University of British Columbia

Faculty of Land and Food Systems

LFS 350

Community Based Experiential Learning Project Report

Young Agrarians

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EXECUTIVE SUMMARY

***Introduction*:** Industrial agriculture, or agroindustrial farming, relies heavily on external resources, such as fossil fuels, fertilizers, pesticides and herbicides leading to environmental degradation poverty, social inequity and consequently to a lack of food sovereignty and food insecurity. Agroecology uses an Asset Based Community Development (ABCD) approach and aims to solve these issues. Several initiatives aim to promote agroecology, however despite these efforts, number of farms in Canada is in decline, while the average age of the farming population has increased. We partnered with Young Agrarians (YA) to aid them with the creation of a sustainability impact dashboard with the aim of promoting agroecology to new farmers, investors and policy makers. Our objectives were to create a list of sustainability indicators to include in the sustainability impact dashboard, and to identify other successful impact dashboards from various farming organizations. In addition, throughout our data collection process, we were guided by our research question: what are the environmental, social and economic indicators to be presented in a sustainability impact dashboard?

***Methods*:** A literature review of peer-reviewed articles, journals, government statistics and existing survey results was conducted as a systematic approach, to document and evaluate the benefits of agroecology based on the 3 pillars of sustainability.

***Results*:** Our research found several indicators for each of the three pillars of sustainability: Environmental, Social and Economic. We framed our results based on the Sustainability Assessment of Farming and the Environment (SAFE) framework.

***Discussion*:** Using the SAFE framework provides a holistic approach, to evaluate and analyze the sustainability impact of agriculture. Assessments and measurements could then be framed into a dashboard similar to that of Five Borough Farm (5BF).

***Conclusion*:** Our results include a list of useful indicators and recommendations to YA in creating a sustainability impact dashboard to evaluate the impact of agroecological farming operations.

INTRODUCTION

Industrial agriculture, is a chemically intensive food production method that relies on external resources, such as fossil fuels, fertilizers, pesticides and herbicides (Pimentel *et al.,* 2005). This farming method has been perfected over time to meet the constant rise in human population (Pimentel *et al.,* 2005). To this end, industrial agriculture directs resources to promote maximum crop yields and high efficiency (Brosari, 2011). However, there is mounting evidence to show the serious negative impacts of industrial farming on public health and the environment. Furthermore, agro-industrialized farming that caters to a centralized food industry is decreasing food sovereignty and food security, especially for those living in rural communities due to reduced accessibility to urban food distribution centers, and increased prices of commercially sold food and fresh produce in rural regions (People's Food Policy, 2011).

Despite of all the negative impacts that industrial agriculture is causing, there are many optimistic developments. A number of positive initiatives aim to promote food security and food sovereignty, by preserving the livelihood of small farmers using sustainable farming practices. Agroecology is a method that employs a holistic approach to produce crops that does not rely on the use of practices that degrade the ecosystem (Bengtsson *et al.,* 2005). Agroecological farming principles focus on local knowledge and the use of nature's resources in creating methods that promote healthy environments and communities (Bengtsson *et al.,* 2005). For example, by using techniques such as, crop rotation and conservation tillage, farmers are able to protect biodiversity and foster the development and maintenance of healthy ecosystems (Bengtsson *et al.,* 2005). As ecosystems are densely interconnected by social relationships, any changes relating to either the environment or the economic health of the system will have an impact on the structure and function of the community (Bengtsson *et al.,* 2005). Hence, the adoption of agroecological principles yields

a sustainable community that enhances and stabilizes food production. Agroecology relies on internal inputs, such as human capital, local assets and local knowledge. Thus, it demonstrates an ABCD approach, which is essential to addressing the current food insecurity and food sovereignty issues (Mathie & Cunningham, 2003).

Even with the positive sustainable impacts of agroecological farming in comparison to traditional farming methods, academics have found evidence that many people are reluctant to undertake farming professionally. Since 1991, the number of farms in Canada has declined. At the same time, the average farm size has increased, which seems to be an indication of farm consolidation (Beaulieu, 2014). Furthermore, the average age of farmers has risen from 47.5 to 54 years, and is nearing retirement age for Canadians (Beaulieu, 2014). One of the main factors is the lack of profitability, due to the high capital costs, unstable commodity prices and the competitive nature of the farming industry (Census of Agriculture, 2011). Thus, it has created strong barriers for potential farmers to enter the farming industry (Census of Agriculture, 2011).

