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# The Agricultural System: Components, Linkages, and Rationale

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## 1. Introduction

Agriculture happens because of a diversity of relationships.

At its most basic level it exists as a relationship between farmers and the land. Farmers use the earth's resources to harvest crops that they grow. These crops are also used to feed people and livestock, and provide many other products that all humans require to sustain life.

At its most complex level, agriculture exists as a web of relationships between farmers, natural systems involving climate, geology, soil, air, pests, and water; and human systems involving politics, land-use planning and infrastructure, law, finances, and marketing. These systems and the relationships within and between them inform the production of food, agricultural goods and other commodities. This web of intricate relationships is sometimes referred to as the "agricultural system". The viability and sustainability of an agricultural system depends on the ability of farmers to be profitable.

The agricultural system is connected to numerous other systems, including the provision and distribution of energy, the marketing of agricultural goods, the provision of monetary and financial services, and of central relevance to this report the planning of land use. Further, the components of an agricultural system – and consequently agricultural viability – have varying degrees of importance in various locations.

The concept of an agricultural system is present within the provincially adopted Greenbelt Plan (2005) but is not discussed within the Provincial Policy Statement (2014). Some have noted that this is in direct contrast to the treatment of natural heritage. Jason Thorne, in the Ontario Planning Journal (2014, Volume 29(1)) for example, writes that:

*"In considering how effective provincial policy has been in protecting various land use interests, it is informative to compare the treatment of agricultural lands with the*



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*treatment of natural heritage areas. Provincial policy requires the proactive identification of natural heritage systems so that the most important areas can be protected, and their ecological functions maintained, for example. A similar systems-based planning approach is not, however, mandated for agricultural areas, and the fragmentation of agricultural lands continues.”*

Although the Greenbelt Plan uses language of agriculture system and natural heritage system, it is important to emphasize that they are overlapping, and that the strength of either depends on how well the other is functioning. For example, farm operations are significantly impacted by the extreme weather caused by climate change, while farms play a large role in carbon sequestration which reduces the impacts of climate change.

This paper is based on the premise that a more thoughtful discussion and understanding of the agricultural system can contribute to improved policy and practices that help to strengthen agriculture. Ensuring a strong agriculture system is important for ensuring a healthy source of local food and strong rural economies. In the Golden Horseshoe, agriculture contributes \$2.65 billion in GDP, and accounts for 55 percent of Ontario’s fruit production. It is important that these strengths are maintained and enhanced.

This paper explores the concept of an agricultural system from a farm perspective in relation to the natural influences and human influences, including government; agribusiness; technical and professional expertise; and the non-profit and community sector. The proper functioning of these components is essential for a “viable” agricultural system. It relates to both near-urban contexts and within other important areas of production across Southern Ontario. This paper also recognizes that the notion of an agricultural system is explicit or implicit within legislation, plans and by-laws, and that further understanding of this is required. Four hypothetical diary entries are also included: the intention of these being to assert the importance and relevance of the concepts of an agricultural system to the business and livelihood of farming.

**This paper has an intended audience of municipal staff (planners, building officials, etc.), municipal politicians, provincial staff (MMAH, MNR, MOE etc.) and Conservation Authority staff and board members. It aims to enhance this audience’s understanding of agriculture in relation to their work and decision-making. In doing so, this paper can contribute to improved policy and practices that help strengthen agricultural viability.**



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## 2. Natural Influences

Most fundamentally, farmers manage the soil and water, plant seeds, apply nutrients, control weeds, and harvest crops. Some farmers also raise livestock, converting some of these crops (or pasture) into animal protein. At the core of these relationships is soil, air, and water quality, and climate (sunlight, temperature and precipitation). Southern Ontario, south of the Canadian Shield, benefits from high quality soils. In fact, more than half of Canada's class 1 soils are located in Ontario and this, combined with access to fresh water in the Great Lakes, and the country's best climate for agriculture, provides the potential for the most productive agricultural landscape in the country. Quite simply, the agricultural land base is a precious resource that cannot be moved – it is finite and the location is fixed.

