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Food Hubs and Food Security

A LIT REVIEW

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Food Hubs:

Consumers across the nation have expressed a growing demand for locally produced, source identified foods that address the moral and environmental concerns with industrial scale production and shipping of produce. Food hubs have emerged as an eloquent solution to this problem by providing a system to connect local farmers and local consumers in a market that has been pushing these two away from each other. Food hubs can take a few different forms, but at its core, a food hub is an organization that actively manages the aggregation, distribution, and marketing of source-identified food products from local and regional producers.

Regional food hubs support local farmers by providing distribution for their product. They are the infrastructure that allows farmers and consumers to connect in a way that was previously unable to be realized. “By offering a combination of aggregation, distribution, and marketing services at an affordable price, food hubs make it possible for many producers to gain entry into new larger-volume markets that boost their income and provide them with opportunities for scaling up production.(USDA 2016)” This system of food management is a unique way of shifting the burden of responsible eating away from the solely individual consumer and allows for mass preparers (i.e. restaurants, cafeterias, grocery stores) to prioritize the same values the individual has and enable them to make that valued choice without all the additional effort that is sometimes required when trying to eat locally and reduce the carbon footprint of their food.

A food hub has three main stakeholders, the producers, the operational team, and the community consumers [Vo and Wo 2017]. Each part of the food hub benefits greatly from this relationship. The producers (farmers, ranchers, beekeepers etc.) are actively linked to the market, can utilize value adding product development, and are trained in smart business management and guidance practices through the food hub. The operational team can negotiate price and demand, provides light storage and packaging, and help develop a brand for the source-identified foods they distribute. Finally, the community consumers have a comfortable place where they can trust where and how they purchased the food, as well as support their local economy in a facile way.

In a 2017 report by Michigan State, over 90% of food hubs consistently stated that they support the triple bottom line, or the balance of social, ecological, and financial profits, as part of their mission [Colasanti et al. 2017]. This business strategy has proven to be both profitable and a clear path to addressing climate change within our food systems. Below we will go through facts about how our warming climate will impact our food systems, and finally, how food hubs can be one of those tools to help mend the damage we have done.

Climate Change vs Food Security:

Global Climate Change is a well documented phenomenon that has begun to impact many facets of daily human life. Temperature, weather patterns, and water availability are all being affected by the shift in Earth's climate. While these factors have an impact on many industries, the impact to the agricultural industry may be the most important. Global climate change has the potential to affect the entire world's food security. In 1996, the UN's Food and Agriculture Organization defined food security is "situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs... for an active and healthy life" [FAO]. This document will break down each of these facets of food security, and describe how they can be impacted by global climate change. While this is a global issue, and many of the topics discussed can impact a large portion of the world, special attention will be given (where information is available) to the direct impacts climate change will have on Utah.

Climate Change vs Food Production

As the climate around the globe continues to change, the potential impacts to the overall food supply chain will begin to become more likely and potentially more damaging. First and foremost, the planting and harvesting seasons in certain areas will begin to shrink. As temperatures rise in already hot and dry areas, the planting season will become shorter. Hospitable temperatures for plants is typically in a fairly small range. For example, corn and soybeans have a peak harvest around 25C, but after 27C, the harvest steeply shrinks [Schlenker et al, 2009]. In addition, the habitable soil for plants will continue to shrink if current practices of monocropping and overusing the soil are continued.

There are some areas around the globe that have the potential to benefit from these changes. Temperate environments could see longer grow seasons, better harvests, and larger overall plantable land [Schmidhuber et al, 2007]. In addition, in humid temperate areas, there will be an increase in pasture land and productivity, which would allow for a larger density of grazing animals per pasture area [Schmidhuber et al, 2007]. These are likely the only areas that will benefit from climate change though. Most models indicate that the increased temperature, more frequent severe weather, and shifts in grow season will have a negative impact on most areas. This will become an increasing issue for areas like Utah that are already stressed for water.

