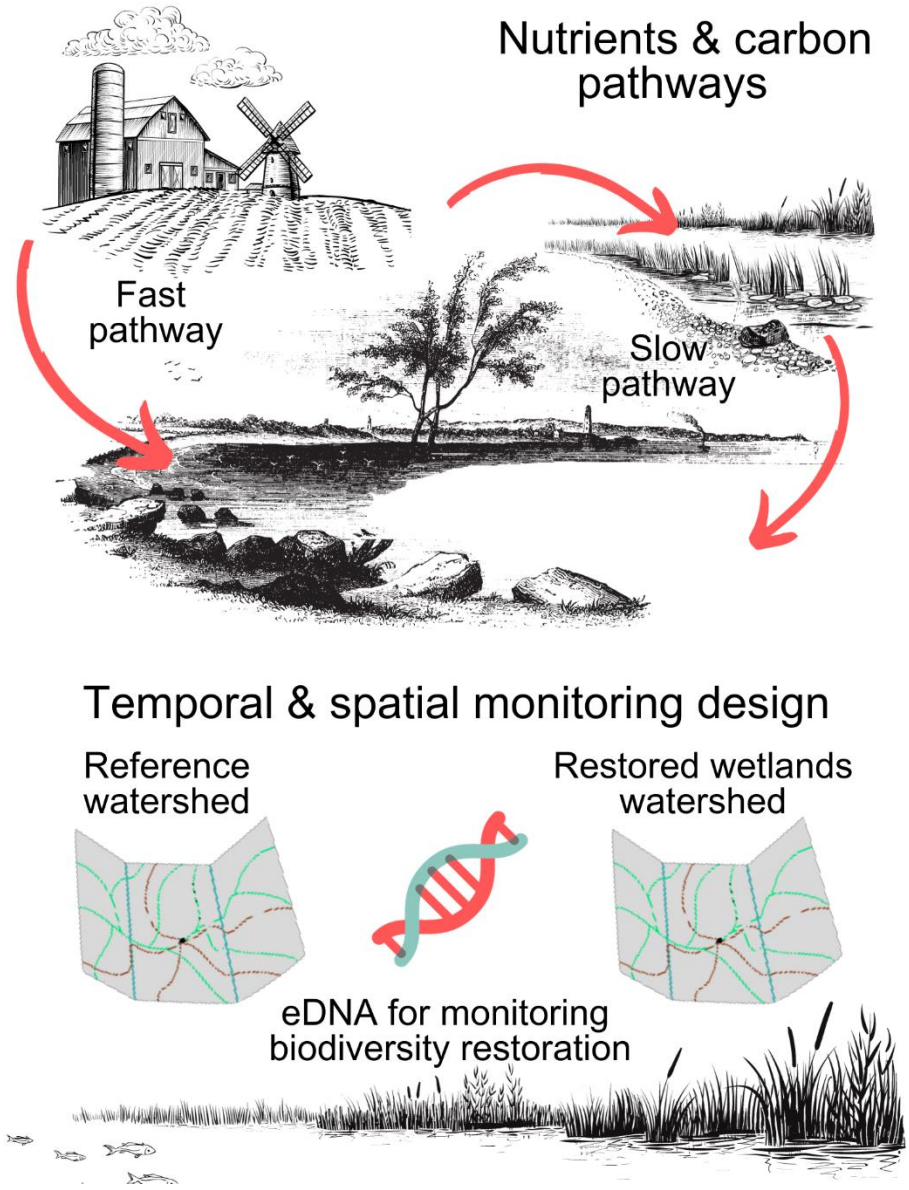

Figure 1. *Watershed level experiment showing reference (fast) and restored (slow) water ways with examples of monitoring programs and agencies involved.*