The Development and Adoption of Conservation Agriculture in Canada:
From the Ecological to the Cultural.
Rene Van Acker, Dept. of Plant Agriculture, University of Guelph, Canada, N1G 2W1. vanacker@uoguelph.ca.

Background
Understanding the multidimensionality of routes to the greater adoption of conservation agriculture in Canada is essential for real increases in adoption and for a more sustainable agriculture in Canada. Conservation agriculture is understood amongst agricultural scientists to be a sustainability based approach to farming and it is commonly agreed amongst agricultural scientists and agriculturalists that current standard models of industrialized agriculture in Canada are inherently not-sustainable. There has been a great deal of work done, both by researchers and by farmers to develop strategies and tactics to increase the sustainability of agriculture often from an ecological perspective. The ecological basis and imperative for sustainable agriculture is undeniable yet the adoption of sustainable or conservation agriculture approaches remains low in Canada. This is the case for a variety of reasons, many of which are practical and are related to agronomy, economics, education and culture. More broadly, Canadian society is increasingly interested in sustainable agriculture. The roots for this interest are in environmental movements but more recently is being driven by an emerging food culture. In recent decades, new and stronger connections have been created between consumers and farmers and these provide examples for ways in which conservation agriculture can be further developed and more broadly adopted in Canada.

Approach
The challenges in achieving conservation (sustainable) agriculture are not necessarily unique to any one jurisdiction in the world although there may be unique conditions that play into the challenges. On the contrary, I would argue that there are a set of common elements required in order to achieve sustainable agriculture and these are; desire, knowledge, opportunity, support, cooperation and technology. For each of these I will explain how the element is required for sustainable agriculture using examples to support my explanation and the examples (or supporting information) that I use will come from my North American (and more commonly Canadian) experience.

Results and Discussion
The first element is desire. Developing a sustainable agricultural system is not easy and it takes ongoing work and commitment and so it cannot be achieved if there is no desire to do so. We experienced the power of desire, in this regard, in a project we did in western Canada working with farmers on a new system for reducing pesticide use on farms (Nazarko et al. 2004). We found that success in the program was not due (significantly) to any farm or farmer factor other than the farmers’ expressed commitment to the project. Knowledge is the next element and it is fundamentally required because simple agriculture is not sustainable and sustainable agriculture is not simple. It is only possible to pursue sustainable agriculture if one understands this principle. Agriculture happens outside on a complex living landscape relying on and impacting many interacting and complex living systems. Sustaining the productivity of agriculture and the health and productivity of the environment it depends upon and lives within cannot be simple because nothing about it is simple. This principle can be well demonstrated with data from Martin Entz's long-term rotation studies in Winnipeg, Canada (Ominski et al. 1999). But although knowledge is important it must be applied. Farmers must be given opportunities to pursue sustainable practices (like diverse cropping systems for example). The reality of farming in industrialized nations is that farmers have been increasingly facing the challenges of the cost-price squeeze. How can farmers adopt diverse rotations when they are facing increasing financial risks and they increasingly are hounded by the need to maintain high cash flow in order to service rising expenses and a rising scale of operations on narrowing marginal returns (Van Acker 2008)? When I was a professor in western Canada (in Winnipeg) I taught a 3rd year weed science course, and each year I asked the students in that course (most of whom were from farms) what the practical challenges were for achieving more sustainable farming systems and their
answers were very insightful highlighting the need for fiscal room to explore new systems (the challenges of cash flow), access to knowledge as well as support from their families and their public institutions. To the last point; gaining support is a challenge when there are very few of you. For farmers in Canada, their falling numbers create a political challenge. With few farmers there are few votes and so their opportunity to gain political will for policies that provide support for sustainable agriculture is limited. In addition, there has been a farmer culture in Canada (and elsewhere) of “us” versus “them” when it comes to “farmers” versus “non-farmers” and so we have seen campaigns in Canada like the “Farmers Feed Cities” campaign which did not work to build on common ground, and in the end it did not work to gain support for farmers from “city” people. The good news, for farmers, is that city people want to support them, they already like farmers and they want to help farmers to be more sustainable if they are given the opportunity. Social watchers, like Michael Pollen, have shown us what the average North American is thinking about food. The thesis of his "Omnivore's Dilemma" (Pollen 2006) was that food had more than one purpose, it was about “Good to Eat and Good to Think” - and this creates opportunities for farmers to build relationships with eaters. And this is where Genetically Modified Organisms (GMO's) (first) fit into the story. GMO’s have been rapidly adopted by farmers in North America, Brazil, Argentina and most recently, India (Brookes and Barfoot 2014). Farmers in these countries have adopted GMO's because of operational benefits, but increasingly, there has grown activism against GMO’s. And the reasons for this are not singular. Some believe they are unsafe to consume, some believe they are unsafe for the environment, some believe that they facilitate globalization and consolidation and control of the world’s seeds. No matter the reason, the opposition builds and creates a divide between consumers and farmers further eroding political will for farmers. And farmers cannot do it alone, they need support and cooperation, which can sometimes be a cultural challenge for farmers. The final required element is technology. We have a long history with technology development and adoption in agriculture, and most notably in the modern-era. Perhaps in some cases we have taken it too far and let technology be the end instead of the means. And always with technology (in relation to sustainable agriculture) we have to be aware of the fact that the history of agricultural technology is one of technologies that facilitated simplified farming systems that separate nutrient, carbon and water cycles on the landscape. So the technologies facilitate fundamentally unsustainable systems and this is a problem. For sustainability we need to be thinking about technologies that reconnect carbon, water and nutrient cycles.

Applications and Implications for Conservation Agriculture
The recent past in agriculture has been very much about technology, and this is not surprising because everything in the recent past has been about technology. But achieving sustainability is complicated. Agriculture happens outside on a complex living landscape relying on and impacting many, many interacting and complex living systems. Sustaining the productivity of agriculture and the health and productivity of the environment it depends upon and lives within cannot be simple because nothing about it is simple. And no single element, even powerful technology, is sufficient to achieve it and in fact the way in which we adopted and exploited technology in agriculture moved us away from sustainability. Sustainable agriculture requires the understanding and employment of many elements. I have suggested 6 elements in this presentation (there may be more) but they are all required in order for us to achieve sustainable agriculture.

References