



## **Major research projects in the Fraser lab:**

### **Exploring novel agricultural frontiers**

This research project aims to explore possible new "agricultural frontiers" in Canada. Agricultural Frontiers are defined as land that is not currently cultivated but that may become suitable for agriculture due to climate change and new emerging technology. Identifying and understanding the impact of these frontiers is important for two reasons. First, developing frontiers is expected to help humanity maintain global food security due to population growth. Second, developing these frontiers implies significant land use change that may have negative environmental consequences. For example, while cultivating new agricultural frontiers may boost global food production, frontiers also store and sequester carbon, hence developing such regions may have unintended and undesirable trade-offs. How significant are such trade-offs? And are there development pathways that will allow humanity to utilize agricultural frontiers without sacrificing the environment? Answering such questions will help address a critical gap that currently hinders our ability to anticipate the effects of climate change on land use systems and then climate change itself? Therefore, this research aims to (1) identify the extent and location of potential agricultural crop-specific frontiers; (2) identify potential negative environmental consequences such as soil organic carbon loss, soil erosion and habitat loss due to deforestation and cultivation. These issues will be explored by combining climate model outputs with fine spatial scale soil, infrastructure data and technologies thereby providing a spatially explicit analysis of possible agricultural frontiers on various technologies.

### **Human dimensions of the digital agricultural revolution**

The world is on the cusp of a digital agricultural revolution that promises the ability to produce more food with less environmental impact. Canada is poised to be a pioneer in this sector and is already a leader in technologies such as "smart -driverless- tractors" and "robotic milkers" that allow farmers to reduce inputs while boosting profits. Canada's agri-food industry is currently the largest global exporter of commodities such as flaxseed, canola, and wheat, and contributes to 1 out of every 8 jobs. The federal government's Advisory Council for Economic Growth argued that by investing in this sector, "Canada will become the trusted global leader in safe, nutritious, and sustainable food for the 21st century". However, while the explosion of digital technologies in agriculture may provide a host of benefits, there are growing social concerns. For instance, these technologies are currently accessible to only a few and it is unclear who will benefit from the economic opportunities associated with these disruptive technologies. Second, many of these technologies are data-driven and this means concerns pertaining to data ownership and cybersecurity (normally associated with the IT and financial sector) are becoming issues for growers. Finally, these technologies have major implications for postsecondary education that must quickly develop new pedagogical approaches to ensure that the agri-food leaders of tomorrow are prepared for the challenges and demands of this rapidly changing industry. In light of these challenges, the purpose of this work stream is threefold: (1) to better understand how members of rural communities, focusing on producers, are using digital technologies, how they perceive benefits and barriers to these technologies, and how they think policy and research can enable them to realize benefits and reduce barriers; (2) to work with a range of stakeholders to scope out what a "national agri-food data framework" for agri-food



data might look like and work to propose a preliminary national agri-food data framework; and (3) to explore new educational opportunities, requirements and industry needs in order to develop pedagogical tools to ensure that the post-secondary system in Canada is equipped to train the next generation of agri-food thought leaders.

### **Assessing the impact of climate change on food system diversity in the arid mountains of Nepal**

Global warming would open up millions of acres for farming in the high mountains across the world. While there is a robust body of literature on climate change impacts, the current focus is on hydrology and meteorology in the high mountains and livelihoods and food security in lower altitudes. Research on positive adaptation to climate change is unacceptably thin and the evidence is inconclusive as to whether climate-induced agricultural transitions are low carbon or they further reinforce carbon intensive industrial production systems. This research project aims to explore the adoption of new agricultural activities in the arid mountains of the Nepal Himalayas due to climate change and the availability of new emerging technologies. The specific objectives are as follows: (1) identify, map and document the new agricultural activities in the arid mountains of Nepal; (2) identify potential negative environmental consequences, such as soil organic carbon loss, soil erosion and habitat loss due to deforestation and cultivation; (3) investigate the role of newly developed agricultural activities on increasing food systems diversity and local food and nutrition security; and (4) assess how new agricultural practices are enabled by the use of digital technologies in accessing information about identification, production, processing of food items, and accessing new markets.