Communities have established innovative ways to encourage new farmers with opportunities to gain knowledge and hands-on experience in the field of sustainable farming. In particular, YA was established in 2012 to promote agroecology and provide support and resources for new agroecological farmers. Based in British Columbia, YA members include urban and rural farmers, gardeners and food activists guided by the principles of agroecology, and by land and soil stewardship (Young Agrarians, 2016).

For this project, we have partnered with YA to develop a list of recommendations to create a sustainability impact dashboard. This dashboard will be used to assess environmental, social and economic impacts of agroecological farming operations. These 3 categories, or pillars of sustainability, were chosen because academics have shown an interdependence relationship

between the three (Allen *et al.*, 1991). This concept not only promotes environmental justice and natural resources stewardship but also takes full consideration of the society's interests. Therefore, the aim of our project is to promote agroecology to young farmers, investors and policy makers. In order to achieve the aim of the project, our group has developed a list of objectives:

1. To create a list of sustainability indicators and recommendations for data collection methods, to include in the sustainability impact dashboard for YA
2. To research other companies or organizations that have made successful impact dashboards and learn from their challenges and successes

Thus, based on the information above our guiding question for our literature research is:

What are the Environment, Social and Economic Indicators to be presented in a sustainability impact dashboard?

METHODS

We used a systematic process to document and evaluate the benefits of agroecology on the three pillars of sustainability. This method consists of analyzing and summarizing peer-reviewed articles, journals, government statistics and existing survey result, and presenting these in an annotated bibliography format in the appendix. When conducting the literature review, the research topic and system boundary, which is "social, environmental and economic sustainability indicators on a farming operation scale" were first identified. In addition, key words such as "agroecology", "sustainability", "social justice", "diversity", "economics", and "well-being" were combined and entered into several search engines, such as Google Scholar and UBC Library that were useful in accessing peer-reviewed journals.

The criteria for choosing the indicators were that these need to be sound, simple to calculate, and easy to interpret and use by decision-makers. The process of selecting the indicators

was driven by the social, economic and environmental benefits of agroecology. This was done by analyzing and evaluating 40 peer-reviewed journal articles. Once a set of indicators have been collected, they were then grouped into their respective social, economic and environmental sustainability criteria and presented in a table format. The table consist of 4 columns that represents categories, principles, criteria and indicators.

Ethics Considerations

We took into account 3 ethics considerations regarding our research and analysis of peer reviewed articles. First, all of the information gathered was from a wide variety of reliable sources, to support our recommendations and reduce bias. Additionally, all of the sources that were directly given to us from our community partner were kept confidential. Finally, acknowledgements were given to the authors for the sources that we have used in selecting our sustainability criteria.

RESULTS

Based on the SAFE framework proposed by Cauwenbergh *et al.* (2006), we have grouped the different indicators into a table format. The first component of the framework includes the 3 *Categories* (or pillars) of sustainability: environmental social and economic. The second component is *Principles*, which consist of general conditions in a sustainable agricultural system and account for the all the pieces that make up that system. The third component is *Criteria* that describe the desired state of a principle when it is managed sustainably. The last component in our results table are *Indicators*, which contains quantitative and qualitative variables to assess a criterion. Our results are presented in Table 1.