### Farmer A's Diary Entry (January 5)

Sure was good to get out in the woodlot today. That 13 acres at the back of the farm is my prized possession. The ground was frozen solid and virtually no snow yet – I cleaned up several-downed trees-enough firewood for next winter. And a few years ago we took out \$30,000 in logs – you wouldn't know it today except for the occasional stump. I even had a log buyer in last week asking if I thought it was ready for another cutting, but I think I'll leave it for a couple more years. And the creek that flows into the northeast corner of the bush – drains my entire farm – I've got tile feeding into the municipal drain that flows into it. Without that drainage I'd probably still be stuck out in the fields. Funny, what some people call the natural system is an essential part of my farm. Anyway, for tomorrow it's back to the bush with the tractor to get the firewood before the heavy snows forecast for the weekend.

While agricultural production depends on the quality of natural inputs, farms also provide numerous environmental benefits, demonstrating that the natural heritage system and agricultural system rely on each other in several ways. Crop production contributes to the quality of air and water, while farms include the vast majority of privately owned natural spaces in southern Ontario. Woodlots provide habitat, serve as carbon sinks, filter and store water, and produce high quality timber. In many instances, woodlots contribute directly to farm income (maple syrup and lumber). Farms are an essential element of green infrastructure, and help to mitigate climate change. Agriculture deals with its own by-products – recycling crop residue and manure (nutrient management). Natural systems also contribute to agricultural production indirectly by allowing water infiltration, reducing soil erosion, and in turn, can help to increase yields. While normally thought of as part of the natural system, watercourses are equally important for managing water for drainage or irrigation on the farm.



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In many ways, the processes of raising livestock and producing crops have existed for thousands of years. There are, however, increasing complexities, challenges and opportunities that impact these systems of production. Within Ontario for example, adequate land drainage is an essential aspect of production. Fields need to be dry enough to accommodate equipment, minimize soil compaction, extend the growing season and contribute to plant development and growth. Many farmers spend tens of thousands of dollars on infrastructure to allow for proper land drainage to occur. Conversely, irrigation, especially for fruits and vegetables, is essential for many crops. Farmers also focus significant effort on soil management practices that improve soil health by improving internal soil drainage during times of excess water or maximizing soil water retention during times of limited water. The presence of natural features can also affect farming activities, which can be restricted through municipal and provincial policy in proximity to key natural heritage features.

The relationship between farming and natural systems can also vary depending on location. On one hand the North American agricultural system shares much in common, from marketing, to food safety and standards, to suppliers of equipment and agricultural inputs. Likewise the Canadian dairy industry shares commonalities across the entire country. At a more local level, however, we can identify a more refined spatial component. The tender fruit lands of Niagara, for example tend to share much in common (soils, climate, common crops and production practices) that help to delineate that area as part of a unique system. In fact, there are commonalities shared across the Greenbelt in terms of their proximity to large urban markets and the opportunities and challenges that this provides.

### **3. Human Influences**

#### **3.1 Government**

All orders of government impact agriculture in a variety of ways. While this paper is oriented towards the relationship between land use planning and the agricultural system, it is important to recognize the broader roles of the provincial and federal government. Trade policy, food safety, food labeling, and related regulations, farm support and crop insurance, and research are examples of activities that impact the agricultural system and fundamentally determine farm profitability. The provincial government also plays a critical role in the development and implementation of land use policy. The Planning Act (1990), The Provincial Policy Statement (2014) and the



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Greenbelt Act and Plan (2005) are examples of important provincial initiatives that influence and direct municipal land use policy.

Local government is perhaps most directly connected to the day-to-day operation of the farm through the provision of services and regulations impacting the built infrastructure. The land-use planning system is key, as it provides a framework for the growth and development of agriculture and the agri-food industry. It helps to ensure that development within the countryside is consistent with long-term agricultural objectives. Official Plans, zoning bylaws, and planners help to articulate the role of agriculture within a community – they can be facilitative and enabling or they can be restrictive and limiting. Many rural zoning by-laws, for example, include detailed provisions that capture many elements of the agricultural system from setbacks for farm buildings to agricultural processing activities. Further, severance policy applied to prime lands minimizes or prohibits residential development and helps to ensure that parcel size is consistent with agricultural needs.