In one climate change model, water access in the form of runoff may shrink as much as 15% in certain climates [Milly et al, 2005]. Especially in areas that are already stressed for water, this could be incredibly damaging for their agricultural, and thus economic, well being. While Utah has not specifically been targeted in this type of research, there is a strong potential for water to become more scarce and for irrigation to become more

difficult. It has been reported that, in locations (like Utah) where water availability is dictated primarily by snowmelt, water availability could shrink during summer months [Barnett et al, 2005; NCA 2014]. It has also been reported that, in these arid climates, there will be an additional decrease in soil moisture [Schmidhuber et al, 2007; Intergovernmental Panel 2007; Intergovernmental Panel 2001].

In Utah, this may be compounded if the Great Salt Lake continues to shrink. It has been discussed that, as the lake shrinks, a larger amount of dust will be kicked up from the dry lakebed. This dust can then migrate into the surrounding mountains, increasing the solar absorbance, and the likelihood of early snowmelt [Wurtsbaugh et al, 2016]. The change in snowmelt could impact the grow season in Utah, and require more food to be imported from surrounding states. While Utah already imports a large fraction of its food, sourcing the food from local areas will allow Utah to be more resilient to the other impacts of climate change.

It is still up for debate if the increase in food production from temperate locations will offset the reduction in areas like Utah. Regardless of the net production though, food distribution maps will need to be redrawn as climate change impacts the agricultural industry. Utah has the option to become more resilient to the potential changes with the help of a local net of food suppliers.

Climate Change vs Food Access:

In addition to the obvious impact that climate change can have on the agricultural industry, there are several other potential hazards that climate change poses. One threat to food security will be the potential for more severe weather. Not only can this disrupt harvests, but could impact distribution chains. As severe storms become more severe, the potential for infrastructure damage becomes more likely - potentially halting or diverting food distribution from greater distances [Arndt et al, 2011; Brown et al, 2015; Jones et al, 1991; Wakeland et al., 2012].

With America's infrastructure already stressed, the potential greater frequency of floods, harsher winters, and drier summers may push the roads and bridges connecting supply lines to the brink. The World Bank commissioned a report on the economic damage that harsher weather has caused in recent years. The data in the report indicates a clear increase in infrastructure costs over the last few years [Freeman and Warner, 2001].

Additionally, structures that were designed for a non-changing climate will be less resilient to the weather under climate change [Wang et al, 2010]. For example, concrete bridges and overpasses are designed to sustain a set number of freeze thaw cycles. As the winters become more mild, it is likely that the number of freeze thaw cycles will be reduced. However, summer months have the potential to become more severe, reducing the overall lifespan of flexible pavements [Boyle et al, 2013]. In addition,

increased carbon levels in the atmosphere can deteriorate concrete structures at a greater rate [Talukdar et al, 2012]. One study found that, in the arid or temperate climate of Australia, damage to concrete infrastructure from carbonation could increase by up to 400% in the next 80 years [Stewart et al, 2011].

Having a local framework for providing food, should some distant infrastructure fail, will be essential for Utah. While local infrastructure will be just as susceptible to failure as elsewhere in the country, local shipments will be more flexible to change, and will have lower likelihood of being delayed; increasing the risk of food spoiling, food wastage, and missed shipments of essential nutrition for the Utah population.

Climate Change vs Nutritious Food:

In addition to the reduction in overall harvests from climate change, it has been shown that overall crop nutrition could decrease. A large portion of the globe survives on cereal crops like wheat, rice, and corn. These crops are also some of the most susceptible to the impacts of climate change. For example, it has been shown that increases in carbon dioxide decreases the amount of iron, zinc, and protein in crops like wheat, rice, peas, potatoes, and soy [Fanzo et al, 2018; Unep 2010].

Climate Change vs Safe Food:

Climate change has a well known potential to impact the food security that many places currently have. Another important aspect of the food security definition used in this document is the access to safe food. For this document, safe food will imply that it is not contaminated with pathogens, carcinogens, or other human toxins.