Category:	Principles	Criteria	Indicator
Environmental sustainability	Soil	Soil erosion is minimized Soil quality is maintained	Nitrogen fertiliser use Pesticide use Emission of greenhouse gases Emission of ozone depleting gases Emission of acidifying gases Emission of nitrifying substances Emission of pesticides Emission concerning terrestrial eco-toxicity Emission concerning aquatic eco-toxicity Emission concerning human toxicity Waste production and utilisation Agricultural biodiversity Natural biodiversity
	Air	Air quality is maintained or enhanced	
	Water	Water quality is maintained	
	Biodiversity	Agricultural biodiversity is maintained or enhanced Natural biodiversity is maintained	
	Input use	External inputs use is minimized	Use of non-renewable energy Use of other non renewable resources Water use Land use
Economic sustainability	Farm	Farm income Dependency on external finance Adaptability to market demand	Total sales per farm per year Average sales per farm per year Total purchases per farm per year Total farm jobs per year
	Community	Market activities are optimal	Total food bought locally per tear Buyers' jobs per year
Social sustainability	Food security and safety	Production of food is aligned with society's demand	Total annual amount of food production
		Quality and Quantity of Food Production	Qualitatively analyze the community's satisfaction on the production of food
		Diversity and Culturally acceptable food	
	Working and Living Conditions	Farmer income sustained or enhanced	Impact of income on the farmer's lifestyle and living conditions
	Psychological well-being of Farmers	Farmers are satisfied Cultural, spiritual and aesthetic value features are maintained	Qualitatively analyze the success of the farmers Qualitative analysis of acceptance of food for cultural and traditional use

Table 1: Indicators of sustainability for agroecology adapted from the SAFE framework (Cauwebergh et al., 2006), 2013 Economic Impacts of Iowa's Regional Food Systems Working Group (Enderton, Bregendahl, 2013) and van der Werf & Petit (2002)

DISCUSSION

We chose to frame our results for indicators based on the SAFE framework offered by Cauwenbergh et al., (2006). Cauwenbergh et al explained that the benefits of using the SAFE framework, in comparison to other frameworks, is its holistic approach with regards to inclusivity of all the three pillars of sustainability, as well as hierarchical structure that enables organization of information in order of sustainability level. It also includes the qualitative criteria for a sustainable agricultural system, such as soil, water and air quality, as well as the quantitative measurements needed to assess these conditions. However, our table differs from that proposed by Cauwenbergh et al in several aspects.

First, for environmental sustainability, we chose to replace the principle of "energy" with "input use" which includes energy use, water use, land use and other non-renewable resources as indicators to measure. We decided on this modification because of the fact that Cauwenbergh et al did not include land and water use in their list of criteria of assessments and these two indicators make some of the critical differences between agro-industrial farming methods and agroecology. Similarly, we added the use of other non renewable resources to account for activities and resources required in livestock farm operations, such as waste management and feeding that are vastly different in agroecology, in comparison to industrial farming. The indicators that we chose for air, water and soil quality, as well as biodiversity were merged into one group to account for the complexity of interactions between these principles, and because indictors for environmental sustainability influence any of the above principles and criteria. We decided to use indicators of environmental sustainability proposed in a study by van der Werf and Petit (2002). Although reasons for choosing these indicators were not given in that study, this is a peer reviewed article

that was published in a reputable journal that targets a specific knowledgeable audience. Therefore, we feel confident in the reliability of this resource.

Second, we divided the economic sustainability category into two principles; one is dedicated to the economic sustainability of the farm, and one to the economic sustainability of the community. Although Cauwenbergh et al limit the scope of the SAFE framework to on-farm activities, we argue that the impact of agroecology and the sustainability of the farm are inseparable from the community in which it operates, so it is important to demonstrate the positive impact that local production and distribution have on the community thanks to the multiplier effect. These indicators were also used to demonstrate the positive impact of local agriculture in Iowa in a report by the Regional Food Systems Working Group (Enderton, Bregendahl, 2013). Additionally, Cauwenbergh et al included market activities as a criterion for economic sustainability, which requires measurability. Thus, we have included indicators to measure the amount of food bought locally, as well as the number of buyers' jobs to demonstrate the importance of local production and distribution, as principles of agroecology.

Lastly, because the economic and social pillars of sustainability are inherently linked due to the impact of economics on living conditions and one's ability to support their desired lifestyle, in Cauwenbergh et al there were separated into two categories, but with overlapping criteria. However, we completely separated the two categories and criteria by mostly choosing indicators of social sustainability that require qualitative analysis, rather than quantitative measurement to account for range in human perceptions of socioeconomic conditions. We chose indicators of social sustainability based on the needs of YA as they were communicated to us by YA coordinator, Sara Dent (S. Dent, personal communications, February 1st, 2016).