The application of Minimum Distance Separation (MDS) formula also informs agricultural development and operations as they provide a framework for accommodating new and expanding livestock operations in proximity to residences and other non-agricultural uses (while also restricting residences in close proximity to livestock

**Farmer B's diary entry: December 1**

What a difference. Three bankers at three banks in three weeks! Today's banker was raised on a farm and when we talked about my operating loan she got what the other bankers didn't get! Farming is complex and everything is connected. Putting the crop in isn't just dumping seed in a planter and driving up and down a field. There's the expense and connecting with my crop advisor and the local co-op about fertilizer, seed and crop protection materials. There are also the unknowns - like rebuilding the tractor engine last winter. Or the markets - how much of the crop do I sell on the futures especially with the weather these last 2 years? And do I aim for the premium on Identity Preserved (IP) beans? On top of this do I establish my own drying facilities or truck the crop to the nearest commercial elevator and wait in line. And do I buy a new combine - the neighbour purchased a 16-row corn header and can cover well over 100 acres in a day while it looks like I'm standing still. No... putting the crop in isn't just dumping seed in a planter and driving up and down a field!

Well, the good thing was this banker got it and I'm going to switch banks. I was able to talk to her about all of these ideas and she understood the connections and the people and services that keep this farm going: from my accountant, to the elevators, to the truckers, to the co-op, to the roads, to the internet, to the equipment dealers, to the mechanics, to the neighbours and more.



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barns). MDS is an example of a policy intended to help reduce conflict in the countryside – farms are best able to function where they are able to operate free from conflict from adjacent uses.

These planning tools determine whether and how on-farm development occurs, which affects farm activity. Whether buildings, structures and facilities are dispersed over several properties or consolidated on a single property, they represent a significant investment. Normally this includes a farm residence, a well and septic system and related utilities. If livestock are present it normally means there will be buildings to house livestock ranging from the traditional bank barn to modern facilities intended to potentially house large numbers of animals or birds. Manure storage facilities will also be present, whether they are internal to the barn or in a separate enclosure. In the case of both livestock and crop farmers there will likely be sheds for the storage of equipment and potentially the storage of feed or produce. This includes silos, storage bins and other containers, as well as the potential for large volume grain drying facilities. Other structures may include greenhouses, packing and processing facilities, climate controlled coolers, direct farm sales outlets and even agri-tourism related activities. The concept of accessory structures is also important - if something is normally incidental it is generally allowed.

This built infrastructure is connected to the land base in fundamental ways. Parts of the province are ideally suited to large volume crop or commodity production. Other areas have much higher densities of livestock; and other areas have a combination of both. We can also look to the Niagara, Norfolk, Leamington and Holland Marsh areas to see quite diverse agricultural systems and needs (tender fruit, vineyards and wineries, greenhouses and vegetable production). In some instances production can be very intense on relatively small acres. The suitability of soils and climate for different crops will influence the type of production and in turn the nature of the on-farm built environment.

Municipalities also interact with agriculture on a day to day basis through the provision of essential services such as roads, road maintenance, and the issuance of building permits. Municipalities play a major role through many activities ranging from the administration of municipal drains, to fence viewing under the Line Fences Act, to responding to stray dogs, to encouraging agri-tourism (which serves as an example of a permitted use that captures the directions of the Provincial Policy Statement and is implemented through municipal plans and by-laws).



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Conservation Authorities also play an important role – both in the development and administration of natural heritage planning (working with municipalities and their own regulations) – but also some Conservation Authorities work with farmers to improve land management through the improvement of cropping practices and the adoption of best management practices, through the Environmental Farm Plan model, for example.

### **3.2 Agribusiness**

Agribusiness includes the range of wholesale or retail companies which buy and/or distribute goods or services to or from farms. As agriculture has evolved and changed so too has its relationship with agribusiness and the community. Historically, southern Ontario was crisscrossed with a network of towns, villages and hamlets that were established with a primary purpose of supporting surrounding farms and farm population. The gristmill, blacksmith and general store were fixtures in countless communities. Today, however, this network has evolved and services agriculture in very different ways. The scale of these operations tends to be much larger and often regional or provincial in scope. While there are localized services and some of these are growing (for example recent growth in farmers' markets) other aspects of agriculture, and by far the vast majority of agricultural production in Ontario is connected in one way or another to global markets and trends. The distribution of seed, fertilizer and crop protection (including herbicides, pesticides, fungicides, and fungicides), for example, tends to flow through a very limited number of suppliers with outlets concentrated in areas of key production. Likewise, equipment dealers are fewer and farther between but generally handle large volumes. Certain agricultural needs and types of farms are still largely serviced at the community level (the local co-op, veterinarians, the needs of the Anabaptist horse and buggy community, etc.). New and evolving technologies have significantly impacted agriculture from changes in equipment size to new items like drones and precision agriculture.