One of the biggest ways that climate change will be able to degrade food safety is by increasing the likelihood that human pathogens will be able to replicate and survive food [Tirado et al, 2010]. For example, it is documented that warmer temperatures allow different vibrio species to grow and bioaccumulate in the tissue of mussels and oysters [Kaneko and Colwell, 1973; Deepanjali et al, 2005]. Some species of vibrio are known human pathogens, and can cause severe gastroenteritis; Vibrio Cholerae is one of the leading causes of waterborne disease in developing countries [Wright et al, 1996; Deepanjali et al, 2005; Kaneko and Colwell, 1973]. As the average temperature rises around the globe, these nearly ubiquitous bacteria may be more likely to infect the average population. Additionally, salmonella and its associated disease have been shown to be more prevalent when temperatures increase [Tirado et al, 2010; Bi et al, 2009; Kovats et al, 2004]. A relationship between increases in temperature and salmonellosis has been shown in Canada, Ireland, and Australia [Tirado et al, 2010].

Climate change can also impact human exposure to certain toxins already present in the environment. Human exposure to mycotoxins, potentially carcinogenic, cytotoxic, immunosuppressive (in addition to other impacts), could increase as climates continue

to change [Tirado et al, 2010; Smith and Moss, 1985]. While limited exposure to mycotoxins has low risk, the acute symptoms from high dose exposure are severe [Tirado et al, 2010].

Harmful algal blooms are another increasingly studied phenomenon that climate change may be contributing to. Harmful algal blooms (HABs) occur when a large plug flow of nutrients enter a water body; Utah Lake is often impacted by HABs. This input of nutrients causes a large growth of bacteria, predominantly cyanobacteria, that consumes the nutrients, along with most of the available dissolved oxygen resulting in hypoxia and fish kills. Certain species of cyanobacteria produce human toxins that can bioaccumulate in fish, and be harmful if consumed in large quantities [Hardy et al, 2015; Ferrao-Filho and Kozlowsky-Suzuki, 2011; Funari and Testai, 2008].

Local Impacts:

Utah already imports a large portion of the food that its population consumes. As was discussed earlier, there are existing ways to continue importing the food needed, while doing it in a more environmentally sustainable way. A large number of the food hubs in other states pull their food from a 400-mile radius around that state. This reduces the travel distance, time, and impact each piece of food has.

As we have discussed, food systems are particularly sensitive to climate change and we must explore all options to mitigate this dynamic situation. Currently, Utah only produces 2% of vegetables and 3% of fruits that are consumed within the state. This fact demonstrates the potential for a locally sourced produce program that would help increase these numbers [Utah 2018]. Other states and communities have implemented Food Hubs as a solution to this problem and Utah should be next.

Food hubs have a few advantages over the traditional import-heavy system that the current food industrial complex relies on. By sourcing locally, food hubs can support environmentally friendly options over outsourced foods and allow for the flexibility to respond to growing issues that will affect the American southwest.

However, food hub's champion strength is less tangible than shifting produce production to meet the demands of a changing climate. A food hub reconnects people with their food. Across the nation, consumers are less and less connected to their food with countless prepackaged, perfectly trimmed, produced foods that lack any emotional/intellectual connection [MSU 2017]. This is an alarming issue because without any foundational relationship to food, it is increasingly challenging to persuade people to change those habits. By distributing local produce and highlighting the local farmers, food hubs instills an emotional relationship that is otherwise lost on most people. This concept is not unique, the rise in organic restaurants and vegan lifestyles has shown that people do care

about these issues. However, that market is small and niche. Food hubs allow for that market to grow in ways that were previously reserved for the privileged.

Overall, food hubs need to be considered as one of the many major paradigms shifts that must occur in the mindset of American consumers. Just like combustion engines or one-use plastics, food culture is due to a fundamental change. By implementing a food hub, the community would gain economic prosperity, a closer relationship to its food, and boost jobs and local farming to support our own peers.

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