Based on our criteria for the different principles, we recommend to YA to use an impact dashboard design that is similar to that of 5BF (Figure 1 of the appendix), as it depicts the impact of urban agriculture on sustainability and the health of the community in which it operates. The design of 5BF's impact dashboard is simple read, and it is easy to interpret how the ongoing activities on the farm impact the different pillars of sustainability. Although 5BF represent urban agriculture rather than agroecology, the design of the dashboard, as well as the criteria for most of the on-farm activities are closely related to those of agroecology in both urban and rural settings.

One of the advantages of using the SAFE framework for the sustainability indicators is that SAFE is universally applicable. Nevertheless, our research and the use of the SAFE framework also has some limitations. First, the main one is that, with exception of economic sustainability, the boundary of the system is limited to the farm alone, so that the impact of the product use, processing and transportation outside of the farm is not assessed in the framework. Second, our research focused on finding indicators that could be used in an impact dashboard that demonstrates the impact of agroecology. However, we did not assess methods to collect, measure, evaluate and analyze any of the indicators. The feasibility of measuring any of the indicators could influence their inclusion in the final impact dashboard. Third, the dynamic nature of the concept of agroecology poses a challenge to assessment of the impact on each specific sustainability category as these categories are interdependently related. Lastly, in the SAFE framework, Cauwenbergh et al proposed an additional component consisting of reference values. We excluded this from our results as this is also beyond the scope of our project.

CONCLUSION

Our goal for this Project was to find indicators of sustainability that could aid YA in the creation of a sustainability impact dashboard aimed to promote agroecology. Our research found several indicators for each of the pillars of sustainability that we framed using the SAFE framework. Based on our research we also recommend a dashboard design similar to that of 5BF due to its high readability and adaptability to agroecology. Future research for completion of the dashboard could include further analysis of methods for data collection for each indicator, analysis of on-farm activities that could be presented on the final sustainability impact dashboard, as well as further analysis of reference values for the chosen indicators to enable comparison to a desired level of sustainability, as offered by Cauwnebergh et al.