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While agribusiness has changed, it remains core to the operation of virtually every farm in Ontario. The small organic producer may be purchasing mulch from a supplier or heirloom seeds on-line, but there are important connections to be maintained. Likewise, producers of fruits and vegetables will be dependent on marketing systems to purchase and distribute their produce. In fact, all farmers are dependent in one way or another to a host of marketing and processing services. For producers of commodities (corn, wheat, beans for example) and livestock there are a multitude of connections, relationships and dependencies that are necessary for a vibrant agricultural system.

Without a doubt, the multiplier effect associated with the direct and indirect expenditures of agriculture reverberates throughout the rural economy. In some areas it is dominant (for example much of Southwestern Ontario), in other areas it represents an opportunity for the growth and development of a more vibrant rural economy (for example Northeastern Ontario) and in other areas it is a major component of rural economies, coexisting with major urban settlements (for example the Greater Golden Horseshoe).

**Farmer C's diary entry: December 1**

Finally, we've worked out an arrangement to sell the dairy farm to our daughter and son-in-law. We're lucky - far enough away from the city that we can have a large dairy herd. This truly is a family business - people don't always get it - people see our large barns, driving shed, silos, equipment and house and think we're some large corporate farm - but this is a family business. Sure we're incorporated and have hired some help, but this farm has supported 2 families since our daughter came back to the farm 10 years ago. It will be tough for them - I think the finances look sound (as long as we have the quota system), and they have a good handle on the operation of the farm but it's all of the connections they have to manage. The veterinarians, the equipment dealers, the technicians that look after the robotic milkers, the electricians, carpenters and plumbers who are always helping to make improvements in the buildings when we can't make them ourselves. It's about keeping the milk storage facilities spotless- they can't run the risk of any issues with milk inspection. Also, they need to keep in touch with the municipality - seems like every year we leave a trail of mud between here and the other farms. The township has been pretty good about explaining this when they get a complaint about dirt or manure on the roads. I could go on and on about these connections, but the good news is that although I plan to retire - I'll still be helping them pretty much on a full-time basis for the next several years. Will allow me to continue to pass on the knowledge about this farm that I picked up from my father-sure helps with the efficiencies of running the farm which can mean the difference between profit and loss. It sure feels good to see the farm getting passed on - been in the family for 4 generations now.



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Most crop production requires various inputs including fertilizer, biological controls, and other crop production products. Some farmers have found natural alternatives to these inputs. In many instances there are strong connections to the livestock sector in that manure becomes a valuable crop input. The processing, management and regulation of these inputs are key aspects of the agricultural system.

For the producers of livestock there are additional levels of complexity. In addition to all of the networks associated with the production of crops there are a host of inputs associated with the raising of cattle (dairy and beef), hogs, sheep, goats, chickens and turkeys (and a host of other livestock types that while smaller in number may be the key aspect of someone's livelihood). Moreover, each of these sectors tends to be subdivided – one farmer will produce fertile eggs for a hatchery that will hatch chicks for laying hens that will be raised for eventual population of a laying hen barn. Each of these phases of production is part of a system that depends on a number of connections to properly function. In the case of laying hens, for example, there are inputs ranging from the production of a proper feed ration to the catching of birds to both populate a barn and to empty it at the end of a production cycle. There are trucks and truckers and people to disinfect barns and abattoirs and people with jobs catching birds. The connections are nearly endless and these are repeated for the dairy sector, for hogs, for beef and so on. The equine sector is also notable because of the diverse and unique range of associated economic activity.

