

Sustainable Agriculture as Adaptation to Climate Change

This aerial photo of a prairie farmstead was one of many thousands taken starting in the 1950s. Companies like Continental Air of Edmonton took these images expecting that farmers would buy a photo of their place. Fortunately my grandparents were able to buy this picture of the family farm, where my mom was raised and where I spent summers as a boy. In the barn, sheds and corrals, there were milk cows, beef cattle, hogs, chickens and horses. Three quarter sections were in grain crops and about five quarters were pasture. My grandma sold milk, cream and eggs and had a huge vegetable garden. This was the heyday of mixed farming, the most common strategy in those days to sustain the farm.



A lot has changed since the 1950s. There was no talk back then about climate change. Natural resources were used and managed assuming that the climate did not change. Now sixty years and thousands of scientific studies later, we know that the climate is changing at an unusual rate. Climate change was the theme of the Fall 2015 edition of this magazine. To the facts reported there, we can now add that this past year was by far the warmest year ever recorded and March 2016 was the 373rd consecutive month with temperatures higher than the 20th century average.

Given the overwhelming evidence for global warming, and its impacts, the agricultural sector is now preparing for these climate changes. We can't possibly know what the future will bring; no one can predict the future, even though we like to try. The best that scientists can do is to suggest some likely scenarios based on the clearest trends in climate observations and the most consistent results from climate models. On the northern plains, our climate is clearly getting less cold; the strongest trend over the past several decades has been rising minimum temperatures – winters are definitely much less cold than they used to be. Every run of every climate model produces this same tendency for higher minimum temperatures in future decades. The implications of warmer and shorter winters are many – a longer frost free season, more rain and less snow, and a more hospitable climate for pests, invasive species and pathogens; to name just a few of the consequences.

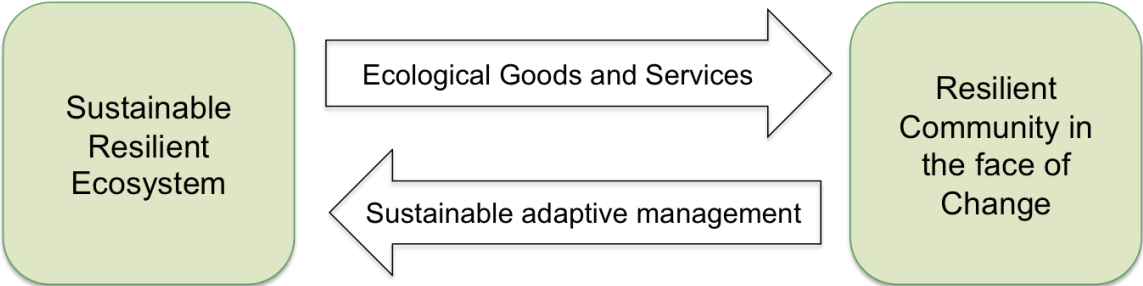
While this temperature trend is almost undeniable (the closest we can get to certainty), other climate changes and impacts are not as clear. Given what we know about climate change, and the things we were not so sure about, a critical question is “how should governments and the agricultural industry adapt – adjust practices, structures and policies - to prevent adverse impacts of climate change on farming and to take advantage of a longer growing season”? Social scientists who study the process of adaptation to climate change agree on some general principles of good adaptation planning. These key principles are listed in the left column in the table below. They include practices and policies that are sustainable, adaptive, flexible and transparent, and based on scientific evidence. Nearly all adaptation occurs locally, on farms and forests and in rural and urban municipalities, while higher levels of government provide policy and coordination. In the right column of this table are key principles of sustainable agriculture taken from a few sources, mostly from the Canadian-based organization Alternative Land Use Services (www.alus.ca). ALUS has a vision to “create a healthy landscape that sustains agriculture, wildlife and natural spaces for all Canadians”.

Key Principles of Sustainable Agriculture and Planned Adaptation to Climate Change

Planned Adaptation	Sustainable Agriculture
Sustainable	Sustainable
Engage the local community	Developed by local communities
Evidence-based	Science-based
A balanced / holistic approach	Integrated: complement existing programs and policies
Prioritized	Targeted
Flexible and adaptive	Flexible and adaptive
Transparent	Accountable

Responsive to local climate variability	Respect local agricultural and environmental priorities
Implemented locally	Farmer-delivered
Manage risks and economic impacts	Market driven

There is an obvious correlation between these two sets of key principles. It's even stronger if we compare sustainable agriculture to one specific category of adaptation known as "ecosystem-based". The UN Convention on Biological Diversity defines ecosystem-based adaptation (EBA) as "the use of biodiversity and ecosystem services as part of an overall adaptation strategy to help people to adapt to the adverse effects of climate change". Referring again to ALUS, their mission includes "providing support to farmers and ranchers to *enhance and maintain ecosystem services*", which sounds very much like EBA. The following diagram depicting an ecosystem approach to adaptation suggests that a major component of EBA is the sustainable and adaptive management of agro-ecosystems.



EBA has a lot of proponents. Research from all over the world demonstrates its effectiveness, especially in terms its relatively low cost and engaging local people in maintaining resilient local ecosystems and rural communities. Recently researchers from Cambridge in the UK and Washington D.C. examined the "evidence-base for EBA as effective interventions to enable people to adapt to climate change, climate variability and climatic shocks". They compiled evidence from more than 100 countries, reviewing 132 peer-reviewed articles and 32 case studies. They found that, among various resources and sectors of the economy, agriculture was the most common target of EBA. The second most popular target was protection of water, which in most regions of the world is closely related to agriculture. The vast majority of EBA-related interventions are practices associated with sustainable agriculture; such as soil and water conservation, rangeland and watershed management, shelterbelts and diversification.

Thus throughout the world, sustainable agriculture practices are being used to increase the resilience of rural economies and communities in the face of climate change. What are the lessons for us on the northern plains? Well, if the most certain and consistent climate change scenarios are a wetter warmer winter and amplified extremes (including drought and excess water), then a resilient agro-ecosystem must have the capacity to store excess water to withstand dry conditions lasting a

growing season or longer. In this scenario, the best adaptation practices would maintain the storage of water in wetlands and in the soil. Soil organic matter is the main determinant of field capacity, the water retained by freely draining soil. Improving soil carbon also removes some carbon dioxide, the most common greenhouse gas, from the atmosphere. A major change in farming practices has occurred in the past several decades largely in response, at least initially, to the degradation of prairie soils. As it turns out the agricultural industry is better prepared for climate change as a result. The capacity of agricultural ecosystems to withstand climate extremes and change is ensured through the proper management of water, soil and pasture, and the increased resilience and biodiversity of agro ecosystems from sustainable farming practices. These best practices and agricultural policies represent both adaptation to climate change and the foundation of sustainable agriculture.

Most of the impact of climate change in western Canada will be caused by shifts in the quality and distribution of water and ecosystems. The photo on this page, looking north at sunrise from the Cypress Hills, includes four different ecosystems: the fescue prairie on which I was standing, aspen forest, conifer forest and the mixed grassland that is now almost entirely agricultural land. Small differences in temperature and precipitation over short distances support entirely different ecosystems. It's not hard to imagine how much larger changes, as result of global warming, will cause these climate-sensitive ecosystems to shift with the potential for some to entirely disappear. But this process will not unfold naturally because this entire landscape is managed; the foreground is provincial park and the rest of the landscape is managed by farmers and ranchers.