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APPENDIX

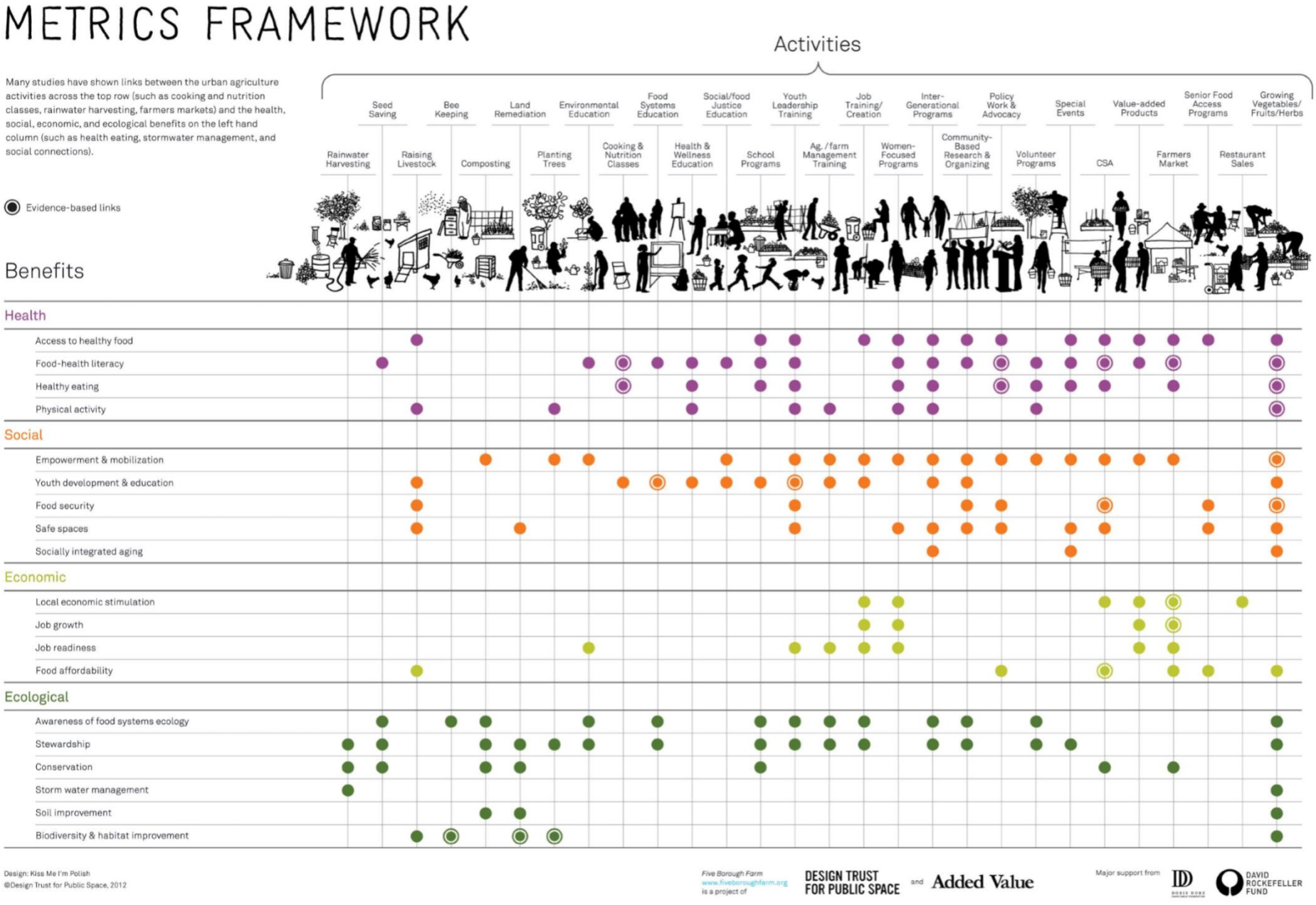

Figure 1: Impact dashboard for Five Borough Farm (2016). Retrieved from http://www.fiveboroughfarm.org/impact/

PERSONAL REFLECTION

Student 1 - Growing up in Indonesia where poverty and environmental issues are prevalent, I developed a passion for solving sustainability-related issues. Upon taking the LFS 350 course, I immediately felt that I would be able to acquire the knowledge that I desired. The LFS 350 course fascinates me, as I believe that there lies a key to solving food security issues, advancing me towards my vision of decreasing poverty and creating a sustainable future.

What? So What? To gain a broader scope of our global issues, I decided to partnered with Young Agrarians (YA) to create a Sustainability Impact Dashboard. With a great interest in natural resource management, I want to learn more about how agroeocological farming can tackle food insecurity issues. This project has definitely broadened my perspective about farming in British Columbia, the different and farming policies and most importantly how agroecological farming will be able to solve food insecurity issues. The lectures and tutorial sessions were a great way to engage with our course instructor as well as our teaching assistant, to help us in critically analyze issues and solutions for our project. In addition, my partner and I have conducted Skype meetings with our community partner to give her updates about our progress in developing recommendations for Young Agrarians. These sessions have helped us to communicate and establish a strong relationship with our community partner.

Most importantly, besides the theoretical knowledge that I have gained, this course has taught me to use an Asset Based Community Development(ABCD) approach in tackling personal issues relating to my group. It has definitely been a rough journey and it is not as simple as I thought with only having 2 people working on this project. However, I have learned to remain flexible, and to quickly adapt to new environments, as I solve many different issues with varying situations.

Now what? I hope that the recommendations that we have developed for Young Agrarians to develop a Sustainability Impact Dashboard, will help to promote the great works of agroecologial farmers in our present-day community as well as to attract millenials to enter the farming industry.

Student 2 - Although working on this project was quite challenging, I feel privileged that I had the opportunity to do so. I am also grateful for the opportunity to work in the community. Our group found it quite difficult to conceptualize our project and create our project proposal, and even after our proposal was written and submitted, we felt unsure about our goals and objectives since the project description in the course website is different from what we thought Sara said she needed during our meetings with her. Only once we started to write our final report did this become clearer, and we realized a plan to achieve this. My interest in this project stems from my desire to become a dietitian in order to help improve peoples' health and wellbeing through nutrition. Since food insecurity and lack food sovereignty are persistent problems specifically in rural communities, there seems to be a need for intervention to increase accessibility to nutritious foods. Aside from the actual work on the project, I am also thankful for the knowledge I have gained about the food system and agroecology:

What? I have never heard of the term agroecology before working on this project.