For horticulture producers, there are nurseries and transplant suppliers, food safety auditors, irrigation and cold storage suppliers, biological control suppliers, container and packaging providers and crop consultants that are all connected to deliver farming inputs. Similarly, the connections that exist post-harvest include: small and large retailers, trucking companies, brokerage houses, on and off-farm packagers and processors, distribution centres and marketing boards. A range of professional services also operate to support the greenhouse industry.

Across all farming industries, a range of businesses are used in the distribution, storage, packaging, processing, sale, marketing, and servicing of food and agricultural products.



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### 3.3 Technical and Professional Expertise

As the size and complexity of farms has grown, the need for a range of technical and professional expertise has, on many farms, also grown beyond the ability of the individual farmer or farm family to meet this need. As a result, there are a host of arrangements that address the farm's requirements. Some farms depend on part-time workers, others employ seasonal workers and yet others have full-time employees. These positions entail a variety of skills and expertise.

Many farmers rely on custom application of farm inputs, the harvesting of crops, and post-production expertise. In some instances contracts will have been developed for the sale and quality of product. Some farmers may be selling specialty products (for example seed quality crops or specialty beans).

Throughout all of these processes are the buying and repair of equipment and the little items from nuts and bolts to the repairing of broken field tiles to the more major construction of new sheds and storage facilities. Small businesses also exist to support farms ranging from tile drainage contractors to crop advisors. Crop advisors and nutrient management consultants work with soil testing labs to help determine nutrient requirements for crops.

Broader technical services are also important parts of the agricultural system. Finance is a big aspect of any farm and accountants, bankers and occasionally lawyers provide essential services. Real estate agents, marketers, and researchers that focus on

**Farmer D's diary entry: November 1**

I can't believe I had to travel half way across the province to attend that workshop on Community Supported Agriculture (CSA). Seems like I'm always attending one workshop or another to try to get ahead or understand some new regulation. Also hard to get away with a young family and a husband that works full time. Still things are looking up. While the weather has been a challenge this past year our sales are starting to grow. Our focus on organic produce seems to be connecting - finally. With the greenhouse and the use of plastic mulches and row covers we've extended our growing season considerably.

I guess when I think about it our challenge is to pull all of this together. Marketing (farmers market, road-side stand and CSA); labour (interns, high school students); information (workshops, internet) and improving the fertility of the land itself (including drainage and irrigation). I guess with all of this it's no wonder I always seem to be going from one course or workshop to another.

Oh yes, and tomorrow I need to talk to the township about road signs. I heard from a neighbour that someone complained about people stopping at my roadside stand and causing a traffic issue.



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agriculture, hardware stores, lumber yards, redi-mix providers, and providers of skilled trades for agriculture are also important elements of the agricultural system. IT services are critical for many applications ranging from finance, to marketing, to herd and crop management.

### **3.4 Non-Profit and Community Sector**

Non-profit organizations including research and innovation institutes, farm associations, advocacy organizations, and community groups also play a part in an agricultural system. Farm organizations help to ensure that the interests of farmers and the farm community are recognized in the market place, by government, and in the community. They represent the diversity of the agricultural industry and the range of activities that comprise farms. Farmers rely on the movement and flow of information to help inform daily and strategic business decisions. The internet is an essential tool as are postal and courier services. Farmers also require information that flows from workshops, courses, training events, information meetings or the media. The scientific research and educational framework helps to advance and inform the agricultural system.

Agriculture also exists as part of a local community. This includes producer organizations that contribute to a community of producers focused on their joint interests. It also includes neighbours – farmers and non-farmers who interact, support schools, churches and each other – all essential aspects of a vibrant agricultural system. Within the local community there are many other essential services that support the farm family including schools, churches, medical services, local fairs, 4H Agricultural Leadership groups, and so on.



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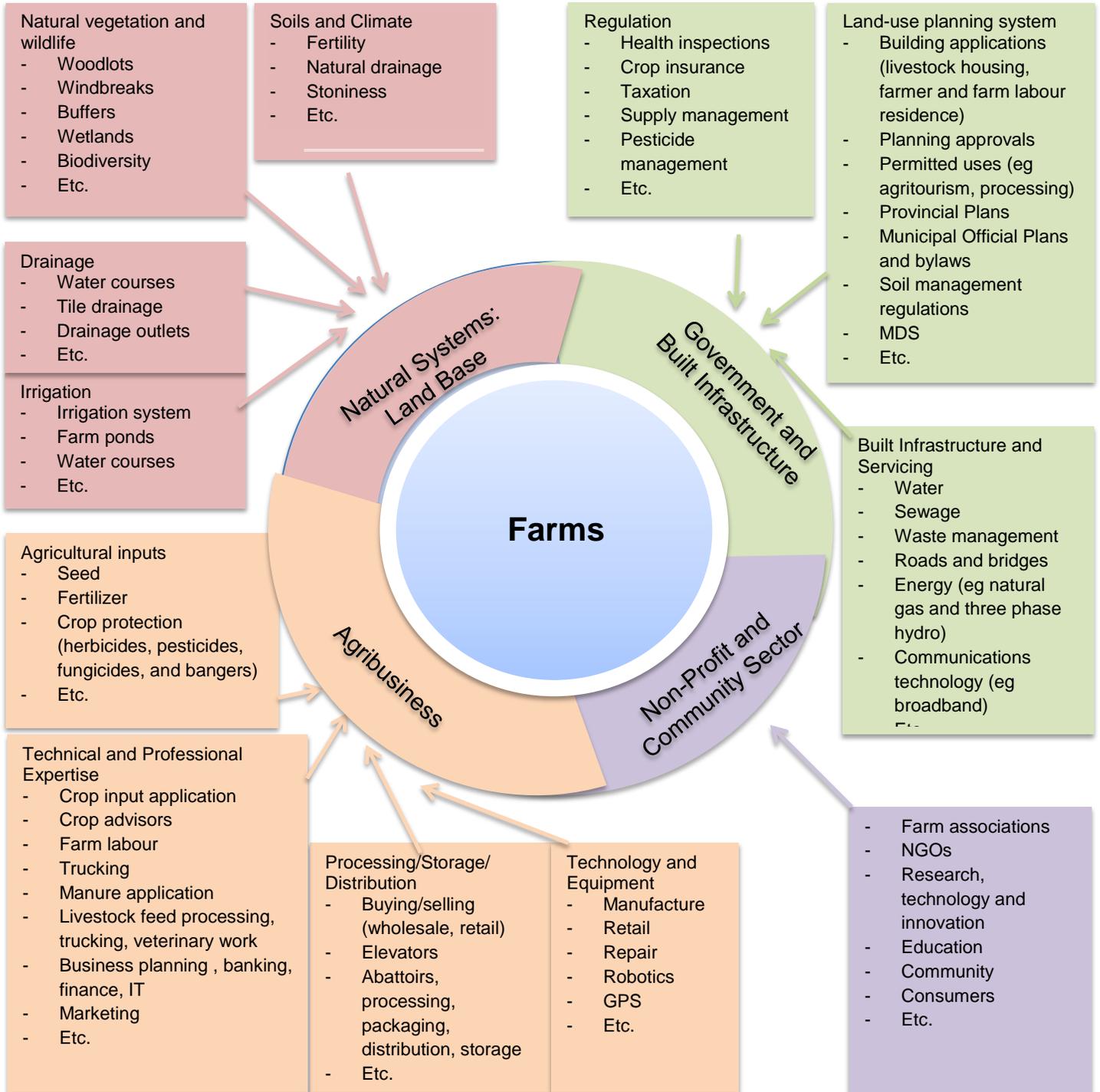
**Table 1: Linking the Components of an Agricultural System**