So what? My understanding is that it is quite a loaded concept with a political connotation and not without controversy. This is probably due to political influence on global markets. However, the current paradigm, agro-industrialism is unsustainable, and despite best intentions to produce food on a large scale to address the food crises in developing countries, it is leading to land degradation, land loss, food waste, poverty and leads to food insecurity and lack of food sovereignty. It is simply falling short of its goals.

Now what? After completing our project, I cannot help but feel encouragement and hope that we can change our current flawed production paradigm. I truly hope that our work in this project brings us one step closer to promoting agroecology, to attracting a new generation of farmers, and finally to changing public policies to adopt sustainable agriculture that respects the environment, farmers and consumers.

ANNOTATED BIBLIOGRAPHY:

Cauwenbergh, N. V., Biala, K., Bielders, C., Brouckaert, V., Franchois, L., Cidad, V. G., . . . Peeters, A. (2007). SAFE—A hierarchical framework for assessing the sustainability of agricultural systems. *Agriculture, Ecosystems & Environment, 120*(2-4), 229-242. doi:10.1016/j.agee.2006.09.006

The authors of this journal provide a comprehensive list of criterea and indicators for sustainability assessment in agricultural systems. This is referred to as the Sustainability Assessment of Farming and the Environment Framework (SAFE). This article offers a comprehensive study of frameworks for sustainability impact of agriculture, and compares and contrast different approaches and frameworks to assess sustainability. Upon review of this study, the SAFE framework was chosen to frame our results.

Enderton, A., & Bregendahl, C. (2014). *2013 economic impacts of iowa's regional food systems working group*. United States of America: Leopold Center for Sustainable Agriculture. Retrieved from http://www.leopold.iastate.edu/sites/default/files/pubs-and-papers/2014-11-2013-economic-impacts-iowas-regional-food-systems-working-group.pdf

This document reports the economic impact of Iowa's food system in terms of amount of food sold and amount purchased locally, as well as job creation both on farm and in the local community. This document was written by the Leopold Centre for Sustainable agriculture, and although it is not written for an academic audience, its authors represent a reputable institute. The report is the source of the economic sustainability indicators presented in Table 1, and could be a valuable source for demonstrating the positive impact of a local or regional food system.

Columbia Basin Trust. (2015). Phase 1 and 2 community action plans. Retrieved from http://adaptationresourcekit.squarespace.com/community-action-plans/

This reference is a link to a webpage depicting a program that was created by the Columbia Basin Trust aimed at addressing food insecurity as a consequence of climate change. Along with the following study by Roussin, Wilson, Utzig and Lavkulich (2015), it could aid YA in creating future programs in that region.

Roussin, R., Wilson, J. E., & Utzig, G. & Lavkulich, L. M. (2015). Assessing the Potential for Pocket Agriculture in Mountainous Regions: A Case Study in West Kootenay, British Columbia, Canada. *Journal of Agriculture, Food Systems, and Community Development, 6*(1), 175-188. Retrieved from :http://www.cbrdi.ca/wp-content/uploads/Assessing-the-potential-for-pocket-agriculture-in-mountainous-regions-A-case-study-in-West-Kootenay-Roussin-2015.pdf

This study evaluates the suitability of the West Kootenay for climate resilient pocket agriculture as a way to address issues of food insecurity as a result of climate change. Assessment is based on soil and topographical evaluations. Although this study was not used as a source for recommendations for the sustainability impact dashboard, it could be a valuable source of information for YA in their mission to attract new entrants to farming.

van der Werf, Hayo M.G, Petit, J. (2002). Evaluation of the environmental impact of agriculture at the farm level: a comparison and analysis of 12 indicator-based methods. *Agriculture, Ecosystems & Environment, 93.* Retrieved from http://www.sciencedirect.com.ezproxy.library.ubc.ca/science/article/pii/S0167880901003541

This study analyses 12 methods to assess the environmental impact of agriculture. The authors do not give details about any of the methods, rather it compares the methods for the amount of time they require for implementation, the categories of sustainability that they assess, and who might use that method. This article was used as a reliable source for the environmental indicators presented in Table 1, however it might also be useful in order to find an appropriate data method collection for future projects on the dashboard.