Agriculture System				
Natural Influences	Human Influences			
	Government and Built Infrastructure	Agribusiness	Technical and Professional Expertise	Non-Profit and Community Sector
Natural vegetation and wildlife - Woodlots - Windbreaks - Buffers - Wetlands - Biodiversity Drainage - Water courses - Tile drainage - Drainage outlets Irrigation - Irrigation system - Farm ponds - Water courses Soils and Climate - Fertility - Natural drainage - Stoniness Etc.	Land-use planning system - Building applications (livestock housing, farm and farm labour residence) - Planning approvals - Permitted uses (including agritourism and processing) - Provincial Plans - Municipal Official Plans and bylaws - MDS - Soil management regulations Regulation from all levels of government - Health inspections - Crop insurance - Taxation - Pesticide management - Supply management Built Infrastructure and Servicing - Water - Sewage - Waste management - Roads and bridges - Energy (natural gas and three-phase hydro) - Communications technology (broadband) Etc.	Agricultural inputs - Seed, trees, transplants - Fertilizer - Crop protection (herbicides, pesticides, fungicides, and bangers) - Mulch, row covers, greenhouses Processing/Storage/ Distribution - Buying/selling(wholesale and retail, including grocery stores and farmers' markets) - Elevators - Abattoirs - Processing, packaging, distribution, storage Equipment and Technology - Manufacture, retail and repair - GPS, drones etc Etc.	- Crop input application - Crop advisors - Farm labour - Trucking - Manure application - Livestock feed processing, trucking, veterinary work - Business planning, banking, finance, IT - Marketing Etc.	- Farm associations - NGOs - Research, technology and innovation - Education - Community - Consumers Etc.



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**Figure 1: Linking the Components of an Agricultural System**





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## 4. The Elements of the Agricultural System

The agricultural system is of course, the totality of all of the above. While this paper has taken a segmented approach to discuss, review and link the various aspects of the agricultural system – the reality is that it is a composite of all of these features (Table 1 and Figure 1). It is important to note that the lists of elements are not exhaustive. Many more could be added to reflect the comprehensive nature of the agriculture system and the diversity, breadth and depth that is difficult to capture in a single document.

There are six elements of the agricultural system that can be identified and help to summarize this report.

1. Farms: Farms of various sizes produce a range of crops, livestock and other goods and services. They can include multiple properties and combinations of owned and rented lands.
2. Natural Environment: Including climate, soil types, and water access, these and other natural inputs impact agricultural viability but are also impacted by farming activity.
3. Government: Services and programs, policy directives, and regulations from all levels of government impact production, building and other on-farm activities, as well as marketing, processing, and distribution.
4. Agribusiness: Includes the range of wholesale or retail companies who buy, process, package, store and/or distribute goods or services to or from farms, including crop inputs and farm outputs.
5. Technical, and Professional Expertise: Farms depend upon labour and the services of various technical and professional people, including accountants, bankers, lawyers, IT service providers, crop advisors, tile drainage contractors, nutrient management consultants, veterinarians, electricians, carpenters, and plumbers.
6. Non-Profit and Community Sector: Includes a broad range of organizations including those involved in research, innovation, and knowledge transfer. It also includes agricultural associations and non-profit organizations, which offer organizing, programmatic, and advocacy support for agricultural communities. Community groups and local churches are also part of this category.



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## 5. Conclusion

At the core of this discussion is the importance of economic viability at the individual farm level and within the context of the entire agricultural system. While the term viability is not often discussed in the context of agricultural systems – the reality is that farmers choose to farm for various reasons, but almost all farmers aspire to make a living from their farming activities. In the absence of profits, which translate to family income, an area will gradually be lost to agricultural production. In this context an agricultural system must have a reasonable expectation of profit.

While the concept of the “agricultural system” has relevance across southern Ontario, it has specific relevance in the near-urban environment. Within these locations, there are further pressures that compete for farmland, inflate its value and simply complicate the process of farming (traffic, trespass, regulation, etc.). There are also, however, opportunities, such as market availability, and the potential for diversification into niche areas of production. Thoughtful approaches are required to both manage the challenges and enhance the opportunities to help contribute to the long-term success of agriculture in these environs.

The concept of an agriculture system is an important component of land use planning. The term system is often used to help describe broader considerations related to transportation, water, sewage and electricity for example. Increasingly, these terms are also applied to elements of land use such as natural heritage or agriculture to help clarify the relationships and interdependencies that exist between different elements of any given “system”. Within Ontario, considerable attention has been directed to the concept of a Natural Heritage System. Some would argue that a similar level of attention is required as it relates to the Agricultural System, especially given the proximity and relationship between these two important land uses. Failure to do so runs the risk of one land use receiving preferential treatment relative to the legitimate needs and aspirations of the other. Moreover, failure to recognize the relationship between systems also runs the risk of misinterpreting them as competing against each other. By defining and considering the Agricultural System there is potential for more consistent interpretation, more informed decision-making and enhanced understanding concerning how policies and land-use planning changes impact agriculture.